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Essays on Work and Fertility

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ACADEMIC DISSERTATION

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Essays on work and fertility

Jenni Kellokumpu

Abstract

This dissertation consists of four empirical essays all related to children and parents' labor supply, earnings and income in Finland. In the essays the problem of unobserved heterogeneity has been attacked in various ways. In the first essay, identical adult twins are used to estimate the impact of children on lifetime earnings and income. Identical twins share not only the same family but the same genes, hence such unobserved factors as family background and innate ability can be controlled for in the estimation. This is the closest possible similarity between two persons. The results suggest that both mothers and fathers have around 30 to 40% higher lifetime earnings compared to childless women and men even after controlling for family background and innate ability. The positive and large effect on mothers' earnings is a surprising result and against previous empirical evidence – though the focus of earlier research has typically been on the immediate years following childbirth. Although there are several potential explanations for such a large effect, the size of the found effect is surprisingly great.

The second essay studies the effect of income on fertility by using job loss due to a plant closure as a source of exogenous variation in household income. Unlike previous studies, this essay focuses on couples and the impact of joint family income on fertility. The results show that the woman's job loss has a negative effect on fertility, while the man's has no impact on fertility. This suggests that the income effect is not the main mechanism through which job loss influences couples' fertility behavior. Career concerns, especially in the case of highly educated women, seem to be a much more important determinant. The result is similar to the one found in a previous study of the effects of female job loss.

The third essay exploits the exogenous variation in family size, caused by the families' preference to have both boys and girls, to study the impact of children on parents' labor supply and income. The results suggest that another child has a sizeable negative impact on the maternal employment of cohabiting and married mothers, while there is no effect on the labor supply of single mothers. The labor supply response of Finnish mothers is much larger than found in the previous empirical studies in the US, the UK and Sweden using the same identification strategy. However, the relatively large maternal labor supply effects are in line with the earlier Finnish research. I find that another child has no impact on labor supply of fathers.

In the fourth essay, the wages after maternity and paternity leaves are studied. However, in this essay the chosen method is less suitable in tackling the unobserved heterogeneity: being unmarried in the 1995 is a poor predictor of being childless: If one is not married in the 1995 no longer necessarily means one is without children in the years 2001 and 2002. In this essay, a maternity leave is associated with a reduction in wage after returning to employment. However, this association seems to be only short-lived. A paternity leave has no or only a small positive effect on wages.

Key words: children, earnings, income, labor supply, unobserved heterogeneity

Esseitä työstä ja syntyvyydestä

Jenni Kellokumpu

Tiivistelmä

Väitöskirjassa on neljä empiiristä esseetä, joissa käsitellään lapsia ja vanhempien työn tarjontaa, ansiota ja tuloja Suomessa. Havaitsematon erilaisuus lapsettomien ja perheellisten välillä on otettu huomioon näissä esseissä eri tavoin. Ensimmäisessä esseessä lasten vaikutus elinkaariansioihin ja -tuloihin arvioidaan identtisillä kaksosilla. Identtiset kaksoset eivät ainoastaan jaa samaa perhettä, vaan myös samat geenit, jolloin sellaiset havaitsemattomat, tuloihin vaikuttavat tekijät, kuten perhetausta ja synnynnäinen kyvykkyys, voidaan kontrolloida estimoinneissa. Tulosten mukaan äidit ja isät ansaitsevat elinaikanansa keskimäärin 30 %–40 % enemmän kuin lapsettomat naiset ja miehet. Lasten positiivinen ja suuri vaikutus äitien ansioihin on yllättävää ja vastoin aiempaa empiiristä näyttöä – tosin aiemmissa tutkimuksissa on yleensä arvioitu lasten vaikutusta ansioihin ainoastaan lasten syntymää seuraavina lähivuosina. Vaikka näin suurelle vaikutukselle on useita mahdollisia selityksiä, vaikutuksen suuruus on siitä huolimatta yllättävää.

Toisessa esseessä tutkitaan tulojen vaikutusta syntyvyyteen hyödyntämällä kotitalouksien tulojen satunnaista vaihtelua, mikä aiheutuu työpaikan menetyksestä, kun toimipaikka lakkautetaan. Toisin kuin aiemmat tutkimukset, tässä tutkimuksessa keskitytään pariskuntiin ja kotitalouden tulojen vaikutukseen syntyvyyteen. Tulokset osoittavat, että naisen oman työpaikan menetys vähentää syntyvyyttä, mutta miehen ei. Tämä tulos viittaa siihen, että tulot eivät ole päätekijä lastenhankintapäätöksissä. Sen sijaan erilaisilla naisen uraan ja työllistymiseen liittyvillä näkökohdilla voi olla vaikutusta – erityisesti korkeasti koulutetuilla naisilla. Tulos on samanlainen kuin aiemmassa kirjallisuudessa naisen työpaikan menetyksen vaikutuksesta syntyvyyteen.

Kolmannessa esseessä hyödynnetään perhekoon satunnaista vaihtelua, mikä johtuu vanhempien preferensseistä saada sekä tyttöjä että poikia: ne perheet, joissa kaksi ensimmäistä lasta ovat samaa sukupuolta, todennäköisemmin hankkivat vielä yhden lapsen kuin vanhemmat, joiden kaksi ensimmäistä lasta ovat eri sukupuolta. Tulosten mukaan yksi lisälapsi vähentää merkittävästi äitien työn tarjontaa muilla paitsi yksinhuoltajaäideillä. Suomessa lasten lukumäärän vaikutus äitien työntarjontaan on paljon suurempi kuin mitä on havaittu aiemmissa tutkimuksissa Yhdysvalloista, Isosta-Britanniasta ja Ruotsista samaa tutkimusmenetelmää käyttäen. Tulokset ovat kuitenkin yhdenmukaisia verrattuna aiempaan suomalaiseen tutkimustietoon. Isien työn tarjontaan lasten määrällä ei tulosten perusteella ole vaikutusta.

Neljännessä esseessä tutkitaan perhevapaan vaikutusta sen jälkeisiin äidin ja isän palkkoihin. Tämän esseen tutkimusasetelma on aineistosta johtuen selvästi heikompi kuin väitöskirjan muissa esseissä käytetyt menetelmät. Tämä johtuu siitä, että tiedolla, onko henkilö naimisissa vuonna 1995 vai ei, voidaan hyvin heikosti ennustaa sitä, onko hän lapseton 2000-luvun alussa. Tutkimuksessa äitiysvapaan ja sen jälkeisen palkan välillä havaitaan negatiivinen yhteys, joka tosin on vain väliaikainen. Isyysvapaalla ja sen jälkeisellä palkalla on korkeintaan heikko positiivinen yhteys.

Asiasanat: lapset, ansiot, tulot, työn tarjonta, havaitsematon erilaisuus

Acknowledgements

The first time I attended economics lecture I knew it was my thing. However, when I started doing my PhD I was not that sure anymore. I guess it was my curious nature which lead me to start my research. Besides curious, I am impatient by nature – a characteristic that does not fit well with doing a PhD. Nevertheless, I finally finished the work and have numerous people to thank for it.

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Helsinki, January 2015

Jenni Kellokumpu

List of Essays

This thesis manuscript consists of an introduction and the following four essays:

Essay 1: “The Effect of Children on Lifetime Earnings and Income: Evidence from Adult Same-Sex Twins”. 2013. Unpublished.

Essay 2: “The Effect of Job Displacement on Couples' Fertility Decisions”, with Kristiina Huttunen. 2012. Forthcoming in Journal of Labor Economics.

Essay 3: “Children, Labor Supply and Income: Evidence from Exogenous Variation in Family Size in Finland”. 2012. Unpublished.

Essay 4: “Baby and Pay: The Family Gap in Finland.” 2007. Unpublished.

Contents

1. Introduction

The question of how income affects fertility decisions and how these decisions, on the other hand, affect income is of major policy relevance. The commonly held view is that children are one explanation to the weaker labor market position of women relative to men. Many countries implement new policies to enable women to have children in addition to a successful career. Moreover, fathers are encouraged to take more responsibility for the care of children by policies targeted especially to fathers.

What is the causal interpretation behind the well documented negative relationship between children and female wages (e.g. Gronau, 1988, Korenman and Neumark 1992, Waldfogel 1997, 1998)? Do children have a negative effect on female wages or is it rather so that women with lower wages tend to have more children? The challenge in empirical work on fertility and wages is to identify the causal effect of children to wages. Mothers and childless women may differ from each other in ways, which cannot be observed from the data on earnings and family size – such as ability, motivation, ambition and career orientedness, which are both positively correlated with wages and negatively correlated with the desire for children. Hence, the observed negative correlation between children and female wages is rather caused by this unobserved heterogeneity than children. To rephrase, it may be that mothers would earn even less in the absence of children. Another reason for the possible selection of low-wage women into motherhood is that the wage is a component of the cost of children. This might make low-wage women more likely to become mothers.

Similarly, it is unclear to what extent the documented positive association between male earnings and marriage is causal (Korenman and Neumark 1991, Gray 1997)? The "marriage premium" can be explained by a positive selection into marriage: those men who succeed in the labor market are often the same men who succeed in the marriage market. Alternatively, the premium can be a reflection of a true improvement in productivity: if the wife allocates her time more to housework and children, the husband can specialize in market work.

The past empirical work has solved the endogeneity of fertility and unobserved heterogeneity by using a natural experiment, a policy reform or fixed-effects estimator. The birth of twins is probably the most well-known example of a natural experiment used to study the impact of children on labor market outcomes pioneered by Rosenzweig and Wolpin (1980) and followed by many others (e.g. Bronars and Grogger 1994, Gangadharan and Rosenbloom, 1996, Jacobsen et al. 1999, Vere 2011). Since giving birth to twins is random, twinning causes an unexpected increase in family size. Hence data on the birth of twins and parents' labor market outcomes is close to experimental data. Alternatively, twins have been used to study the impact of schooling on various outcomes

beginning from Ashenfelter's and Krueger's (1994) famous twin study of the effect of schooling on earnings. Adult twins are also employed in studies concerning the effect of schooling on assortative mating and fertility (see e.g. Behrman and Rosenzweig 2002, Kohler et al. 2010). A recent study of Amin and Behrman (2014) use identical twins to estimate the impact of schooling on the timing of fertility. Somewhat surprisingly, the effect which children have on their parents' income has not been investigated by using data on identical twins.

Another example of a natural experiment is the documented western families' preference to have both a son and a daughter (see e.g. Westoff et al. 1963, Williamson 1976). Angrist and Evans (1998) were the first ones to use this preference to study the inference between fertility and the labor market outcomes of parents in the US in 1980 and 1990. In their study they exploit the parents' preference to a sibling sex mix (and also the birth of twins at second birth) when estimating the causal effect of children on the parents' labor supply. Other studies using families' preference for a sibling sex mix to study maternal employment in western countries include Iacovou (2001) for the UK, Daouli, Demoussis and Giannakopoulus (2009) for Greece, and Hirvonen (2010) for Sweden. A preference for sons in the Asian countries has been used in studies of maternal labor supply in Korea (Chun and Oh 2002) and in Taiwan (Ebenstein 2007).

Typically, these studies find a negative effect of children on maternal employment and no effect on the fathers' labor supply.

Job displacement due to a plant closure is also one example of a natural experiment. Such displacement creates potentially exogenous variation in household income and hence enables to analyse the causal effect of income on the number of children in the family. There are only a few studies, which have used exogenous variation in income due to job loss to identify the effect of income on fertility. While Lindo (2010) and Amialchuk (2011) focus on man's job loss in the US, Del Bono, Weber and Winter-Ebmer (2012) use woman's job loss in Austria. All of these studies find a negative effect of job displacement on fertility, but the interpretation of the effect differs. Del Bono, Weber and Winter-Ebmer (2012) conclude that the possible mechanism is not the income effect, but the difficulties women face in re-establishing their careers after job loss.

There is also abundant literature on the effect of family policies on fertility and employment. In Canada (Milligan 2005) and in France (Laroque and Salanié 2013) a strong effect of financial incentives on fertility has been found. The reduction in child-care prices in Sweden had no effect on employment (Lundin et al. 2008), while in Canada (Baker et al. 2008, Lefebre and Merrigan 2008) there was a positive effect on employment. The availability of school slots for two-year-old children had a positive impact on the employment of single mothers in France (Goux and Maurin 2010). Ruhm's (1998) cross-country comparison finds

a positive association between the maternity leave and female employment. A study on the effect of an extension of parental leave in Austria finds a negative impact on employment (Lalive and Zweimüller 2009). The results also suggest that both cash transfers and job protection are important for employment decisions. Also Baker and Milligan (2008) find that long expansions in job-protected leave result in reductions in maternal employment in Canada. Similarly, the policy of job-protected child home care leave has a large negative impact on maternal employment in Finland (Kosonen 2011).

There are a number of studies which use panel data and fixed-effects estimators to control for time-invariant unobservables that affect both family and labor market outcomes: Korenman and Neumark (1992), Waldfogel (1997), Lundberg and Rose (2000) all use US panel data. Their findings suggest that there is a negative selection into parenthood: parents earn less than non-parents even before the birth of the first child. While Korenman and Neumark find the motherhood wage gap to be solely due to this unobserved heterogeneity, the fixed-effects estimates of Waldfogel (1997), and Lundberg and Rose (2000) confirm that the motherhood wage penalty exists even after controlling for the unonbserved differences.

Although, in Lundberg and Rose this is true only for mothers who experience a career break. Similarly, Napari (2010) have found that there is a motherhood wage penalty for Finnish mothers – especially for mothers who spend more time out of the labor market. Lundberg and Rose (2002) also showed that becoming a father increases the hourly wage and also working hours of US men. Hyung-Jai et al. (2008) have found similar results in men living in Western Germany.

2. Overview of the Thesis

2.1 **Overview of the Main Findings**

This dissertation consists of four empirical essays all related to children and parents' labor supply, earnings and income in Finland. In the essays the problem of unobserved heterogeneity has been attacked in various ways. In the first essay, identical adult twins are used to estimate the impact of children on lifetime earnings and income. Identical twins share not only the same family but the same genes, hence such unobserved factors as family background and innate ability can be controlled for in the estimation. This is the closest possible similarity between two persons. The results suggest that both mothers and fathers have around 30 to 40% higher lifetime earnings compared to childless women and men even after controlling for family background and innate ability. The positive and large effect on mothers' earnings is a surprising result and against previous empirical evidence – though the focus of earlier research has typically been on the immediate years following childbirth. Although there are several potential explanations for such a large effect, the size of the found effect is surprisingly great.

The second essay studies the effect of income on fertility by using job loss due to a plant closure as a source of exogenous variation in household income. Unlike previous studies, this essay focuses on couples and the impact of joint family income on fertility. The results show that the woman's job loss has a negative effect on fertility, while the man's has no impact on fertility. These results suggest that income does not influence a couple's fertility behavior. The result is similar to the one found in a previous study of the effects of female job loss.

The third essay exploits the exogenous variation in family size, caused by the families' preference to have both boys and girls, to study the impact of children on parents' labor supply and income. The results suggest that another child has a sizeable negative impact on the maternal employment of cohabiting and married mothers, while there is no effect on the labor supply of single mothers. The labor supply response of Finnish mothers is much larger than found in the previous empirical studies in the US, the UK and Sweden using the same identification strategy. However, the relatively large maternal labor supply effects are in line with the earlier Finnish research.

In the fourth essay, the wages after maternity and paternity leaves are studied. However, in this essay the chosen method is less suitable in tackling the unobserved heterogeneity: being unmarried in the 1990s is a poor predictor of being childless: If one is not married in the 1990s no longer necessarily means one is without children. In this essay, a maternity leave is associated with a reduction in wage after returning to employment. However, this association

seems to be only short-lived. A paternity leave has no or only a small positive effect on wages.

The results of this thesis should be interpreted in the context of the Finnish society – a high fertility/high female employment economy. Finland has a decades-long history in policies, which are targeted to improve the labor market participation of both parents, particularly of mothers. The rapid expansion of the Finnish welfare state started in the 1970s and continued through the 1980s until the deep recession of the early 1990s. The construction of the welfare state enabled women to participate in the labor market by offering maternity leaves and a public day care for children. At the same time, the welfare state needed female labor force: the comprehensive school reform introduced a uniform nine-year comprehensive school in 1972, the Primary Health Care Act introduced centers for primary care in the same year and the Child Care Act of 1973 increased the number of child day care places radically. Health and social services, and education all became female-dominated occupations.

At the same time when new opportunities for labor market work for women arose, so did the need for policies to help mothers and fathers to combine work and family. In 1970 employees got the right for a short absence from work to care for a sick child. In 1974 the maternity leave was extended from 3 to 7 months. In 1978 a short paternity leave of 12 days was introduced (however, the father's use of these days reduced the mother's days correspondingly). In 1980 the maternity leave was extended further and a new parental leave was introduced. In 1984 a public day care for children under 3 years was guaranteed. In 1990 the job-protected child home-care leave for children under 3 years was introduced by the support of the Home Care Allowance. Since 1990 the reforms in family policies are targeted mainly to fathers to promote gender-equality both in the labor market and in the care of children: a new paternity leave of 6 days in 1991, an extension of paternity leave to 18 days in 1993, an extra “daddy month” in 2003. Despite this, the fathers' rights still remained fairly modest compared to the rights of mothers.

In the first essay, the children in the target group were born between 1971 and 1989 – a time period in which the construction of the Finnish welfare state took place and a series of new family policies were introduced. Hence, the large positive motherhood premium in lifetime earnings might be due to better labor market opportunities for women and family policies which enabled establishing both a professional career and family. The second essay studies the effect of a sudden and very deep recession of the early 1990s on couples' fertility decisions in Finland – in particular, the effect of a job loss due to a plant closure on fertility. The third essay analyses the labor supply of women (and of their spouses) who became parents during the 1990s and early 2000s. In this time period a unique family policy even among the Nordic countries, a job-protected home care leave up to three years per child, gained popularity among Finnish

mothers. The found large labor supply responses of cohabiting and married mothers most likely are due to this unique policy. The last essay considers the relation between career breaks due to childbirth and earnings in the late 1990s and in the beginning of the 2000s. There appears to be a negative relation between career interruptions due to childbirth and subsequent wages for women, while fathers' wages are either unaffected or even increased. Since women use the majority of the leave entitlements – despite the policies targeted to fathers – this result is not very surprising.

2.2 **Overview of the Essays**

2.2.1 The Effect of Children on Lifetime Earnings and Income: Evidence from Adult Same-Sex Twins

The first essay studies the effect of children on earnings and income by using identical adult twins. The study uses a cohort of like-sexed twins (born between 1944 and 1950) linked to administrative records on annual taxable earnings and income and births. Using identical twins allows controlling for unobserved differences in the family background and innate ability. Moreover, the impact of children is estimated on lifetime earnings and income. The focus of previous studies has been on the motherhood wage effects following childbirth. Furthermore, the study also analyses the impact of children on the fathers' earnings and income: a side of the parenthood wage effect, which has received much less attention in earlier research.

The data set used in the analysis comes from various sources. The base data is the Cohort of Older Like-sexed Twins Data (COLTD) – a survey data from years 1975, 1981 and 1990 collected by the Department of Public Health in the University of Helsinki for purposes of epidemiological studies on chronic disease. COLTD is combined with the Finnish Longitudinal Employer-Employee Data (FLEED) of Statistics Finland. FLEED consists of all Finnish residents aged 16–70 and of all firms from the year 1990 to 2004. The information on individuals is based on the Employment Statistics data base, which includes information on the labor market status of individuals and their background characteristics from different administrative registers. With individual, plant and firm identification codes FLEED can be merged to other data sources. The combined data include selected information from COLTD from the years 1975, 1981 and 1990 (survey years) and inclusive register based information, such as level and field of education, marital status and annual labor earnings and taxable income, for these twin pairs from FLEED in the years 1990–2004. In addition, information on earnings and income from Population Censuses of 1970, 1975, 1980 and 1985 is linked to these data. This allows observing the earnings profiles for over 30 years. The information on the number of biological children and their birth year comes from the Population Information System (PIS) of the Population Register Centre.

The results suggest that being a parent has a positive and economically large impact on lifetime earnings and income around 30 to 40% of both males and females. The economically sizeable effect is a somewhat surprising finding – particularly concerning mothers. Typically, previous studies have found a negative effect of children on female earnings. However, the focus of previous studies has been on the earnings around the childbirth, not on the lifetime earnings as in this study. The found increase in fathers' earnings in earlier research is typically more modest, around 10 to 20%. There are numerous possible explanations for such a large effect. First, the child premium might reflect some form of selection – even within a twin pair. Those without children may be a negatively selected group of individuals. In other words, they may be persons who have experienced an individual specific shock – for example a health shock – in their lives, which prevents them from making both children and money. Equally, having a child can be a positive "shock" to one's health. Second, it might be that having a child actually improves productivity – whether it is due to the parenthood changing one's personality or one's use of time. Third, having a family could be a signal from a responsibility, commitment, prestige, etc. – things that are valued by the employer. Fourth, becoming a parent sets demands on the family economy – for example a larger house is often needed – which in turn is reflected in one's labor market choices and performance. Becoming a parent might also change the preferences on lifestyle – for example, a larger house is often preferred, if not needed. Last, a child premium may be explained by the so-called in-group bias, meaning that people have a tendency to favor their own kind and are more altruistic within their group. When considering the cohorts of this study, for individuals born between 1944 and 1950, being a parent has been the social norm. One explanation could also be institutional. In some manufacturing industries the employee contracts require that when employers need to lay off workers for reasons related to production, they first have to lay off workers with the least tenure and no children. These industries are male-dominated, which might explain the high "father premium" after the deep recession in the early 1990s. The study of the channels of this "parent premium" is left for future work.

2.2.2 The Effect of Job Displacement on Couples' Fertility Decisions

The second essay analyses the effects of a job loss due to a plant closure on fertility. Because job displacement should be an exogenous shock to a worker's career, we can disentangle the causal effect of income changes on the fertility behavior of couples. In the analysis, we use Finnish longitudinal employer-employee data (FLEED) matched to birth records. The data consist of all 16–70 -year-old Finnish residents from 1988 to 2004. Each worker and their employer in these data have a unique identification code. In addition, information on the workers' spouses is included, which makes it possible to create a sample of couples and follow them several years after the event of a job loss. We focus on couples where one spouse lost his or her job due to a plant closure (or mass

layoff) in the years 1991–1993. As a comparison group we use similar couples who were not affected by a plant closure (mass layoff). We follow each couple for 4 years before the job loss and 11 to 13 years after the job loss in order to investigate the changes in their fertility in post-displacement years.

Our set-up and the data allow us to study the causal effects of income shocks on a couple's fertility behavior at the micro-level. Unlike previous studies (Lindo 2010, Amialchuk 2011, Del Bono, Weber and Winter-Ebmer 2012), we focus on couples and can distinguish between the woman's and her spouse's job loss, and thus make a distinction between the shock to the woman's career and a pure income shock. We also study how job displacement affects family income, joint employment decisions and divorce probability. This helps us to better understand the mechanism through which job displacement affects fertility behavior. Moreover, the very long time span makes it possible to distinguish between the impact on postponement and completed fertility. Career and income shocks may force a couple to postpone childbearing without having an impact on completed fertility. The rich data also allow us to examine how this effect varies by various observable dimensions, such as education, the spouse's income, family composition, etc.

We find that a female job loss decreases fertility. For every 100 displaced females there are approximately three less children born. The effect is stronger for women with higher education and for high-wage earners. The negative effect of a woman's job displacement may be explained by career concerns after the job loss. This may also explain why we find that job displacement has a stronger effect on women with higher education. Women with higher education are more attached to the labor market and more concerned about losing human capital during career breaks. They do not want to suffer from long employment breaks after a job loss and decide to postpone child bearing to better times. When analyzing the impact of male job loss on a couples' fertility behavior we find that his job loss has a much weaker and insignificant effect on fertility than if the woman had lost her job. Since men are less engaged in the care of young children, we expect a man's job loss to affect fertility mainly through income.

The result suggests that income does not influence a couple's fertility behavior. The results are in line with the study using Austrian data by Del Bono, Weber and Winter-Ebmer (2012) who also find that a woman's job displacement decreases fertility, especially for highly educated women. They also conclude that the possible mechanism is not the income effect, but the difficulties women face in re-establishing their careers after the job loss. Despite the fact that we find that the man's job loss results to a very long-lasting and even stronger impact on total family income than the woman's job loss, the man's job loss has no impact on completed fertility. This is in contrast with the study by Lindo (2010), which provides some, although not very robust, evidence that the man's job displacement decreases fertility in the US. The difference with his and our

findings suggests that the effect of income on fertility may depend on institutional factors, such as the costs of higher education and the access to health care.

2.2.3 Children, Labor Supply and Income: Evidence from Exogenous Variation in Family Size in Finland

The third essay in the dissertation considers the causal effect of children on maternal employment, wages and income in a Nordic welfare state, in which there is a high female employment rate and a strong preference for children's home care promoted by the state. Nordic countries – Finland among them – have been the pioneers in developing models for combining work and family. Policies adopted in the Nordic countries have inspired many other European countries to create their own family policies and many countries today are making decisions on their family policies. When countries decide, which family policies to implement and how to develop the existing policies, the pros and cons of each model should be recognised. As in all Nordic countries, Finland has such family policies as job-protected parental leave, low cost-high quality public day care and the right to take time off for the care of a sick child. Despite sharing many of the key features of the family policies common to all Nordic countries, Finland has a very unique model of reconciling maternal employment and the care of small children.

A key feature that distinguishes Finland from other Nordic countries is the families' preference for the home care of small children, which is promoted by the right to extend the job-protected parental leave with the support of Child Home Care subsidies until the youngest child is three.

The identification of the causal effect of children on labor market outcomes is based on two sorts of "natural experiments": (i) families' preference for sibling sex mix or (ii) the birth of twins. The same sex instrument is based on the observation that parents of same-sex siblings are more likely to go on to have an additional child (see e.g. Westoff et al., 1963, Williamson, 1976, Angrist and Evans, 1998). Because the birth of twins is virtually randomly assigned, an event of twinning creates potentially exogenous variation in family size.[1] The analysis is based on Employment Statistics Database of Statistics Finland merged to Population Information System of the Population Register Centre to include information on childbirths. The combined data set covers the years 1988–2004.

The results show that having more than two children decreases the maternal labor supply by 26 percentage points. Furthermore, this effect varies by marital status and the spouse's earnings and by the mother's education. Cohabiting and married

[1] The randomness of twinning may be violated due to infertility treatments.

women's employment decreases by almost 40 percentage points. Mothers with higher education have almost 35 percentage points and mothers with secondary education have even over 40 percentage points lower employment probability after another child. For fathers and for single mothers children have no effect on employment.

The estimated effect of children on Finnish mothers employment is remarkably larger than the ones found in the earlier empirical research on maternal employment in the US, in the UK and in Sweden using the same identification strategy (see Angrist and Evans 1998, Iacovou 2001, Hirvonen 2010). Although there are several possible reasons for larger effect in Finland, the main explanation is probably the differences in the labor market institutions between these countries and Finland: mainly the job-protected maternity leave of up to three years per child.

2.2.4 Baby and Pay: The Family Gap in Finland

The fourth essay in this dissertation is an attempt to analyse the effect of career interruptions due to parental leave to both the mothers' and fathers' subsequent wages. Having children causes different labour market outcomes, especially for women. Most women withdraw completely from the labour market to care for the child. However, the purpose of this study is to examine the effect of career interruptions due to childbirth for those women who remain in the labour force and return to work after the formal maternity scheme.

The data set is a unique linked employer-employee panel data set (FLEED) covering almost the entire private sector in Finland during the years 1995–2002. Thus, it is possible to control for unobserved time constant heterogeneity among individuals in the data. In addition, information about parental leave from Social Insurance Institution of Finland has been combined to the FLEED data base. The main advantage of these data is that it includes registered data about a person's hourly earnings provided by the Confederation of Finnish Industries. By using the hourly wage I am able to control for the hours worked. When the hourly wage is not used, the possible differences in monthly (or yearly) earnings can be due to the different number of hours worked. If it is more likely for women than men to cut down their working time when there are little children in the family, it is very important to control for hours worked.

There appears to be a significant negative relation between career interruptions due to childbirth and subsequent wages for women in Finland. The relative loss in earnings of mothers is almost 7%. The effect for men is quite the opposite: their wages are either unaffected or even increased. However, this result is mainly due to the fact that men take only short leaves – less than a month. For those men, who take significantly longer periods of parental leave, the effect of the leave on wages becomes negative. The estimates from wage equations are

higher when log monthly earnings are used instead of log hourly earnings. This indicates, that a remarkable part of the cost of having children comes in that women, when becoming mothers, cut down their working hours (or do not take extra hours). Men, on the other hand, tend to work longer hours when there are children in the family, which explains the positive effect of a short parental leave on wages. However, the negative effect of taking parental leave on wages of women and positive for men remains even when log hourly earnings are used as a dependent variable. For women, the most obvious explanation would be human capital depreciation: women suffer from skill atrophy during the parental leave and therefore are less productive at work after the career break. For men, the positive effect of having children on wages, even after controlling for the hours worked, could reflect unobserved heterogeneity: men who are successful in the labor market, are also successful in the marriage market.

The results are in line with the previous empirical evidence which finds a negative impact of career breaks on mothers' wages and an increase both in income and in hours worked of fathers after the childbirth (Waldfogel 1997, Lundberg and Rose 2000, 2002, Hyung-Jai et al. 2008, Napari 2010). However, the results of this study are mainly descriptive. The main drawback of this essay is the chosen estimation method. The Heckman selection model, and particularly the chosen identifying variable to estimate the model is outdated: being unmarried is a poor predictor of being childless in Finland in the mid-1990s. Hence, this essay fails to use credible identification in the analysis and is above anything a lesson for the researcher how important it is to carefully consider the relevance of the used methods.

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Essay 1:
The Effect of Children on Lifetime Earnings and Income: Evidence from Adult Same-Sex Twins

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Unpublished

The Effect of Children on Lifetime Earnings and Income: Evidence from Adult Same-Sex Twins

Abstract

The family gap in earnings is often interpreted as women bearing the consequences of having children. Fathers, on the other hand, seem to benefit from children in the form of "marriage premium" in their wages. The causal effect of children on earnings, however, is difficult to examine due to the unobserved heterogeneity between mothers and non-mothers and between fathers and non-fathers. This study uses a cohort of same-sex twins (born between 1944 and 1950) linked to administrative records on annual taxable earnings and income to examine the causal effect of children on lifetime income. Using identical same-sex twins allows controlling for unobserved genetic and environmental factors. The study shows that parenthood increases lifetime labor earnings and income around 30 to 40% for both men and women.

JEL: J13, J22

Keywords: family gap, income, children, selection, twin data.

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1. Introduction

The connection between fertility and women's labor market outcomes has been of economic interest for decades. The empirical focus has been on the link between the number of children, and women's labor supply and wages.[1] Fathers, on the other hand, are documented to earn more than non-fathers.[2] The major challenge, however, in all empirical studies on fertility and labor market outcomes is to identify a causal effect of children on labor market outcomes. The causal effect of children on wages is difficult to estimate because of the unobservability of the counterfactual. Observing the same person in two different states – with and without children – at the same time is impossible. Hence, econometricians are forced to come up with other strategies to identify the "true" impact that children have on their parents' earnings.

This study uses a "natural experiment" – identical same-sex twins – to study the causal effect of children on their parents' income. Identical or monozygous (MZ) multiple births are truly "natural natural experiments" for two reasons. First, MZ-twinning is considered to be a random event: only about 1/80 births in Caucasians[3] is a twin birth, and of these about 30% produce MZ twins.[4] Second, identical twins are the only source of humans that have identical genotypes.

To my knowledge, the present study is the first one to use identical twins to overcome the unobserved heterogeneity of individuals in the estimation. It is likely that individuals differ from each other in ways unobserved to the econometrician that affect both the number of children and earnings. Unobserved heterogeneity – for example "taste for work" – is presumably an even more severe source of bias when comparing the labor market outcomes between parents and childless individuals. When using twins, I am able to control for family background characteristics and genetic endowment that cannot be observed.[5] More importantly, estimation with only identical twins is less subject to "ability bias" that arises from differences in innate ability.

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[1] The majority of empirical studies find a negative correlation between fertility and female labor supply and wages. See, e.g. Gronau (1973), Rosenzweig and Wolpin (1980b), Schultz (1990), and Goldin (1995) on labor supply and Gronau (1988) and Korenman and Neumark (1992) on wages.

[2] For the association between male wages and marriage see, e.g. Korenman and Neumark (1991), Gray (1997).

[3] Finns are of the Caucasian type.

[4] There may be a small genetic component to the twinning rate, particularly for dizygotic (DZ) twins, though also familial MZ-twinning has been described. The DZ-twinning rate is dependent on family size and maternal age. (Kaprio et al., 1979, 20.)

[5] Previously, Neumark and Korenman (1994) have used data on sisters to control unobserved family attributes, such as unmeasured and equal parental investment in their daughters' human capital.

A large body of economic literature uses (identical) twins as a credible identification strategy. Particularly, twins are used to study the causal effect of schooling on earnings beginning from Ashenfelter's and Krueger's (1994) famous twin study. Twins are also employed in studies concerning the effect of schooling on assortative mating and fertility (see e.g Behrman and Rosenzweig 2002, Kohler et al. 2010). A recent study of Amin and Behrman (2014) use identical twins to estimate the impact of schooling on fertility. Somewhat surprisingly, the effect that children have on their parents' income has not been investigated by using identical same-sex twins.

The unique feature of this analysis is that I can study the impact of children on their mother's lifetime income. So far, empirical evidence on the motherhood wage penalty is limited to the immediate years following childbirth. The occurance of a family gap in earnings around childbirth is not very surprising since almost all mothers experience a career break after giving birth. The interesting question is whether these career breaks related to the child have consequences on the lifetime labor earnings as could be expected based on the theory of human capital. Finland is a particularly interesting country in this respect, since it has a long tradition of family policies – such as public, low-cost day care and a job-protected maternity leave – which aim at facilitating the reconcilement of family and work and hence to improve the labor market outcomes of mothers. Moreover, I analyse the impact of children on fathers' earnings. The wage effects of fatherhood are much less known in economics literature than those of motherhood.

Another interesting feature of Finland – and of other Nordic countries – is that the earnings losses during career breaks related to having a child are compensated by earnings-related maternity and paternity allowances. Hence, during these career breaks, workers receive a part of their salary and continue to pay pension contributions. This means that the impact of children on lifetime income – including pensions – might not be significant. The combined data set used in this study serves as an astounding ground for investigating this particular feature of a welfare state. The data set has various different administrative measures for the financial state of a person. For the purposes of this study, the following two are the most relevant ones: annual taxable earnings and annual taxable income. The annual taxable earnings are the sum of earned and entrepreneurial income received by income recipients during the year.[6] The measure of annual taxable income is income that is subject to state taxation. It includes (i) wage income, (ii) entrepreneurial income and (iii) other income subject to state taxation – such as other earned income (e. g. dividends, which are taxed as earned income), (iv) pension income, (v) social security transfers subject to state taxation – such as unemployment benefit, sickness benefit, maternity and

[6] For a more thorough description, see http://www.stat.fi/meta/kas/tyotulot_en.html.

paternity allowance, child home care allowance, study grant and adult education subsidy and other social security benefits.[7]

I find that being a parent increases lifetime labor earnings and income around 30 to 40% for both men and women. An important finding is also that the estimated impact of children is nonlinear: being a parent is what matters, not the number of children. It remains unclear, what causes such a large difference in lifetime labor earnings and income between parents and non-parents.

The paper is organized as following. Next section describes the combined data set. Section 3 presents the empirical model and the main results. Section 4 concludes.

[7] Social security benefits, which are not subject to state taxation are child benefit, general housing allowance and other forms of housing assistance, and labor market subsidy.

2. Data Sources and Sample Definitions

2.1 Cohort of Older Same-sex Twin Data Combined with Other Data Sources

The study uses the Cohort of Older Like-sexed Twins Data (COLTD) collected by the Department of Public Health in the University of Helsinki. The older part of the Finnish Twin Cohort consists of all Finnish twin pairs of the same gender born before 1958 with both co-twins alive in 1975.[8] These twin pairs were selected from the Central Population Registry of Finland in 1974. For twin candidates were chosen the sets of persons with (i) the same birth date, (ii) the same commune of birth, (iii) the same sex, (iv) the same surname at birth, and (v) born before 1958. The youngest age group, born in 1950–1957, contains nearly all same-sex twins of the Finnish population except for those who have died of fatal diseases of early manifestation, or who have migrated at an early age. (Kaprio et al., 1979, 1–4.)

The Department of Public Health has conducted three surveys of the entire cohort.[9] The first questionnaire was mailed to all pairs in August-October 1975. Two follow-up questionnaire studies have been carried out in 1981 and 1990.[10] Twin zygosity was determined by validated questionnaire methods initially in the entire cohort (Kaprio et al., 1979).[11] The initial number of same-sex twin pairs was 13 888 in the beginning of the older Finnish Twin Cohort study in 1975. COLTD is collected according to an international standard.[12]

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[8] The Finnish Twin cohort also consists of following cohorts: FinnTwin16 (twins born 1975–1979) and FinnTwin12 (twins born 1983–1987).

[9] A fourth questionnaire was sent to the older twin cohort in 2010 to assess self-reported health, functional capacity and lifestyle factors, thus enabling a study spanning 35 years in the lives of the participants, with four time points of measurements and multiple outcomes. In 2007, there were more than 10 000 twins in the cohort alive and resident in Finland born between 1945 and 1957.

[10] The questionnaire of 1981 in English http://wiki.helsinki.fi/download/attachments/52076778/Twin+questionnaire+1981+English.pdf.

[11] The zygosity of the twin pairs in the The Cohort of Older Like-sexed Twins Data was determined using a deterministic method, which classified twin pairs on the basis of their responses to two questions on similarity in appearance in childhood. The questions were: "Were you and your twin partner during childhood as alike as "two peas in a pod" or were you of ordinary family likeness?" and "Were you and your twin partner so similar in appearance at school age that people had difficulty in telling you apart?". A subsample was taken to verify the classification using 11 blood markers. The classification results by the questionnaire method and by blood markers agreed 100%, the probability of misclassification of a blood marker concordant pair being 1.7 % (Kaprio et al., 1979, 29.)

[12] In the 1970s in San Juan and in Miami Beach, twin investigators reviewed the application of twin methods to epidemiological studies, with emphasis on smoking and cardiovascular disease. In the San Juan report it was stated "In advocating the establishment of new large-scale twin registries and the support and development of those already in existence, it is recognized that such registries constitute valuable national resources for investigations into the causes and prevention of disease". At the same time

The Department of Public Health at the University of Helsinki established the Finnish Twin Cohort study for epidemiological studies on chronic diseases. COLTD contains information on symptoms of illnesses and reported diseases, use of drugs, physical characteristics, smoking, alcohol use, leisure time physical activity, and psycho-social factors collected from a baseline questionnaire study of the Finnish Twin Cohort study in 1975 and from its follow-up questionnaire studies in 1981 and 1990. All the three questionnaires have reached remarkably high response rates.

COLTD is combined with the Finnish Longitudinal Employer-Employee Data (FLEED) of Statistics Finland. FLEED consists of all Finnish residents aged 16–70 and of all firms from year 1990 to 2004. The information on individuals is based on the Employment Statistics data base, which includes information on the labor market status of individuals and their background characteristics from different administrative registers. For instance, various earnings and income information are based on tax registers. With individual, plant and firm identification codes FLEED can be merged to other data sources. The combined data include selected information from COLTD from years 1975, 1981 and 1990 (survey years) and inclusive register based information, such as level and field of education, marital status and annual labor earnings and taxable income, for these twin pairs from FLEED in years 1990–2004.

Since FLEED only begins in 1990, we include information on earnings and income from the Population Censuses of years 1970, 1975, 1980 and 1985. This allows to see the earnings profiles for over 30 years.

There is no retrospective fertility information in the FLEED other than the number of individuals under the age of 18 living in the same household. Since the collection of the data began in 1990, this variable does not include children who died before 1990. More importantly, it does not contain those over the age of 18. For the purposes of this study, information on the total number of children born alive to each individual in COLTD is linked to these data. The information on the number of biological children and their birth year comes from the Population Information System (PIS) of the Population Register Centre. A short summary of the combined data set is presented in Table 1.

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the protocol attempted to develop comparable methods and data collection criteria, so that results from different registries could be subsequently comparable and even pooled. The protocol from the Miami Beach meeting formed the initial basis in the compilation of the Finnish Twin Registry and for the planning of the questionnaire studies. (Kaprio et al., 1979, 10–11.)

Table 1. Combined Data Set

Data:	Cohort of Older Like-Sexed Twins Data (COLTD)	Finnish Longitudinal Employer-Employee Data (FLEED)	Population Censuses (PC)	Population Information System (PIS)
Source:	Department of Public Health, University of Helsinki	Statistics Finland	Statistics Finland	Population Register Centre
Time of collection and method:	Mail-questionnairy in August-October 1975. Follow-up questionnaire studies in 1981 and 1990.	From 1990 onwards. Updated yearly.	1970, 1975, 1980, 1985	
Description:	Finnish twin pairs of the same gender born before 1958 with both co-twins alive in 1975. Information on symptoms of illnesses and reported diseases, use of drugs, physical characteristics, smoking, alcohol use, leisure time, physical activity, and psycho-social factors.	All Finnish residents aged 16–70. Information on individuals (e. g. age, education, marital status, labor market status) from various administrative registers, for example earnings and income information are based on tax registers. Includes the code of the employer (enterprise code) and the local kind-of-activity unit (establishment code).	All Finnish residents aged 16–70. Information on individuals (e. g. age, education, marital status,labor market status) from various administrative registers, for example earnings and income information are based on tax registers.	All Finnish residents.

2.2 **Sample of Like-sexed Twins at Least 40-years-old in 1990**

The sample employed in the empirical analysis consists of same-sex twin pairs, who are at least 40 years old and who have completed their fertility by the year 1990. In addition, I exclude individuals older than 60 years old in the year 2004. The outcomes for this sample are the log average annual taxable earnings and the log average annual taxable income between the years 1990 and 2004. The log average annual earnings is the sum of earned and entrepreneurial income received by income recipients during the year.[13] The measure of annual taxable income is the income that is subject to state taxation. It includes (i) wage income, (ii) entrepreneurial income and (iii) other income subject to state taxation – such as other earned income (e.g. dividends, which are taxed as earned income), (iv) pension income, (v) social security transfers subject to state taxation[14] – such as unemployment benefit, sickness benefit, maternity and paternity allowance, child home care allowance, study grant and adult education subsidy and other social

[13] For more thorough description, see http://www.stat.fi/meta/kas/tyotulot_en.html.

[14] Social security benefits, which are not subject to state taxation are child benefit, general housing allowance and other forms of housing assistance, and labor market subsidy.

security benefits.[15] The earnings and income variables are deflated with the cost of living index into 2010 euros.

The key explanatory variable – total number of children born – is the number of children that were born (alive) by the year 1990 to individuals who had all their children by the year 1990 and who were childless in the year 1970. Hence, individuals with children in 1970 and individuals who had or continued to have children in 1990 or /and later are excluded from the sample. The reason to exclude those individuals with children in 1970 is to be able to observe pre-children earnings.

The cohort sizes and age profiles are presented in Table 2. In total, there are 2 044 individuals in the sample, of whom 960 are women and 1 088 men.

Table 2. Age Profiles of the Sample Cohorts by Data Source

	Birth Year						
	1944	1945	1946	1947	1948	1949	1950
	Cohort of Older Like-Sexed Twins Data (COLTD)						
Observation year:	Age Profiles						
1975	31	30	29	28	27	26	25
1981	37	36	35	34	33	32	31
1990	46	45	44	43	42	41	40
	Population Censuses (PC)						
Observation year:	Age Profiles						
1970	26	25	24	23	22	21	20
1975	31	30	29	28	27	26	25
1980	36	35	34	33	32	31	30
1985	41	40	39	38	37	36	35
	Finnish Longitudinal Employer-Employee Data (FLEED)						
Observation year:	Age Profiles						
1990	46	45	44	43	42	41	40
1991	47	46	45	44	43	42	41
1992	48	47	46	45	44	43	42
1993	49	48	47	46	45	44	43
1994	50	49	48	47	46	45	44
1995	51	50	49	48	47	46	45
1996	52	51	50	49	48	47	46
1997	53	52	51	50	49	48	47
1998	54	53	52	51	50	49	48
1999	55	54	53	52	51	50	49
2000	56	55	54	53	52	51	50
2001	57	56	55	54	53	52	51
2002	58	57	56	55	54	53	52
2003	59	58	57	56	55	54	53
2004	60	59	58	57	56	55	54
Obs./Year	**100**	**186**	**234**	**302**	**374**	**362**	**490**

[15] For more information, see http://www.stat.fi/meta/kas/valt_veronal_tu_en.html.

2.3 **Descriptives**

2.3.1 Demographic and Other Background Characteristics of the Sample

Table 3 shows the demographic and other background characteristics of both women and men at different time points over the study period based on register data of Statistics Finland. The demographic comparison between future-mothers and childless women show that the future-mothers are, on average, slightly younger. Furthermore, the future-mothers have more often a spouse already in the beginning of the study period, in the year 1970. Of future-mothers 20% are married, whereas of childless women only 7% are married in 1970. By the year 1990 the share of married in the group of mothers have increased to over 80%, but only to 20% among childless women. Either childless women remain childless because they have difficulties in finding a spouse or they remain single because they do not want children.

The sample is selected so that all the individuals in the sample are childless in the year 1970. The reason to select the sample in this way is to see whether future parents and those who will remain childless differ in their earnings capacity already before children. The becoming mothers earn more and are more often employed in 1970. It could be that the future mothers are in some way a selected group – they are women who have not only better labor market, but also better marriage market positions. However, the difference in earnings is not very large.

The sample also is selected so that no-one gives birth after year 1989. In 1990, the difference in earnings between mothers and childless women is the opposite compared to 1970: childless women earn, on average, slightly more than mothers. However, in the year 2004, mothers again earn more than childless women. In fact, mothers' labor market situation is now much better than that of childless women. Mothers earn significantly more and have a higher employment rate.

The wage and income dynamics over the whole study period is drawn in Figure 1. The figure shows the average annual earnings and income over the time period 1970–2004[16] between women who will become mothers after 1970 and will complete their fertility by 1990 and women who will remain childless. Before having children mothers have on average slightly higher earnings. However, the pre-children difference in earnings is not very large. Between the years 1971 and 1990 – the period, in which the children are born – childless women's average earnings exceed the earnings of mothers. However, by the year 1990 mothers' average earnings have reached the level of childless women's average earnings.

[16] Between the years 1970 and 1990 earnings and income are observed only every 5th year.

From 1990 onwards, the average earnigs of both mothers and childless women drop due to a very severe recession, which Finland experienced in the early 1990s caused in part by the collapse of the Soviet Union – the main trade partner of Finland. However, mothers' earnings start to recover already in 1995, while no such recovery is seen for the earnings of childless women. On the contrary, the average earnings of childless women continue to decrease until the end of the observation period. Why do childless women suffer more long-lasting earnings losses due to the recession? One explanation could be that mothers were more likely to be employed in the public sector than childless women and hence were able to maintain their employment in the recession. It is often argued that public sector jobs have family-friendly attributes, such as security of employment and therefore are preferred by mothers. Unfortunately, based on the data, I am not able to say whether mothers were more often employed in the public sector than childless women. Childless women were perhaps more often employed in industries within the private sector that traded with the Soviet Union, such as in the textile industry. After the recession, the textile industry practically disappeared from Finland. Another explanation could be that during the recession those without children were more likely to be laid off in the mass-layoffs. Furthermore, it might be that mothers had a stronger incentive to find new employment after possible layoffs. Last, it could also be that during non-employment time children kept mothers more re-employable. For example, family-life might have prevented mothers from obtaining an unhealthy lifestyle, such as using alcohol excessively.

In fact, Table 3 indicates that one reason for mothers' better labor market performance seems to be health: over 25% of childless women receive disability pension, whereas only 10% of mothers do so in 2004. Do children affect one's health positively or are healthier people more likely to become parents? To get at least some indication of this, Table 4 describes selected health information of the twin survey questionnaires from the years 1975, 1981 and 1990.[17] Childless women report to have chestpain twice as often as mothers, and to use medication for a heart condition four times as often as mothers in 1975. On the other hand, mothers report to have medication for hypertensive twice as often as childless women. Otherwise, self-reported health measures in 1975 do not differ much between mothers and childless women. Moreover, there is no indication of difference in the use of alcohol between mothers and childless women. In the 1981 and 1990 questionnaires childless women report to smoke more than mothers. The share of those who have reported having passed out because of alcohol use is higher for childless women in 1981, but not in 1990. Childless women also report to have chestpain and medication for a heart condition more often both in 1981 and 1990. Based on BMI, a higher share of childless women

[17] The respond rate of the sample is almost 100%.

are also classified as overweight. Unfortunately, there have not been any questionnaires after 1990. It would be interesting to see how the health of these individuals has developed after the early 1990s recession.

Table 3. Demographic and Other Background Characteristics

	Females			Males		
	All	**Childless**	**Mothers**	**All**	**Childless**	**Fathers**
REGISTER DATA:						
Age in 1990	42.2	42.5	42.0	42.2	42.3	42.2
Years of schooling in 1990	11.9	12.1	11.9	11.9	11.2	12.1
Number of children in 1990	1.382	0	1.922	1.493	0	2.053
House owner in 1990	0.840	0.789	0.860	0.858	0.795	0.822
Spouse's earnings in 1990	32 826.49	27 530.64	33 626.20	19 144.42	17 347.23	19 363.29
Family status in 1970						
Single	0.831	0.929	0.794	0.893	0.970	0.863
Married	0.168	0.071	0.205	0.107	0.030	0.135
Divorced	0.001	0	0.001	0	0	0
Family status in 1990						
Single	0.261	0.702	0.089	0.192	0.680	0.009
Married	0.646	0.212	0.815	0.692	0.192	0.880
Divorced	0.093	0.086	0.096	0.060	0.030	0.072
Family status in 2004						
Single	0.283	0.688	0.125	0.237	0.727	0.053
Married	0.534	0.208	0.661	0.630	0.222	0.783
Divorced	0.183	0.104	0.214	0.133	0.051	0.164
Pre-children labor market outcomes in 1970						
Earnings	7 678.50	7 101.22	7 903.23	10 458.73	8 935.39	11 030.7
Income	7 734.82	7 175.59	7 952.52	10 818.21	9 229.8	11 414.73
Employed	0.698	0.662	0.712	0.632	0.609	0.641
Labor market outcomes in 1990						
Earnings	19 691.55	20 099.77	19 532.63	29 302.77	21 120.12	32 375.14
Income	19 691.55	20 099.77	1 9532.63	29 302.77	21 120.12	32 375.14
Employed	0.869	0.851	0.876	0.892	0.788	0.932
Labor market outcomes in 2004						
Earnings	20 217.43	17 424.41	21 304.73	27 505.41	16 528.78	31 626.85
Income	23 949.00	22 489.76	24 517.07	32 867.12	22 761.03	36 661.70
Employed	0.702	0.587	0.747	0.654	0.478	0.721
Unemployment pension	0.010	0.019	0.007	0.002	0.007	0
Disability pension	0.144	0.253	0.101	0.169	0.290	0.124
Old-Age pension	0.015	0.019	0.013	0.022	0.007	0.028
Obs.	**960**	**269**	**691**	**1 088**	**297**	**791**

The overall picture of fathers and childless men is similar to that of mothers and childless women (see Table 3). Of men, fathers are more educated, by one year on average, than childless men. Future-fathers are also more often married (13.5%) than those men who remain childless (3%) in 1970. Moreover, the share of married among fathers has increased to almost 90% by 1990, while the majority of childless men are still single.

Before starting to have children (in the year 1970) the future fathers earn significantly more than those men who remain childless (see Table 3 and Figure 2). Future fathers are also more often employed, but the difference in employment rate is not enourmous. By the year 1990, the gap in earnings has widened further. While childless women earn on average more than mothers between the years 1970 and 1990, childless men's average earnings never exceed those of fathers. This is understandable since fathers do not experience such breaks in employment due to childbirths as mothers. There is also a significant difference in the share of employed between fathers and childless men in 1990. In 2004, childless men do, on average, far worse than fathers in every labor market aspect: their earnings are only half of the fathers' earnings and their employment rate is less than 50% – over 20 percentage points lower than that of fathers. Like for childless women, the explanation for worse labor market performance seems to be health related: childless men receive disability pension three times as often as fathers in 2004 (see Table 3).

Like with women, the self-reported health measures do not differ much in 1975 (see Table 4). Only smoking seems to be more common among fathers. In 1981, a higher share of childless men can be classified as overweight. They also report feeling chestpain more often, but the difference in the use of medication for a heart condition is not significant. However, childless men report to have medication for hypertensive twice as often as fathers in 1981. There is also some indication of different drinking habits. In 1990, 20% of childless men report to have passed out at least once during the last year, while of fathers 15% have done so.

Since I want to see whether those who will become parents and those who will remain childless differ in their labor market earnings potential even before the children are born, I have excluded from the sample those twin pairs of whom either one or both had children already in 1970. The demographic and some other background charasteristics of these twin pairs are shown in Table 5. Furthermore, the earnings and income pattern of those excluded from the sample - those who had children already in 1970 and those who continue to have children beyond year 1989 (and their co-twins) – are shown in Figures 3 and 4.

Of female twin pairs, those excluded from the sample are on average older and less educated than those included in the sample. This is not a surprise, since older women are more likely to have children in 1970 and less educated women usually start to have children earlier than women who pursue further education. There is also a significant difference in the completed fertility between the women excluded and included in the sample. The women excluded from the sample – because both or at least the other co-twin had a child or children already in 1970 – have on average 2.1 children whereas the women in the sample have on average only 1.4 children – which is a very low number for the age cohorts. Since Table 3 shows that mothers in the sample have on average 1.9 children, the

share of childless women must be higher than among those excluded from the sample. To sum up, the sample selected to this analysis concentrates on women who are more educated, more often childless and have a better labor market position already in 1970.

Table 4. Health Measures of the Twin Survey

	Females			Males		
	All	**Childless**	**Mothers**	**All**	**Childless**	**Fathers**
SURVEY DATA:						
Health measures in 1975						
Smoking (packs/year)	1.438	1.324	1.486	4.060	3.519	4.269
Heavy use of alcohol	0.074	0.072	0.074	0.423	0.417	0.425
BMI	21.1	21.2	21.1	23.2	23.3	23.2
Obesity	0.043	0.041	0.043	0.058	0.054	0.059
Chestpain	0.033	0.054	0.026	0.026	0.031	0.024
Medication for heart condition	0.009	0.019	0.005	0.003	0.004	0.003
Medication for hypertensive	0.018	0.011	0.021	0.011	0.011	0.011
Health measures in 1981						
Smoking (packs/year)	2.304	2.627	2.182	6.143	6.164	6.136
Heavy use of alcohol	0.080	0.079	0.079	0.422	0.441	0.415
Passout	0.057	0.071	0.052	0.184	0.187	0.183
BMI	21.8	21.5	21.9	24.0	24.2	23.9
Obesity	0.101	0.123	0.093	0.138	0.192	0.118
Chestpain	0.040	0.053	0.036	0.036	0.049	0.032
Medication for heart condition	0.007	0.009	0.007	0.011	0.013	0.010
Medication for hypertensive	0.029	0.026	0.030	0.019	0.031	0.015
Health measures in 1990						
Smoking (packs/year)	3.603	3.792	3.540	8.966	8.490	9.127
Heavy use of alcohol	0.076	0.074	0.078	0.278	0.256	0.287
Passout	0.053	0.048	0.055	0.164	0.202	0.151
BMI	23.1	22.4	23.4	25.1	25.0	25.1
Obesity	0.292	0.320	0.281	0.380	0.431	0.360
Chestpain	0.047	0.052	0.045	0.054	0.061	0.052
Medication for heart condition	0.012	0.023	0.008	0.025	0.024	0.025
Medication for hypertensive	0.062	0.072	0.058	0.059	0.083	0.051
Obs.	**960**	**269**	**691**	**1 088**	**297**	**791**

Note: Heavy use of alcohol is based on the following question "Does it happen that at least once amonth and on the same occasion you drink more than five bottless of beer or more than bottle of wine or more than half a bottle of hard liquor?". Answer altervatives: No, yes (question #58 in 1975, #59 in 1981, #73 in 1990). Passed out is based on the following question "How often have you passed out while using alcohol during the last year?". Answer alternatives: Not once, once, two-three times, four-six times, seven times or more (question #60 in 1981, #74 in 1990).

Likewise, of men the ones included in the sample are also younger and more educated than those excluded from the sample. However, the difference in average years of education is not as large as between women included in and excluded from the sample. In contrast to women, men included in the sample perform worse in the labor market in 1970 than those men excluded from the sample. There is also a large difference in the total number of children between the men included in and excluded from the sample. Like female twin pairs included in the sample, male twin pairs also have, on average, less children than typical. The men included in the sample have on average 1.5 children and men excluded have 2.2 children. Again, since fathers in the sample have on average 2.1 children (see Table 3), which is close to the average number of children among excluded men, the sample selected consists of more childless men. In short, the selected male twin pairs are younger, slightly more educated, but have worse labor market position and less often children than those excluded from the sample.

Table 5. Comparison of Demographic and Other Background Characteristics of Those Included in the Sample and of Those Excluded from the Sample

	Females		**Males**	
	Included	**Excluded**	**Included**	**Excluded**
Age in 1990	42.2	43.5	42.2	43.6
Education in 1990:				
Primary	0.325	0.510	0.372	0.461
Secondary	0.391	0.374	0.369	0.330
Tertiary	0.284	0.117	0.258	0.209
Years of schooling	11.9	10.8	11.9	11.4
Family status in 1990: Couple	0.715	0.773	0.762	0.851
Number of children in 1990	1.382	2.107	1.493	2.201
Spouse's earnings in 1990	32 826.49	28 817.01	19 144.42	17 973.77
Labor market outcomes in 1970				
Earnings	7 678.50	6 804.01	10 458.73	13 569.59
Income	7 734.82	6 909.02	10 818.21	14 248.93
Employed	0.698	0.625	0.632	0.794
Labor market outcomes in 1990				
Earnings	19 691.55	18 646.90	29 302.77	31 258.84
Income	19 691.55	18 646.90	29 302.77	31 258.84
Employed	0.869	0.876	0.892	0.931
Labor market outcomes in 2004				
Earnings	20 217.43	15 679.38	27 505.41	23 483.84
Income	23 949.00	21 772.65	32 867.12	30 360.94
Employed	0.702	0.616	0.654	0.609
Obs.	**960**	**1 020**	**1 088**	**798**

Figure 1. *Annual Earnings and Income of Childless Women and Mothers*

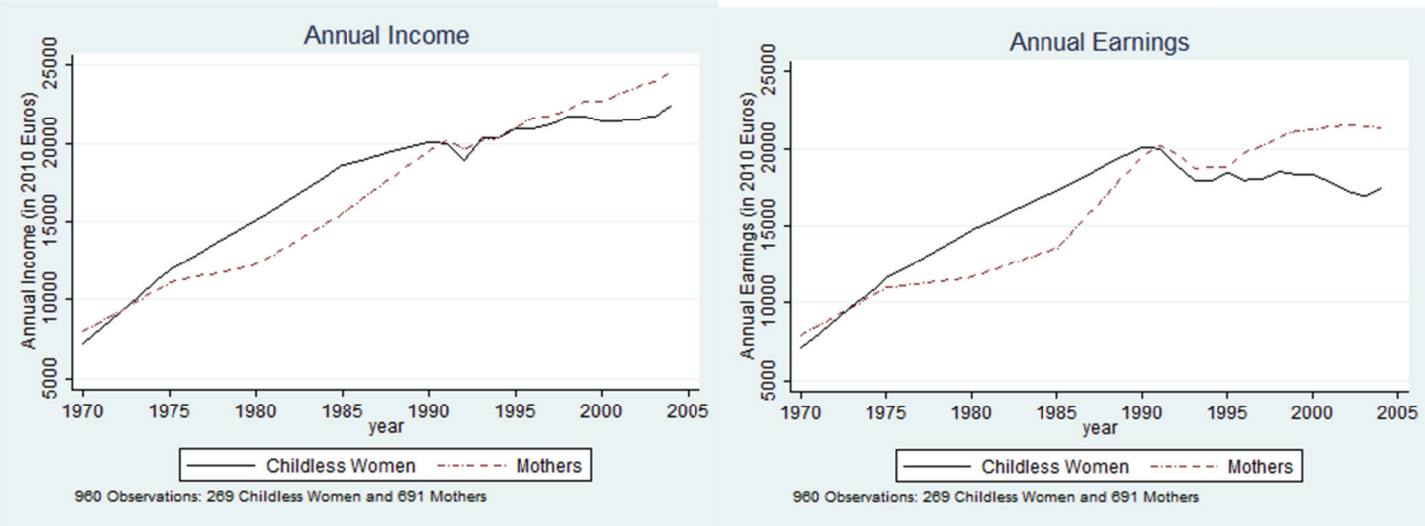


Figure 2. *Annual Earnings and Income of Childless Men and Fathers*

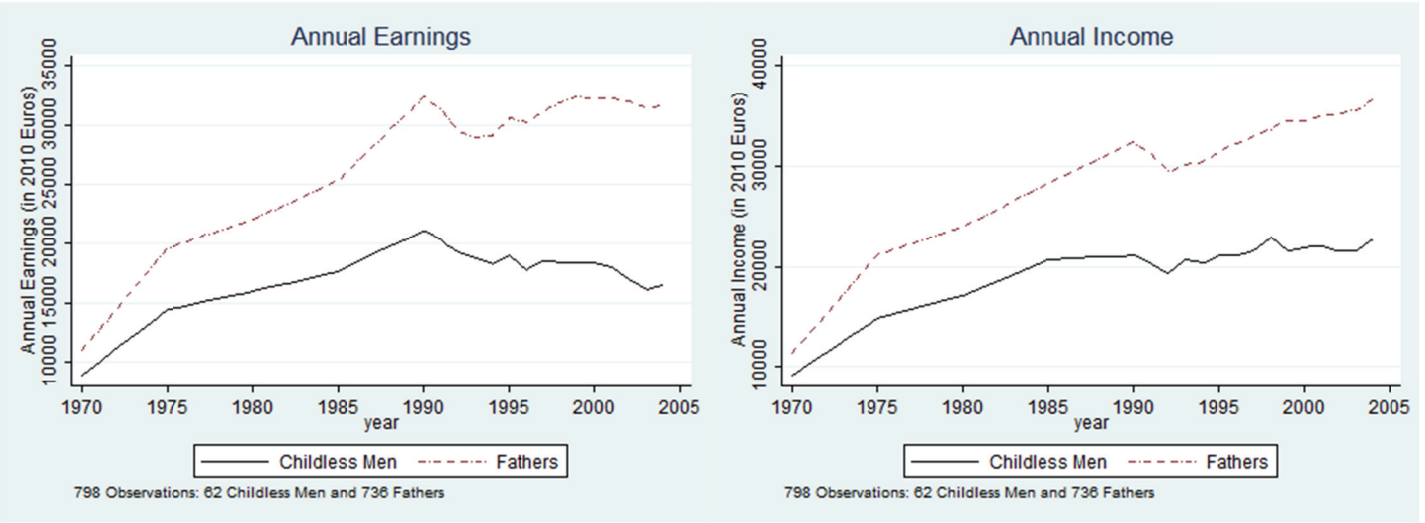


Figure 3. *Annual Earnings and Income of Childless Women and Mothers: Not Included in the Sample*

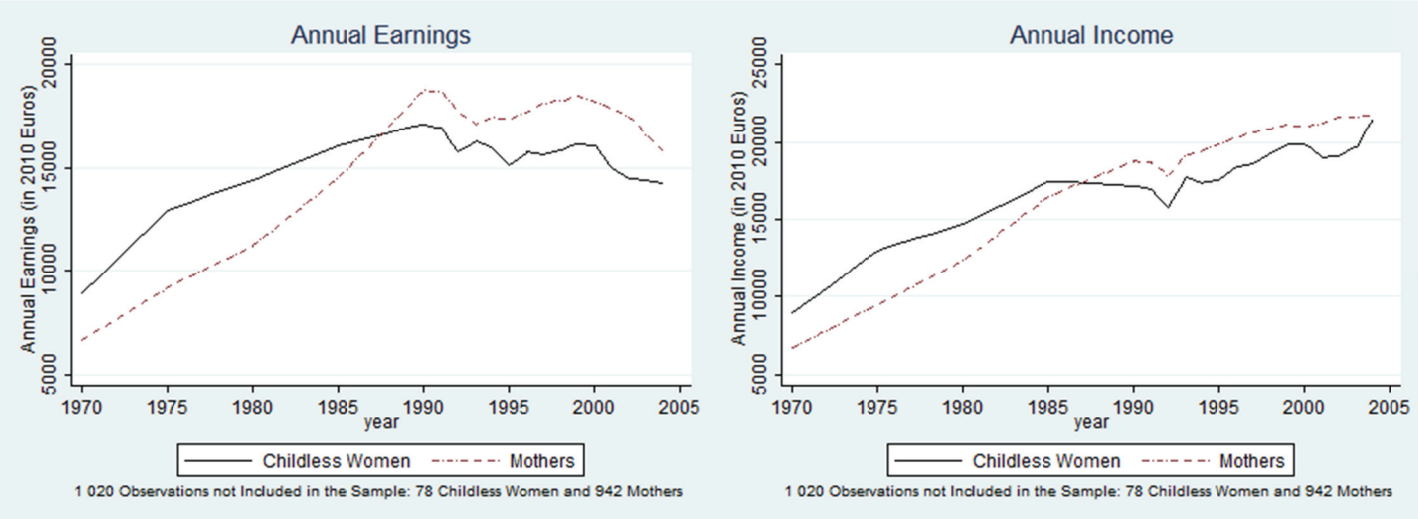
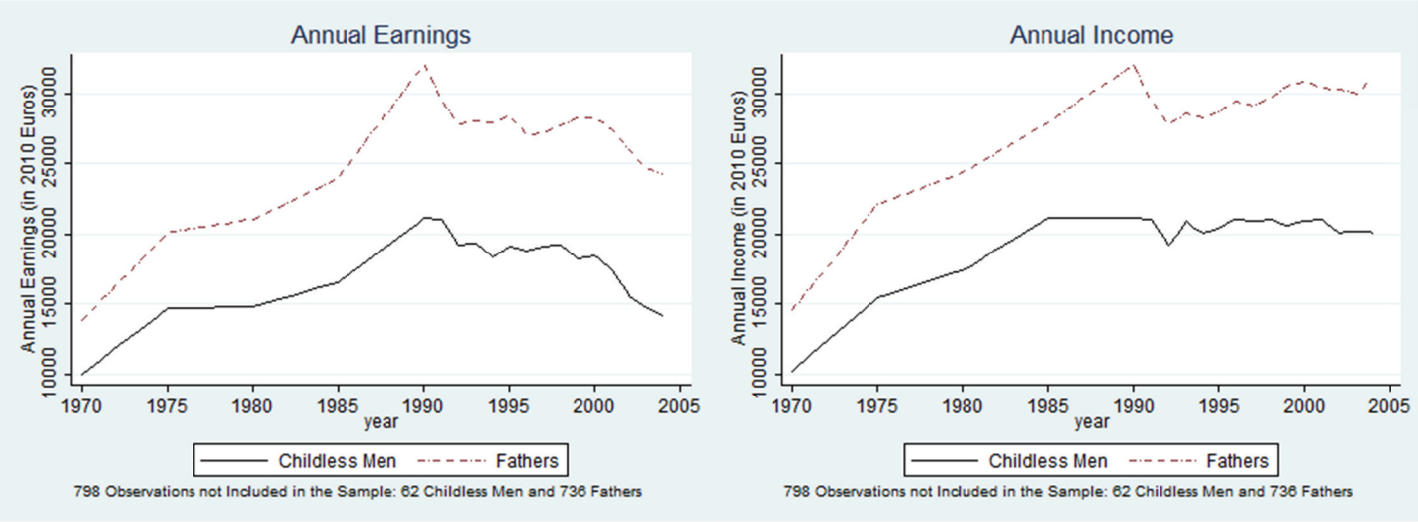


Figure 4. *Annual Earnings and Income of Childless Men and Fathers: Not Included in the Sample*



2.3.2 Within-twin Family Size Difference

Twins share the same family background. Identical twins also share the same genes. Thus, they are more similar in aspects of "ability" or "motivation" than two random persons with the same observed charasteristics – such as age, years of schooling and occupation. Hence, the within-twin difference in earnings by parent status is a better measure of the impact of children on earnings than the simple OLS estimation. The within-twin estimation of identical twins controls for such unobserved differences between parents and non-parents as family background and genetic ability. Although similar in terms of innate ability or earnings potential, some necessary difference within a twin pair has to exist in order to be able to identify the impact of children on income. That is, a difference in the number of children.

Table 6 shows the within-twin pair difference in the number of children for monozygotic (MZ) twins – in other words, for identical twins. This raises the obvious question: If so identical, why do twins differ in the number of children they have? There could be various reasons for this. First of all, even though twins are identical, their partners are not. Second, individual-specific shocks – such as an illness or accident – can affect the fertility pattern of one twin but not of the other. Third, even though identical in their genes, twins may have non-identical preferences with respect to the desired number of children. Table 6 also reports the within-twin differences in fertility for the whole twin sample (All) and for dizygotic (DZ) twins.

Table 6. Within-Twin Difference in the Total Number of Children Born

	Females						**Males**					
Difference	All	(%)	DZ	(%)	MZ	(%)	All	(%)	DZ	(%)	MZ	(%)
0	174	(36.3)	110	(34.5)	64	(39.8)	200	(36.8)	128	(34.4)	72	(41.9)
1	184	(38.3)	127	(39.8)	57	(35.4)	187	(34.4)	130	(34.9)	57	(33.1)
2	98	(20.4)	65	(20.4)	33	(20.5)	117	(21.5)	80	(21.5)	37	(21.5)
3	19	(4.0)	14	(4.4)	5	(3.1)	33	(6.1)	29	(7.8)	4	(2.3)
4	5	(1.0)	3	(0.9)	2	(1.2)	5	(1.0)	4	(1.21)	1	(0.6)
5	-		-		-		2	(0.4)	1	(0.3)	1	(0.6)
Obs.	**480**		**319**		**161**		**544**		**372**		**172**	

Of female and male twins more than 1/3 has exactly the same number of children. With this respect, identical twins indeed seem to be more similar than non-identical (or dizygotic) twins. Of identical female twins approximately 40% compeleted their fertility with the same number, while of non-identical female twins only 34% did so. For identical male twins the similarity between their family size is even higher at 42%, compared to 34% of non-identical male twins. Crucial for the identification strategy of this study, the share of twin pairs who do not have the exact same number of children is higher. Altogether, 64% of female and male twin pairs differ in their fertility. The most typical difference is a difference of one child: 38% of female and 34% of male twins have either one

child more or less than their co-twin. A difference of two children is also a quite typical one: around 1/5 of both females and males differ in their family size by two children. A small share of twin pairs differ in their fertility by three children: 4% of female and 6% of male twins fall into this category. Larger differences are even more uncommon.

If the difference of one child is the most typical one within a twin pair, the most popular family size of these twins is a family of two children. Around 40% of twin cohorts born between 1944 and 1950 have two children (Table 7). For women, having a child (21%) is more common than being childless (18%). Of men a higher share are childless: 22% compared to 20% with one child only.

Table 7. Total Number of Children Born

	Females						**Males**					
Children	All	(%)	DZ	(%)	MZ	(%)	All	(%)	DZ	(%)	MZ	(%)
0	269	(28.0)	168	(26.3)	101	(31.4)	297	(27.3)	195	(26.2)	102	(29.7)
1	217	(22.6)	149	(23.4)	68	(21.1)	208	(19.1)	142	(19.1)	66	(19.2)
2	339	(35.3)	232	(36.4)	107	(33.2)	382	(35.1)	265	(35.6)	117	(34.1)
3	113	(1.9)	76	(11.8)	38	(11.8)	162	(14.9)	116	(15.6)	46	(13.4)
4	18	(0.3)	12	(1.9)	6	(1.9)	31	(2.9)	22	(3.0)	9	(3.4)
5	3	(0.1)	1	(0.2)	2	(0.6)	7	(0.6)	4	(0.3)	3	(2.6)
6	1		1	(0.2)	-		-		-	(0.5)	-	
7	-		-		-		1	(0.1)	-		1	(0.3)
Obs.	**960**		**638**		**322**		**1 088**		**744**		**344**	

2.3.3 To Whom Are these Twins Married?

As discussed earlier in Section 2.3.1, the share of single women is higher among female twin pairs selected into the sample than those exluded from the sample.[18] Now, the question is if the share of single women is the same among childless women and mothers. Table 8 shows that 66% of childless women are single in 1990, while only 14% of mothers are so. Of childless men 70% are single, whereas of fathers only 7%.

It is also worth noting from Table 9, that of those childless women, who have a spouse, the majority have a spouse, whose earnings belong to the bottom or medium category of the earnings distribution. In contrast, the majority of mothers have a high-earning spouse. The majority of childless men have a spouse from the bottom of the earnings distribution. Fathers' spouses have earnings almost equally in the bottom and medium category of the earnings distribution. Of fathers 16% and of childless men 10% have a high-earning spouse.

[18] I have excluded from the sample those twin pairs, of whom either one or both had children already in 1970.

Table 8. Do Childless People Have a Spouse in 1990?

	Childless Women			Mothers		
	All	DZ	MZ	All	DZ	MZ
Single	179 (65.9%)	115 (68.0%)	64 (62.4%)	95 (13.7%)	70 (14.9%)	25 (11.3%)
Couple	90 (33.5%)	53 (31.6%)	37 (36.6%)	596 (86.3%)	400 (85.1%)	196 (88.7%)
Married	57 (21.2%)	32 (19.1%)	25 (24.8%)	563 (81.5%)	376 (80.0%)	187 (84.6%)
Divorced	23 (8.6%)	16 (9.5%)	7 (6.9%)	66 (9.6%)	46 (9.8%)	20 (9.1%)
Obs.	**269**	**168**	**101**	**691**	**470**	**221**

	Childless Men			Fathers		
	All	DZ	MZ	All	DZ	MZ
Single	207 (69.7%)	142 (72.8%)	65 (63.7%)	52 (6.6%)	36 (6.6%)	16 (6. %)
Couple	90 (30.3%)	53 (27.2%)	37 (36.3%)	739 (93.4%)	513 (93.4%)	226 (93.4%)
Married	57 (19.2%)	36 (18.5%)	21 (20.6%)	696 (88.0%)	484 (88.2%)	212 (87.6%)
Divorced	9 (3.0%)	3 (1.5%)	6 (5.9%)	57 (7.2%)	36 (6.6%)	21 (8.7%)
Obs.	**297**	**195**	**102**	**791**	**549**	**242**

Note: Married are a subgroup of Couples and Divorced is a subgroup of Singles.

Table 9. Spouses' Earnings in 1990

	Females		Males	
Spouse's earnings:	Childless women	Mothers	Childless men	Fathers
bottom	23 (25.6%)	107 (18.0%)	46 (51.1%)	329 (44.5%)
medium	26 (28.9%)	154 (25.8%)	35 (38.9%)	290 (39.2%)
high	41 (45.6%)	335 (56.2%)	9 (10.0%)	120 (16.2%)
Obs.	**90**	**596**	**90**	**739**

3. Econometric Analysis

The causal effect of children on earnings and income is difficult to estimate because of the inherent unobservability of the counterfactual. Individuals with different number of children are likely to differ from each other in unobservable ways, for instance in aspects of "ability" or "motivation". The differences in their earnings – even within a specific age, education and occupation group – most likely reflect differences in these unobserved factors rather than the difference in their completed fertility.[19] Hence in this study differences in family size within a twin pair are used in the estimation to control for the most important unobserved factors – mainly family background and genetic ability.

3.1 **Empirical Model**

In Model 1 I estimate the following equation by ordinary least squares (OLS) for twin *i* in family *j*:

$$ln\bar{Y}_{ij} = \alpha_0 + \alpha_1 CHILDREN_{ij} + \mu_j + \varepsilon_{ij}$$

where $CHILDREN_{ij}$ is the total number of children born (alive) for those individuals who have completed their fertility by the age of 40. μ_j represents unobservable components that vary by family (e.g. environment). When this specification of the model is applied to sample of twins (treated as a "normal" sample of individuals), the estimates will be subject to omitted variable bias due to omission of controls for genetic ability and family component μ_j.

When taking into account that these individuals actually are twins, I can control for the genetic ability and the same family background. In this specification, the difference in log average earnings of a twin pair is related to differences in explanatory variables. The model is of the following form:

$$\Delta ln\bar{Y}_j = \alpha_1 \Delta CHILDREN_j + \Delta\varepsilon_j$$

where Δ indicates the *difference* in the values of the particular variable within a twin pair in family *j*. The model is estimated separately for men and women.

Model 1 assumes that children affect their parents' earnings linearly. Mean impacts might, however, give a misleading picture of the effects of children on earnings and income. The effect that children potentially have on their parents' earnings and income might very well be nonlinear, meaning that the consequences of children may increase or decrease with the number of children.

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[19] In their study Neumark and Korenman (1994) conclude based on data on siblings that the motherhood wage penalty is not solely due to unobserved heterogeneity.

To examine whether children affect income differently depending on the sequence of a child, I estimate the following equation:

$$\Delta ln\overline{Y}_j = \alpha_1 \Delta D_1 + \alpha_2 \Delta D_2 + \alpha_3 \Delta D_3 + \Delta \varepsilon_j$$

where the indicator D_1 has a value of one if an individual has at least one child. Similarly, D_2 gets a value of one if a person has at least two children, D_3 gets a value of one if a person has at least three children. For example, an individual who has two children, both the variable D_1 and variable D_2 will have a value of one. Δ indicates the difference in these child-dummy variables within a twin pair in family *j*. Hence, for a twin with two children and the co-twin with no children at all, the parameter α_1 will tell the impact of the first child on income and the estimate for α_2 will reveal the additional impact of the second child. This is Model 2.

Another way of imposing nonlinearity to the model is to estimate the equation (1) with an additional dummy variable, D_{ij}, which is an indicator for whether the person has any children. In Model 3 the following equation is estimated:

$$\Delta ln\ \overline{Y}_j = \alpha_1 \Delta CHILDREN + \alpha_2 \Delta D_j + \Delta \varepsilon_j$$

where Δ indicates the difference in the values of the particular variable within a twin pair in family *j*.

3.2 **Main Results**

3.2.1 The Effect of Children on a Measure of Lifetime Earnings and Income

Table 10 presents the results of the effect of children on lifetime earnings and income. Panel A shows the estimates of the impact of children on log average annual taxable earnings for same-sex twins. Panel B shows estimates of the impact of children on log average annual taxable income. The first three columns show the estimates for females and the last three for males. I report only the estimates with no other explanatory variables. The reason for this is, that it is not clear what should be controlled for (except ability) when examining the effect of children on earnings. The preference for children may potentially affect the choice of education, occupation, etc. Hence, controlling for these characteristics of the individuals would introduce the so-called bad control problem (Angrist and Pischke, 2009).

Model 1 estimates the mean impact of children on average lifetime earnings and income. The first column of results is for the sample of female twins treated as a sample of individuals. The second column shows the effect of children when I control for the family background (within-twin estimation). The third column

shows the within-twin estimate for identical female twins only. Since identical twins not only share the same family but the same genes, both the family component and the ability component drop out of the twin fixed-effects version of the earnings equation. The last three columns present the same results for male twins. There is a positive association between children and lifetime earnings of women. In the within-twin estimation the effect of children on lifetime earnings is 13–14%, but the result is not statistically significant, when only identical twins are used in the estimation. The statistical insignificance is most likely due to the small sample size. For men there is, as expected, a positive association between number of children and earnings of 23%. In the within-twin estimation, the estimate is still positive, but 10 percentage points smaller. For identical male twins the effect is even smaller (8%) and insignifigant, but this is again most likely due to a small sample size. Hence, a large part of the observed "fatherhood premium" in lifetime earnings is due to family background. Nevertheless, both mothers and fathers have an economically significant "parent premium" in their lifetime earnings.

If the impact of children is nonlinear in nature, Model 1 does not reveal it. Therefore, I estimate the nonlinear Model 2 in order to see, whether the first child has a different impact on earnings than additional children. Based on the results from Model 2, the picture of the effect of children on earnings becomes somewhat different. There is a positive "parent premium" in earnings due to the first child. This premium is economically quite sizeable: of 40 percentage points increase for men and 30 percentage points increase for women. Moreover, the results show that the children do have a nonlinear impact on earnings with the first child having the largest effect.

The last model is an extension of Model 1. In Model 3, I add a dummy-variable for being a parent to estimate the Model 1 more efficiently. The results based on Model 3 support the interpretation from the results of Model 2: being a parent affects labor earnings positively. There could be several explanations for this "parent premium" in earnings. Those without children may be a negatively selected group of individuals – as it seems from Table 3 for men particularly. This could be the case if the childless persons have experienced an individual specific shock in their lives, which prevents them from making both children and money. Second, it might be that having a child really improves productivity – whether it is due to parenthood changing one's personality or use of time. Third, having a family could be a signal from a responsibility, commitment, prestige, etc. – things that are valued by the employer. Last, a child premium may infact be explained by so-called in-group bias, meaning that people have a tendency to favor their own kind and are more altruistic toward others in their own group. If being a parent is something that specifies such a group and since most employers, managers and superiors are parents, this might be a potential explanation for a child premium in lifetime labor earnings.

Table 10. Effect of Children on Lifetime Taxable Earnings and Income

	Females			Males		
	Twins treated as a sample of individuals	Within-Twin		Twins treated as a sample of individuals	Within-Twin	
	OLS	All	MZ	OLS	All	MZ
Panel A: Dependent variable is log average annual earnings between 1990-2004						
Model 1						
Number of children	0.086*	0.134*	0.140	0.234***	0.132***	0.084
	(0.044)	(0.070)	(0.134)	(0.032)	(0.044)	(0.065)
Model 2						
First child	0.268**	0.337*	0.338	0.606***	0.448***	0.384**
	(0.128)	(0.190)	(0.228)	(0.120)	(0.162)	(0.163)
Second child	0.125	0.029	-0.075	0.087	0.041	-0.148
	(0.096)	(0.150)	(0.230)	(0.091)	(0.113)	(0.129)
Third child	-0.229*	0.059	0.180	0.117	-0.066	0.078
	(0.131)	(0.205)	(0.437)	(0.075)	(0.095)	(0.139)
Model 3						
Number of children	-0.033	0.054	0.103	0.077**	0.023	0.023
	(0.060)	(0.092)	(0.181)	(0.038)	(0.052)	(0.072)
Parent	0.373**	0.266	0.128	0.541***	0.416**	0.256
	(0.157)	(0.221)	(0.250)	(0.129)	(0.184)	(0.185)
Obs.	**914**	**457**	**154**	**1 030**	**515**	**159**
Panel B: Dependent variable is log average annual income between 1990-2004						
Model 1						
Number of children	0.006	0.001	0.021	0.168***	0.089***	0.085*
	(0.022)	(0.032)	(0.048)	(0.019)	(0.026)	(0.043)
Model 2						
First child	0.086	0.084	0.113	0.479***	0.367***	0.279**
	(0.057)	(0.084)	(0.130)	(0.062)	(0.089)	(0.113)
Second child	0.025	-0.002	-0.060	0.070	0.015	-0.010
	(0.053)	(0.081)	(0.087)	(0.050)	(0.066)	(0.095)
Third child	-0.154*	-0.105	0.028	0.007	-0.100	0.003
	(0.080)	(0.100)	(0.144)	(0.054)	(0.064)	(0.106)
Model 3						
Number of children	-0.046	-0.042	-0.005	0.025	-0.018	0.030
	(0.033)	(0.043)	(0.065)	(0.025)	(0.033)	(0.047)
Parent	0.160**	0.141	0.089	0.482***	0.392***	0.221*
	(0.075)	(0.105)	(0.155)	(0.071)	(0.102)	(0.127)
Obs.	**960**	**480**	**161**	**1 088**	**544**	**172**

Notes: In Panel A the dependent variable is the log average annual taxable earnings between years 1990 and 2004 (in 2010 euros). The estimation is based on 914 observation of female and 1 030 observation of male twins. In Panel B the dependent variable the log average annual taxable income between years 1990 and 2004 (in 2010 euros). The estimation is based on 960 observation of female and 1 088 observation of male twins. Controls include birth year dummies (only in OLS). Robust standard errors are in parantheses. Significance level: *** 1%, ** 5%, * 10%

In Panel B the same results are reported – only the dependent variable is now log average annual taxable income. Since annual taxable income is the sum of wage income, entrepreneurial income and other income subject to state taxation – such as maternity leave benefits, unemployment benefits and other social security benefits, and pensions – this outcome is of major relevance. In Finland, some of the direct costs from childbearing are compensated – at least partly – through maternity and paternity leave benefits. Hence, individuals continue to contribute to their pensions also during these child-related employment breaks. The first child has, again, a positive impact on income. The size of this child premium for women is, however, much smaller compared to the premium in earnings, and also statistically insignificant. For men, the estimated effect of the first child on lifetime income is close to the effect on earnings.

3.2.2 The Effect of Children on a Measure of Lifetime Earnings and Income: Pre-Children Earnings Capacity as a Control

Next, I estimate Model 1 with the pre-children earnings of the year 1970 as a control. The reason to include the year 1970 earnings into the estimation is to control for the difference in the pre-children earnings capacity. In fact, especially for men there is a gap in pre-children average earnings as shown in Figure 2. The model is of the following form:

$$ln\bar{Y}_{ij} = \alpha_0 + \alpha_1 CHILDREN_{ij} + \alpha_2 PRE - CHILDREN\ EARNINGS\ IN\ 1970_{ij} + \mu_j + \varepsilon_{ij}$$

$$i = 1,2, j = 1, \dots n$$

and the within-twin difference

$$\Delta ln\bar{Y}_j = \alpha_1 \Delta CHILDREN_j + \alpha_2 \Delta PRE - CHILDREN\ EARNINGS\ IN\ 1970_j + \Delta\varepsilon_j$$

The pre-children earnings of the year 1970 is also included in Models 2 and 3. When the dependent variable is the log average annual taxable income, the control is the pre-children income of 1970.

Table 11 shows the results. Controlling for the pre-children earnings (or income) in 1970 does not change the results. This means that the differences in earnings due to children arise later.

Table 11. Effect of Children on Lifetime Taxable Earnings and Income: Pre-Children Earnings and income of the year 1970 as a Control

	Females			**Males**		
	Twins treated as a sample of individuals	Within-Twin		Twins treated as a sample of individuals	Within-Twin	
	OLS	All	MZ	OLS	All	MZ
Panel A: Dependent variable is log average annual earnings between 1990-2004						
Model 1						
Number of children	0.086*	0.135*	0.139	0.229***	0.130***	0.083
	(0.044)	(0.070)	(0.131)	(0.031)	(0.044)	(0.067)
Model 2						
First child	0.260**	0.320*	0.345	0.587***	0.443***	0.383**
	(0.128)	(0.187)	(0.236)	(0.117)	(0.161)	(0.166)
Second child	0.129	0.043	-0.082	0.091	0.039	-0.148
	(0.096)	(0.149)	(0.232)	(0.091)	(0.113)	(0.129)
Third child	-0.221*	0.062	0.175	0.119	-0.066	0.078
	(0.132)	(0.205)	(0.432)	(0.076)	(0.095)	(0.140)
Model 3						
Number of children	-0.027	0.062	0.098	0.078**	0.021	0.023
	(0.060)	(0.091)	(0.172)	(0.038)	(0.052)	(0.074)
Parent	0.357**	0.243	0.140	0.525***	0.415**	0.255
	(0.156)	(0.217)	(0.242)	(0.127)	(0.183)	(0.185)
Obs.	**914**	**457**	**154**	**1 030**	**515**	**159**
Panel B: Dependent variable is log average annual income between 1990-2004						
Model 1						
Number of children	0.006	0.001	0.022	0.163***	0.088***	0.081*
	(0.021)	(0.032)	(0.049)	(0.018)	(0.026)	(0.046)
Model 2						
First child	0.072	0.074	0.113	0.463***	0.365***	0.271**
	(0.056)	(0.086)	(0.131)	(0.061)	(0.088)	(0.117)
Second child	0.029	0.004	-0.059	0.071	0.015	-0.008
	(0.052)	(0.080)	(0.086)	(0.051)	(0.066)	(0.096)
Third child	-0.142*	-0.102	0.029	0.009	-0.099	-0.001
	(0.080)	(0.101)	(0.140)	(0.054)	(0.064)	(0.108)
Model 3						
Number of children	-0.037	-0.037	-0.004	0.024	-0.019	0.027
	(0.033)	(0.043)	(0.060)	(0.025)	(0.033)	(0.048)
Parent	0.136*	0.127	0.087	0.468***	0.391***	0.229*
	(0.075)	(0.108)	(0.151)	(0.070)	(0.102)	(0.127)
Obs.	**960**	**480**	**161**	**1 088**	**544**	**172**

Notes: In Panel A the dependent variable is the log average annual taxable earnings between years 1990 and 2004 (in 2010 euros). The estimation is based on 914 observation of female and 1 030 observation of male twins. In Panel B the dependent variable the log averageannual taxable income between years 1990 and 2004 (in 2010 euros). The estimation is based on 960 observation of female and 1 088 observation of male twins. Controls include birth year dummies (only in OLS). Robust standard errors are in parantheses. Significance level: *** 1%, ** 5%, * 10%

3.2.3 The Estimated Impact of the First Child over the Time Period

If the pre-children difference in earnings (in the year 1970) seen in Figures 1 and 2 does not explain the parent premium in lifetime earnings and income, what does? One way to find this out is to see how the estimated "first child premium" or parent premium in earnings evolves over the study period. Following figures plot the estimates of the first-child dummy from Model 2, when the outcome is annual earnings instead of the log average earnings.[20] The figures show the OLS, within-twin and within-MZ twins estimates. Interestingly, for women the within-MZ twins estimates are even larger than the OLS estimates, as if some of the effect of motherhood was hidden behind differences in ability. Once family and ability are controlled for, the effect of motherhood on earnings becomes even larger – both good and bad. Figure 5 shows that after 1970 the estimated impact of the first child on mothers' earnings is negative until 1990. This is the time period when children are born to these women. After 1990 the effect turns positive. Since 1990 the estimated impact on earnings is also strongly increasing over time. The results suggest that mothers have either experienced a wage growth after the child birth period (1971–1989) or they survived better in terms of employment and earnings through the recession of the early 1990s. The estimated impact is similar when the outcome is annual income (Figure 6). When income is used, the effect of motherhood is mitigated: non-mothers receive either entrepreneurial income or social benefits more often than mothers during the 1990s.

For men, the within-MZ twin estimates are slightly smaller than the OLS estimates indicating that the OLS estimates exaggerate the positive impact of fatherhood in earnings. This means that the parent premium in fathers' earnings is to some extent due to unobserved differences in family background and genetic ability. However, the unobserved differences in these factors due not solely explain the parent premium in male earnings. Figure 7 shows that the estimated impact of the first child on fathers' earnings is positive throughout the study period. Moreover, the estimated impact on annual earnings increases over time (though the end of the period is less precisely estimated). These results could have several explanations. First, fathers are a positively selected group even within a twin pair. Second, becoming a father improves productivity if, within a family, the father specialises in market work, while the mother allocates more time to housework and children. Third, it can be that fathers work more hours than childless men. However, since the estimated impact is the strongest after 1990 (although the estimation becomes less precise), this indicates that the 1990s recession has had a different impact on fathers and non-fathers. The estimated impact is similar when the outcome is annual income (Figure 8).

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[20] Between years 1970 and 1990 earnings and income are observed only every 5th year.

Figure 5. Impact of the First Child on Female Annual Earnings

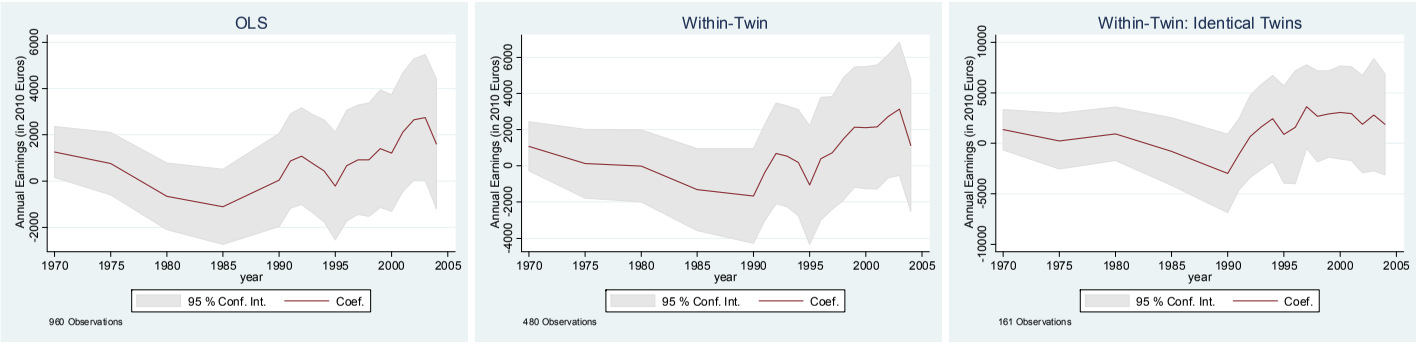


Figure 6. Impact of the First Child on Female Annual Income

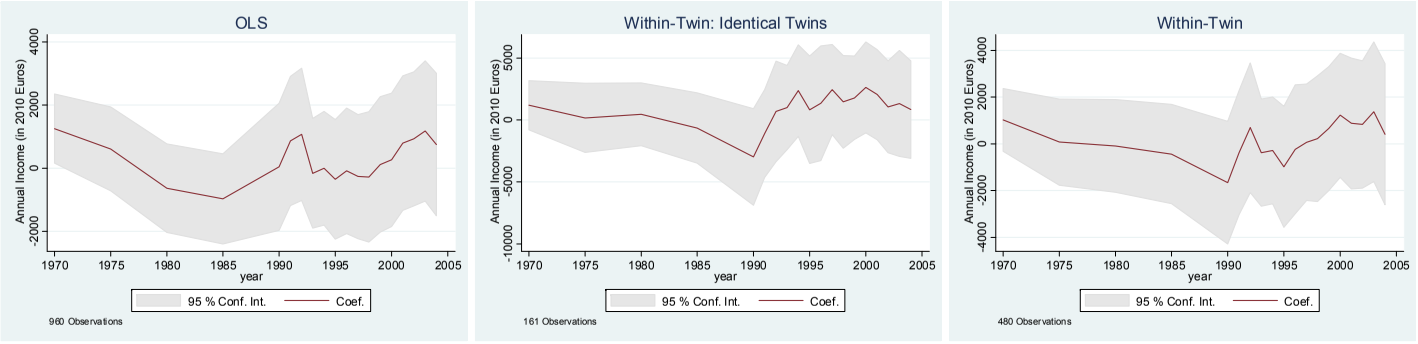


Figure 7. Impact of the First Child on Male Annual Earnings

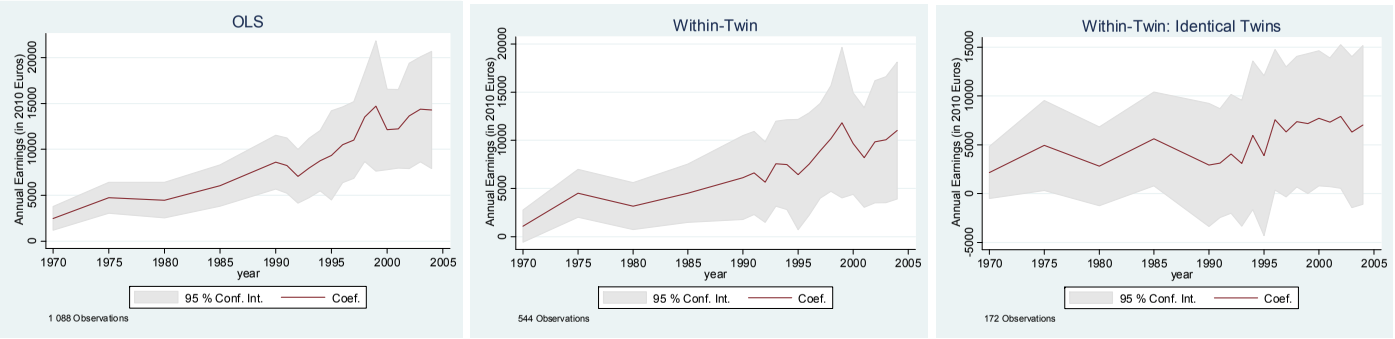
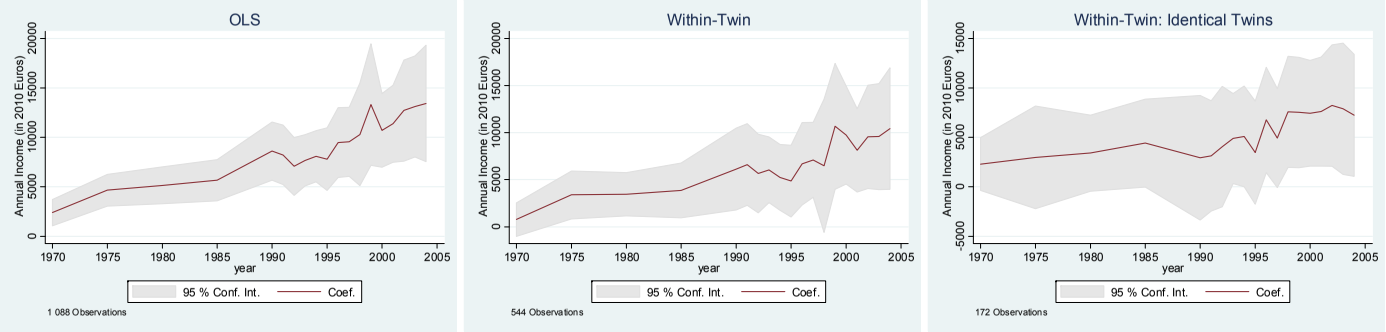


Figure 8. Impact of the First Child on Male Annual Income



4. Conclusions

I find that the lifetime cost of children is nonlinear in nature. The first child has a positive and economically large impact on lifetime earnings and income around 30 to 40% for both males and females. This finding can be explained in various alternative hypotheses. First, the child-premium might reflect some form of selection – even within a twin pair. Those without children may be a negatively selected group of individuals. In other words, persons who have experienced an individual specific shock – for example a health shock – in their lives, which prevents them from making both children and money. Equally, having child can be a positive "shock" to one's health. Second, it might be that having a child really improves productivity – whether it is due to parenthood changing one's personality or use of time. Third, having a family could be a signal of responsibility, commitment, prestige, etc. – things that are valued by the employer. Fourth, becoming a parent sets demands on family economy – for example, a larger house is often needed – which in turn is reflected in one's labor market choices and performance. Becoming a parent might also change the preferences on lifestyle – for example a larger house is often preferred, if not needed. Last, a child premium may be explained by the so-called in-group bias, meaning that people have a tendency to favor their own kind and are more altruistic toward others in their own group. When considering the cohorts of this study, individuals born between 1944 and 1950, being a parent has been the social norm. One explanation could also be institutionally based. In some manufacturing industries the employee contracts require that when employers need to lay off workers for productive reasons, they first have to lay off workers with the least tenure and no children. These industries are male-dominated, which might explain the high "father premium" after the deep recession in the early 1990s.

This study cannot determine which of the above-mentioned reasons is the main explanation for the "parent premium" in lifetime earnings and income. However, one of the main explanations seems to be health: childless women receive disability pension more than twice as often as mothers, and childless men receive disability pension three times as often as fathers in 2004. It seems that the worse development in health indicators of childless individuals in 1981 and 1990 have continued after the 1990s recession. It is unclear what role the 1990s recession had in this.

The evidence of the effect of children on lifetime labor earnings of this study states that the motherhood wage penalty in earnings is only temporary in nature. This result supports the findings of earlier research on wage dynamics around childbirth in the Finnish labor markets. Napari (2010) found that there is a motherhood wage penalty for the first child in the years following childbirth in the Finnish private sector, but these wage penalties of first-time mothers decrease

after the return to employment. This study has shown that there is no permanent loss in earnings due to children. On the contrary, being a parent seems to benefit workers in terms of their earnings. Though, the size of this effect is a somewhat puzzling finding. The channels of this “parent premium” in lifetime labor earnings remain to be solved by future research.

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Essay 2:
The Effect of Job Displacement on Couples' Fertility Decisions

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The Effect of Job Displacement on Couples' Fertility Decisions

Abstract

This paper analyzes the effects of job displacement on fertility using Finnish longitudinal register data. We focus on couples where one spouse has lost her job due to a plant closure and follow them for several years before and following the job loss. The results show that female job loss decreases fertility. For every 100 displaced females there are 3 less children born. Male job loss has no impact on fertility despite resulting in a stronger decrease in family income than female job loss. This indicates that the income effect is not the mechanism through which job displacement influences fertility.

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1. Introduction

The question of how income affects people's fertility behavior has interested economists for decades. The evidence points in various directions. Cross sectional studies suggest that family size is negatively related to household income, while studies investigating changes in aggregate wages or unemployment find that better economic conditions increase the demand for children. The literature suffers from various challenges. A household's income and fertility tend to be jointly determined, which makes it difficult to disentangle the causal mechanism between income and fertility. Some studies have focused on exogenous changes in aggregate income in order to mitigate the problems of reverse causality (Black et al. 2013, Schultz, 1985). The use of aggregate measures may however hide important heterogeneity in responses. According to the standard economic theory of fertility, the distinction between male and female income is crucial, since women are assumed to be more likely the ones that take time off from work to participate in the care of young children.

This article examines the effect of job loss that is due to plant closure on a couple's fertility behavior. A plant closure can be thought of as an exogenous shock to a worker's career since it results in a separation of all plant's workers and it is not related to the worker's own job performance. Several studies have documented that displaced workers suffer from long lasting earnings losses (Jacobson, LaLonde, and Sullivan, 1993, Eliason and Storrie, 2006, Couch and Placzek, 2010, Huttunen, Møen, and Salvanes, 2011). Thus we can use plant closures to explore the causal effect of male and female income shocks on fertility behavior at the micro-level.

We acknowledge that a job loss can have an indirect effect on a couple's fertility decisions through mechanism other than income changes. The career interruption itself may affect fertility since it increases uncertainty concerning future employment conditions and job instability (Stevens 1997, 2001, Farber 2007). Job displacement can also influence fertility behavior through several non-economic outcomes, such as divorce probability (Charles and Stephens 2004, Eliason 2012) and health (Martikainen, Mäki and Jäntti, 2007, and Sullivan and von Wachter, 2009). In order to make distinction between these alternative channels we investigate the effect of job loss on various outcomes, such as earnings, family income, employment, spouse's employment, employment stability and divorce.

We use Finnish longitudinal employer-employee data (FLEED) matched to birth records to analyze the effect of a job loss on fertility. The data consist of all 16–70 year old Finnish residents from 1988 to 2004. Each worker and their employer in these data have a unique identification code. In addition, information on workers' spouses is included, which makes it possible to create a sample of

(cohabiting or married) couples.[1] We focus on couples where one spouse lost his/her job due to a plant closure in the years 1991–1993. As a comparison group we use similar couples who were not affected by a plant closure. We follow each couple for 4 years before a job loss and for 11 years after a job loss in order to investigate the changes in their fertility over the period.

This paper makes several contributions both to family economics and to literature that examines the impacts of job displacements. First, we can distinguish between a woman's own and her spouse's job loss, and thus make a distinction between a shock to the woman's career and an income shock generated by man's job loss. Previous studies have either focused on the effect of a woman's own job loss (Del Bono, Weber and Winter-Ebmer, 2012) or the effect of a husband's job loss (Lindo 2010) on fertility. Second, the long time span allows us to distinguish between the effect on fertility postponement and completed fertility, and analyze the effect on various long-term outcomes, such as permanent family income. Finally, in addition to comparing responses by spouses, the rich data allow us to examine the heterogeneity of responses by various other observational dimensions such as education, tenure, spouse's education etc. We use our theoretical framework to interpret how the effect of job displacement on fertility may vary by worker characteristics.

The results show that a woman's job loss decreases fertility, and the effect is strongest for highly educated women. For every 100 displaced highly educated females there are 5 less children born. Despite the larger reduction in permanent income (-3.63% versus -2.72%), male job loss has much weaker effect on fertility than female job loss. The only groups for which we find significant responses after male job loss are the couples in which women are well attached to labor market and couples with the largest estimated income loss: the low educated high tenure males. This suggests that the income effect is not the main mechanism through which job loss influences couples' fertility behavior. Career concerns, especially in the case of highly educated women, seem to be a much more important determinant.

The paper proceeds as follows. The next section presents a brief theoretical background and gives an overview of the existing literature. In the third section we describe the data, institutions and provide some descriptive evidence. The forth section outlines the empirical set up, presents the results and summarizes the implications of our estimates. The final section concludes.

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[1] We use the word "spouse" to mean both spouses in married couples and partners in unmarried cohabiting couples. Cohabitation (before marriage) is common in Finland.

2. Background and Previous Evidence

In this section we describe the basic theoretical framework for the analysis. We start by reviewing how income affects fertility behavior and then discuss the alternative mechanism through which job displacement can affect fertility. We then summarize the previous empirical literature on the effects of income and employment changes on fertility.

2.1 Theoretical Background

In the traditional model of fertility (see e.g. Becker 1960, 1965) a reduction of a woman's own wage (a woman's job loss) can affect fertility through income and substitution effects. If children are normal goods, reduction in income reduces fertility (income effect). The wage reduction (or unemployment) makes, on the other hand, the value of a woman's time cheaper and reduces the opportunity costs of having children. This substitution effect increases fertility. The overall effect is ambiguous and depends on the relationship between market wages and the profitability of home production. In this traditional static model, a man's earnings changes affect fertility only through the income effect, since men are not assumed to take time off from work to participate in the care of young children (see e.g. Heckman and Walker, 1990). The quantity-quality model (Becker, 1960, Becker and Lewis, 1973) extends this basic model so that parents' demand for the children consists of both the demand for number of children as well as of the demand for child quality (expenditure on education). An increase in income can increase the expenditure on child quality without increasing the number of children.

The effect of the income shock may also differ between workers of different characteristics. Perry (2004) uses the static model of household production introduced by Gronau (1977) to illustrate how a woman's wage changes affect fertility decisions for different skill groups. For high wage women who initially spend little time in home production, a decrease in earnings will only affect the consumption of goods and thus decrease fertility since the income effect dominates. For low-wage women the wage reduction may even increase fertility, since the substitution effect dominates. A dynamic model of fertility can help us to understand the possible heterogeneity in the income effect further. In a dynamic framework the effect of earnings on fertility depends on whether the effect is transitory or permanent, and whether the individuals are credit-constrained or not (see e.g. Hotz, Klerman, and Willis, 1993). Under perfect capital markets (i.e. no one is credit constrained) a transitory effect should not have an effect on fertility. However, for credit-constrained households a transitory effect may affect the spacing of children, since they want to postpone childbearing to periods when incomes are higher. A permanent effect on earnings affects the completed fertility.

Job displacement can influence a couple's fertility decisions through mechanisms other than income changes. The career break itself can influence a worker's fertility decisions. A worker may want to continue into a new employment relationship without breaks and fear that a child or a pregnancy may decrease the chances of finding new employment (Del Bono, Weber and Winter-Ebmer, 2012). Job displacement also increases the uncertainty concerning the future employment conditions since it increases temporary employment relationships and subsequent job displacements (Stevens 1997, 2001, Farber 2007). This uncertainty can reduce parents' desired fertility. Finally, job loss may have an indirect effect on fertility through increased risk of divorce (Charles and Stephens 2004, Eliason 2012, Rege, Telle and Votruba, 2007) and by increased health risk (Browning, Moller Dano and Heinesen, 2006, and Martikainen et al. 2007) and mortality (Sullivan & von Wachter, 2009, Eliason and Storrie, 2009).

Career interruptions may influence workers from different skill categories differently if the rate of skill appreciation differs by workers' skill level. However, the evidence on the effect of skills on human capital depreciation is mixed. Some studies (such as Adda, Dustmann, and Stevens, 2011) show that human capital depreciation is higher in abstract jobs that employ more highly skilled workers. However, the job displacement literature has documented that highly educated workers tend to have shorter non-employment spells and suffer less severe earning losses after job displacement (von Wachter and Weber Handwerker, 2010, Stevens, 1997). These studies argue that skilled workers have more transferable human capital and a better ability to re-accumulate skills faster.

To sum up, we expect job displacement to affect fertility through various mechanisms. The effect is likely to vary both between spouses and by a worker's skill level. If we expect that the effect of job displacement influences fertility mainly through income changes, the reduction in fertility after a male job displacement should be stronger than the reduction after a female job loss (since females' earnings changes work both through substitution and income effects). The effect can vary by a worker's skill level as well, although the direction of heterogeneity of the effect is ambiguous. If job displacement influences fertility decision through career breaks and concerns, then female job loss should have a stronger impact on fertility than male job loss, since females are more likely to take time off from work after a child birth.

2.2 **Previous Literature**

A vast literature has investigated how income affects household's fertility behavior. Majority of the cross-sectional evidence both across countries and individuals indicates a clear negative correlation between income and fertility. For example, Jones and Tertilt (2008) document a negative and surprisingly stable cross sectional relationship between income and fertility in the United States over several decades and estimate an overall income elasticity of about

-0.38. As stated in review by the Hotz at al. (1993) the key challenge in the empirical literature on fertility is how to obtain exogenous variation in households' income and in the prices of children. Earlier studies either ignored this or, as Heckman and Walker (1990), used aggregate wages to mitigate the problems of reversed causality. Their results indicate that rising female wages delay and reduce overall fertility, while male wages have at most a small positive effect on fertility.

The previous attempts to estimate a causal effect of income changes on fertility behavior have exploited exogenous variation in aggregate female and male wages stemming from some exogenous shocks. Schultz (1985) uses exogenous variation in relative female and male wages arising from the changes in world price of butter relative to world price of grains in Sweden in the early 20th century. Since dairy and milk processing were "women's work" in Sweden, the relative increase in world price of butter increased the female wages relative to male wages. Schultz shows that increase in female relative wages decreased fertility, while increases in real male wages had no effect total fertility. Black et al. (2013) use the exogenous shocks to men's income in coal counties in the US that was caused by the coal boom in 1970's to investigate the causal effect of income on fertility. They findings suggest that a 10% increase in income increased fertility by 7%. Lovenheim and Mumford (2013) investigate the effect of family's life time wealth on fertility. They exploit the variation in housing prices in the US caused by the housing boom that began in the late 1990's and affected differentially housing prices across different locations. They find that short-run increases in one's home value are associated with an increase in the probability of having a child, suggesting a housing wealth elasticity of fertility of 0.13.

There have been much fewer attempts to investigate the effects of employment and earnings shocks on fertility behavior at the micro-level. Lindo (2010) uses the Panel Study of Income Dynamics (PSID) to examine the effect of male job loss on fertility. He finds that male job loss increases fertility in the years immediately after job loss, but the effect becomes negative for the years 3 to 8 after job loss. The total effect on fertility by the 8th year is negative, although not statistically significant when individual fixed effects are included in the model. The estimated effect of male job loss on annual earnings by 8th year since job loss is around -31.6%, which together with the 4.8% reduction in total fertility in post displacement years implies an income elasticity of 0.15.

Del Bono et al. (2012) examine the effects of a woman's own job loss using Austrian data from 1972–2002. Comparing the birth rates of displaced women with those unaffected by job losses they find that job displacement reduces average fertility by 5 to 10% in the short and medium term (9 year after job loss). The strong average response is mainly explained by the behavior of white collar women. Although the study focuses on women, they also use as a robustness

check a small subsample of men, in order to examine how male job loss influences fertility behavior. Male job loss decreases fertility, although the point estimates are slightly smaller than those for females. Their interpretation is that it is not only the loss of income that causes fertility to decline but the career interruption that occurs due to the displacement.[2]

Another branch of the literature has investigated how fertility responds to downturns and high unemployment[3]. Most of these studies in both demographics and economics support the idea that fertility is procyclical, since there is a clear negative relationship between aggregate unemployment and fertility (Sobotka, Skirbekk and Philipov, 2011, Ahn and Mira, 2001, Adsera, 2005). Dehejia and Lleras-Muney (2004) study the relationship between unemployment rate and selection into motherhood. They find that the fertility response to temporary shocks in income differs substantially by socioeconomic status and by race in the US. They argue that this reflects the fact that women who are more likely to be credit constrained (low educated black women) have an incentive to postpone childbearing when the unemployment rate is high, while not credit constrained low skilled women (low educated white women) tend to increase fertility in recessions.

Overall, there are relatively few studies which have examined how career shocks or income shocks affect fertility at micro-level. The previous attempts to analyze causal effect of income on fertility have either focused on changes in aggregate wages or on short-term responses. The previous studies that have examined the effect of job displacement on fertility have either focused on male or female job displacement, and have not investigated the effects on long-term outcomes of both spouses, such as permanent family income, joint employment decisions or divorce.

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[2] Del Bono et al. (2012) provide descriptive evidence showing that there is a significant gap in quarterly earnings of displaced women and the comparison group in the first three years after job loss, but cannot follow earnings in time.

[3] There also exist studies that have examined how government transfer policies and subsidies causing exogenous changes in the price of children affect household's fertility decisions. Milligan (2005) and Cohen, Dehejia and Romanov (2013) find that child subsidies have a positive effect on fertility.

3. Institutions, Data and Descriptive Evidence

3.1 **Institutional Background**

All workers who lose their jobs are entitled to unemployment benefits in Finland. In addition, workers who have been working and contributing insurance payments to an unemployment fund for 10 months during the two years prior to unemployment are entitled to earnings-related unemployment benefits. Most workers in Finland contribute to insurance payments either through the labor unions or through unemployment insurance institutions. The average replacement rate is 60%. The maximum length of earnings related UI is 500 days (23 months). After this workers are entitled to labor market support. All parents in Finland are eligible for earnings-related parental allowance. The parental allowance is calculated using the previous year's annual taxable labor income and the average compensation is 75% of previous earnings. The length of the parental leave is 263 days (10.5 months).

3.2 **Data**

The empirical analysis is based on a panel data set from Statistics Finland that links information on employees, establishments and firms. The data include all Finnish residents who were 16–70 years old in the years 1988–2004. The data have unique individual, spouse (cohabiting partner), plant and municipality codes that can be used to merge additional information from other registers. Information on childbirths is drawn from the population registers provided by Statistics Finland. It has information on the time of birth and the gender of the child.

We focus on married or cohabiting couples in which the woman was 20–40 years old and the man 20–50 years old in the year preceding possible job loss, i.e. in a *base year t.* When examining the effect of a women's own job loss we restrict the analysis to women with at least one year of tenure working in a private sector plants with 5–1000 workers, who did not give birth in year *t* or who's parental or unemployment benefits did not exceed their annual earnings in base year *t.*[4] When analyzing the effect of a man's job displacement, we take men with at least one year of tenure working in a private sector plants with 5–1000 workers, who's parental or unemployment benefits did not exceed their annual earnings, and whose spouses (women) did not give birth in base year *t*. In order to better compare the effects of female and male job losses on fertility, we also form a third sample where we require both spouses to be employed in year t.

[4] The employment information is from the last week of the year.

We then divide workers into displaced and non-displaced workers using plant closure definition in year t. A plant is a closing plant in year *t* if it is in the entire register data in year *t* but it is no longer there in year *t +1* or in any of the years after *t +1*. To make sure these are real closures we define those exiting plants for which more than 70% of the workforce is working in a single new plant in the following year as not a real closures. A displaced worker is a worker who was separated between *t* and *t + 1* from a plant that closed down during this time. In addition, we take so called early-leavers i.e. workers who left between *t* and *t + 1* from plants that closed down between *t + 1* and *t + 2* and which reduced their size more than 30% between *t* and *t + 1*. As a robustness check we also use an alternative definition of job displacement: a job loss that results from a mass layoff event. This means that a worker is labeled as displaced in year *t*, if she separated between *t* and *t + 1* a plant that downsizes more than 30% between *t* and *t + 1*. Since small plants are much more likely to have relatively large employment fluctuations, we follow the previous literature and take workers in plants with more than 50 (and less than 2500) workers in base year *t* when using this job displacement definition.

After having defined a worker's displacement status in base year *t*, we follow each worker and his spouse 3 years before a possible job loss, until the 11th after a job loss. Our main base years are 1991–1993[5], and we follow workers form these years using the data covering 1988–2004. The construction of the sample allows us to use the rich information on the pre-displacement period to construct the pre-displacement comparability between those who were affected by the plant closure (*treatment group*) and those who were not (*comparison group*).[6] We investigate differences in several outcomes using all pre-and post-displacement years. Employment is an indicator variable that gets the value one if a worker's employment status is "employed". Annual earnings are measured as annual taxable *labor* income in year *t*. We also use another income measure, annual taxable income, which includes also transfers such as unemployment and parental benefits. It is important to make a distinction between these two measures, since in Finland the level of both unemployment insurance and parental benefits is relatively high. Family income is constructed by adding up both spouses' total taxable income (including transfers). Divorce status is defined using spouse codes. A worker is labeled as divorced if she no longer has the same spouse as in base year *t*. We use two different measures for fertility: an indicator variable that woman has given birth in the current year and the total number of children.

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[5] To investigate the robustness of the results to different business cycle conditions we also redo the analysis for recovery years 1996-1998.

[6] Following most recent studies, the comparison group consists of both stayers as well as workers who separated voluntarily or due to illness etc.

The combined data set has several attractive features. First, it allows us to reliably identify plant closures and downsizing events for the whole economy. Second, we are able to follow both spouses over long-time span and investigate the long-term effect of job displacement on fertility and various other outcomes as well, such as joint employment decisions, family income and divorce probability.

3.3 **Descriptive Analysis**

The mean values of pre-displacement characteristics for displaced and non-displaced workers are presented in table 1. We also report the p-value for the null hypothesis that the means are equal in the two groups. There should be no significant differences between displaced and non-displaced groups since a job loss that is a result of a plant closure should be independent of the worker's own performance. However, the group of displaced workers may be selected if there is selective turnover or if plant closures occur more frequently in regions and industries with certain types of workers.[7] Table 1 shows that the female workers displaced in plant closures are very similar to non-displaced workers. The only significant differences are plant size, and the probability of the spouse working in the same plant, or being displaced. The differences between displaced and non-displaced male workers are also very small, although the difference is more often significant than in female sample. The biggest differences are in the plant size and tenure. This reflects that small and young plants are more likely to die. Displacements are also more frequent in some industries.[8] In the regression analysis we take into account all possible pre-displacement differences in our analysis by conditioning on rich set of pre-displacement worker, and plant characteristics, including plant size and industry dummies. Overall, table 1 suggests that the raw pre-displacement differences between displaced and non-displaced workers are very small in both data sets, supporting the identification strategy in our paper.

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[7] To investigate whether there is any selective turnover before closure, we report the mean values of average worker characteristics in different pre-closure years in appendix B. There are small changes occurring in worker composition, but not very different than changes occurring in surviving plants that are followed same time.

[8] In order to ensure the comparability of our treatment and comparison group we also drop workers working in two-digit industries with displacement rate lower than 0.05%. For females this is 4.5% of the observations and for males 6% of observations.

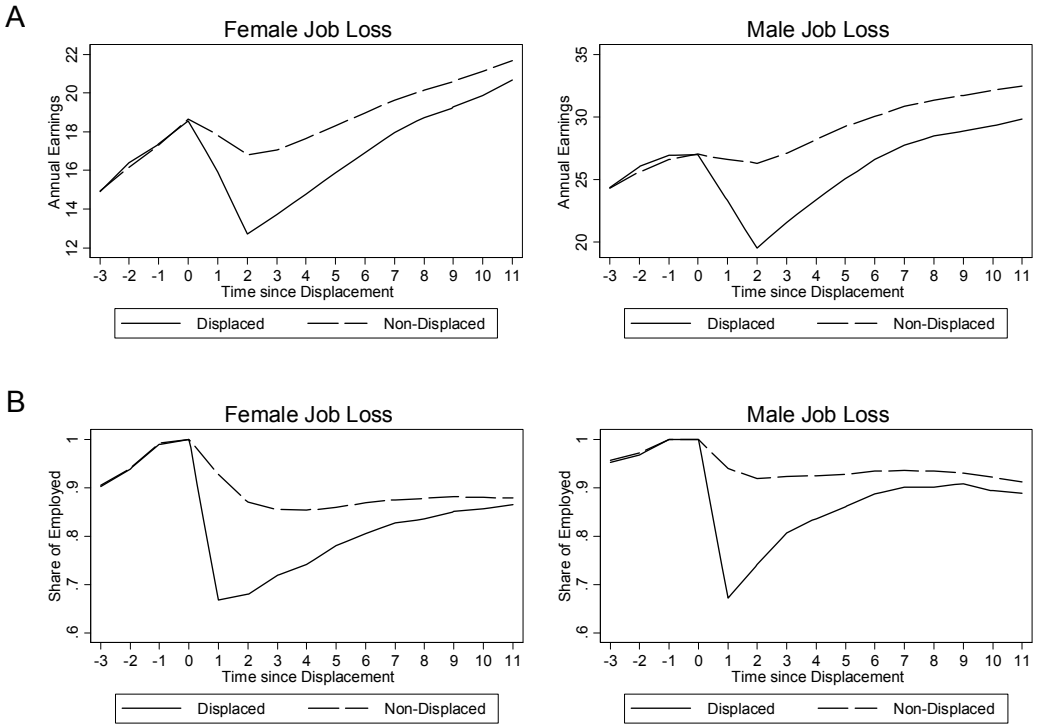
Table 1. Descriptive Statistics

Variable	Females			Males		
	Displaced	Non-displaced	P value for difference	Displaced	Non-displaced	P value for difference
Age	32.49	32.46	.58	34.53	34.68	.01
Primary	.24	.25	.95	.21	.22	.15
Secondary	.42	.43	.15	.44	.46	.00
Tertiary	.33	.32	.11	.35	.32	.00
Experience	11.81	11.72	.30	11.57	11.92	.00
Tenure	6.17	6.26	.18	6.80	8.02	.00
Plant size	58.89	120.13	.00	63.95	149.14	.00
Annual earnings (in 1000 euros)	18.56	18.65	.31	26.97	27.00	.80
Annual earnings at t-3	14.91	14.94	.75	24.32	24.30	.89
Spouse's earnings	18.09	18.14	.74	11.84	11.69	.06
Annual income (inc. transfers)	18.87	18.91	.58	27.21	27.27	.60
Family Income	41.01	41.20	.35	41.51	41.60	.55
Spouse employed	.82	.82	.81	0.76	.74	.00
Spouse displaced	.07	.02	.00	0.05	0.01	.00
Spouse same plant	.05	.06	.00	.03	.04	.00
Married	.67	.66	.55	0.72	.73	.08
Number of children at t-4	.94	.92	.09	0.99	1.00	.30
Number of children	1.12	1.10	.27	1.35	1.37	.12
Agriculture	.00	.01	.00	.01	.01	.00
Mining	.00	.00	.32	.00	.01	.12
Manufacturing	.28	.30	.00	.38	.45	.00
Electricity. gas and water	.00	.00	-	.01	.03	.00
Construction	.05	.01	.00	.15	.06	.00
Wholesale and retail trade	.23	.24	.24	.21	.18	.00
Accommodation. food services	.07	.07	.17	.02	.02	.10
Transportation and storage	.03	.04	.00	.05	.08	.00
Finance	.17	.12	.00	.04	.03	.00
Real estate activities	.14	.11	.00	.12	.09	.00
Health and social work	.02	.06	.00	.00	.01	.00
Other services	.02	.04	.00	.02	.04	.00
Observations	7,011	249,894		11,143	373,588	

NOTE: Sample consist of women (men) who were 20–40 (20–50) years old at the time *t* (base years 1991–1993), who were working in private sector plants with at least one year of tenure and who did not give birth during year *t*.

To illustrate the shock created by job displacement we follow both displaced and non-displaced workers several years before and after job loss and report the average annual earnings (including zeros) for these groups in upper panel of figure 1. The earnings of the two groups are very similar before job loss, which indicates that job displacement was an exogenous shock to these workers. Job displacement reduces the earnings of displaced workers and opens up a significant earnings gap between displaced and non-displaced workers. In line with previous findings the earnings difference between the displaced and the non-displaced begins a couple of years before the job loss occurs. One obvious reason for a big drop in annual earnings is the loss of earnings that is due to non-employment. The lower panel of figure 1 shows the share of employed workers among displaced and non-displaced workers in years preceding and succeeding job loss. In the first year after job displacement there is a significant drop in the employment level of displaced workers. Of workers who are displaced in plant closures 67% are re-employed by the following year. There is an important drop in the employment rate of the comparison group as well, especially in the female sample. It is important to remember that these workers were displaced during a very severe recession, which explains the relatively low re-employment rate compared to previous studies.

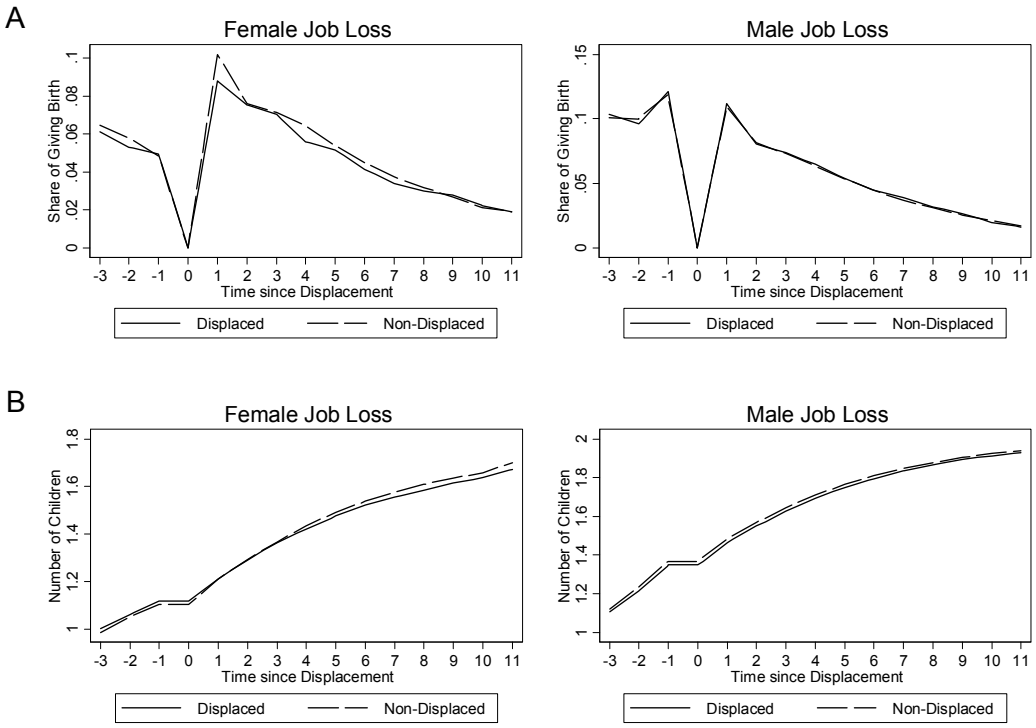
Figure 1. Annual earnings (A) and employment share (B) by displacement status.



NOTE: Solid lines describe the outcome of displaced workers. Dotted line is the outcome of non-displaced workers.

In upper panel of figure 2 we report the birth rates of displaced and non-displaced worker groups. Female displaced workers are less likely to give birth in years around the job loss event than non-displaced workers.[9] We see no difference in birth rates between displaced and non-displaced male workers. In the lower panel we report the number of children for the displaced and non-displaced group.[10] Displaced women have slightly more children than non-displaced women in the years preceding job loss as shown also in table 1. This difference in the number of children diminishes and becomes negative over time. For males, displaced workers have fewer children throughout the period, but the difference is not significant. There is no change in the difference in number of children after job loss. Next we investigate in a regression framework the effect of job displacement when comparing similar workers within same industries.

Figure 2. Share of giving birth (A) and cumulative number of children (B) by displacement status



NOTE: Solid lines describe the outcome of displaced workers. Dotted line is the outcome of non-displaced workers.

[9] Note that we exclude workers who gave birth in year t.

[10] The birth information is linked to males using the base year spouse's id codes.

4. Specification and Results

4.1 Empirical Specification

In order to examine the effect of job displacement on fertility and other outcomes, we use a standard approach in the job displacement literature and estimate the following equation.

$$Y_{ibt} = X_{ib}\beta + \sum_{j=-3}^{11} D_{ibt-j}\delta_j + \tau_{bt}(+\alpha_{ib}) + \varepsilon_{ibt} \qquad (1)$$

Y_{ibt} is the outcome variable for individual i in base year sample b in year t. We use several different outcome measures: annual earnings in 1 000 euros, annual family income in 1 000 euros, a dummy for giving birth in a given year, cumulative number of births, a dummy for being employed, dummy for having an employed spouses, post-displacement tenure, and a dummy for having divorced from pre-displacement partner. X_{ib} is a vector of the observable worker and firm characteristics: the only time varying characteristics is worker's age, age squared (or in some specifications full set of age dummies), all other controls are from pre-displacement (base) year: a dummy for education level (6 categories), a dummy for education field (10 categories), years of tenure, tenure squared, marital status, the spouse's employment status, the spouse's earnings in base year, the spouse's age and age squared, the number of children four years before base year, plant size, region (21 categories) and industry dummies (10 categories). In addition model has a full set of time dummy*base year dummy interactions (τ_{bt}).

The model is estimated using all pre- and post-displacement years. The main variable of interest is the displacement variable $D_{it\text{-}j}$. This is a dummy variable indicating whether a displacement occurs at time $t - j$, t being the observation year. A job loss is assumed to affect labor market outcomes four years before its occurrence and 11 years after its occurrence, hence j = -3, 11. Our estimation method relies on the assumption that job displacement event $D_{ibt\text{-}j}$ is an exogenous shock to a worker's career. We also estimate the model with base year specific individual fixed effects α_{ib} in order to control for the permanent differences in outcome between displaced and non-displaced. In fixed effects specification we use the period t-3 as the base line and thus drop the displacement dummy for this year.

We restrict the estimation to married or cohabiting couples (men and women who had a spouse in year t) and estimate the model separately for each spouse.

We also estimate a specification that includes both spouses' job displacement dummies in the same regressions using data of couples that were both employed in year t. This way we can better compare the effects of male and female job losses.

4.2 **The Effect of Job Displacement on Income**

To understand the magnitude of income losses associated with job displacement, we investigate how female and male job loss affects the annual and permanent income of couples. We begin by estimating the effect of job loss on own annual earnings (in 1 000 euros). The results of specifications with and without individual fixed effects are reported in figure 3. Consistent with previous literature, we find that displacement significantly reduces the earnings of displaced workers.[11] On average, displaced female workers earn around 3 750 euros less in the second post-displacement year than similar non-displaced workers. This corresponds to a 22% decrease in earnings.[12] The significant and negative effect on earnings appears to be long lasting: in the 11th post-displacement year displaced workers earn still 689 euros less than similar workers in the comparison group. A man's job displacement results in a significant and long-lasting earnings loss as well. The magnitude of the effect on the second year earnings is similar in percentage (23%) although the gap in euros between displaced and non-displaced workers is bigger than in the female sample (-5960 euros). In the 11th post displacement year displaced workers earnings are still 1960 euros lower than the earnings of similar non-displaced workers. The fixed effect model indicates a similar reduction in earnings.[13]

Since Finland has a high level of unemployment and parental benefits it is reasonable to focus on total taxable family income rather than just own earnings (from work). Figure 4 present results of regression where the outcome variable is annual taxable family income. This is calculated by summing both spouses' annual income including all benefits and transfers. There is a significant drop in family income immediately after job displacement. For displaced females the OLS effect is around 4.8% (1 840 euros). Male job loss results in a much bigger drop in total family income than female job loss 7.40% (3 220 euros). The effect is long-lasting although diminishes over time: in the eleventh post displacement

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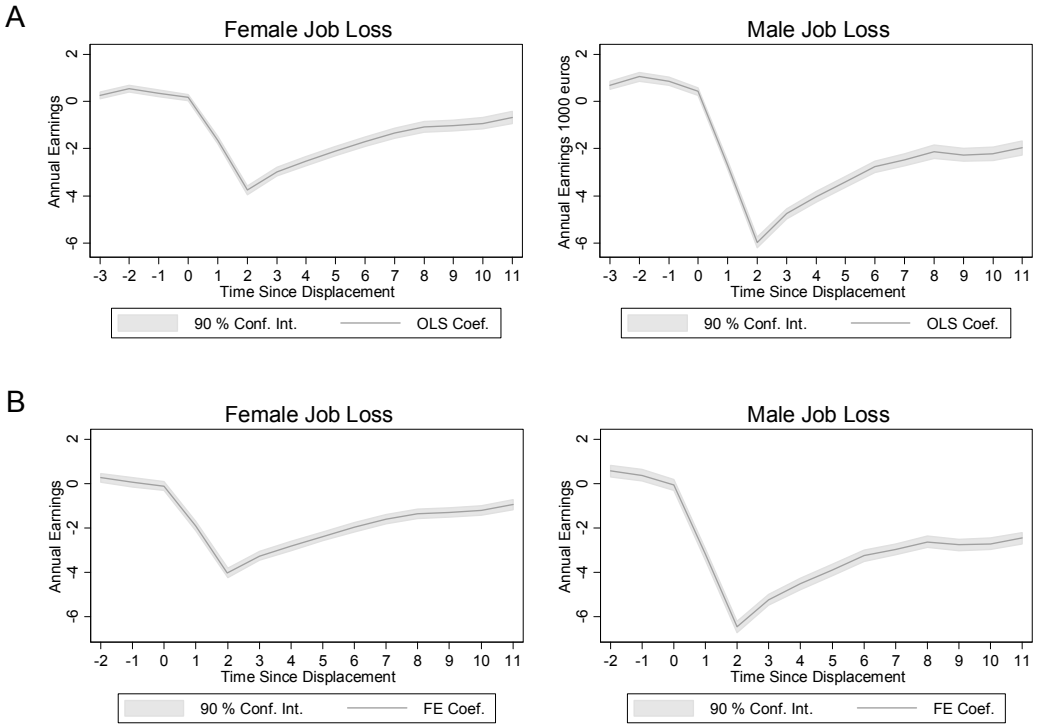
[11] The biggest drop in earnings is in the second year after a job loss. This is expected since the employment information in the data concerns the last week of the year and the displacement event is occurring some time in year 1 and the earnings are from the whole calendar year.

[12] The percentage loss is obtained by dividing the loss in annual income in year 2 by comparison group annual Earnings in year 2 which is 16801 Euros.

[13] The fixed effect model indicates a 4 025 euro reduction in earnings on the second year after female job loss, which is a 24% decrease when comparing with what the counterfactual earnings for displaced workers (calculated as summing the mean for displaced workers - the estimated effect). The fixed effects effect of male job loss on second year earnings is -6,450 euros (-25%).

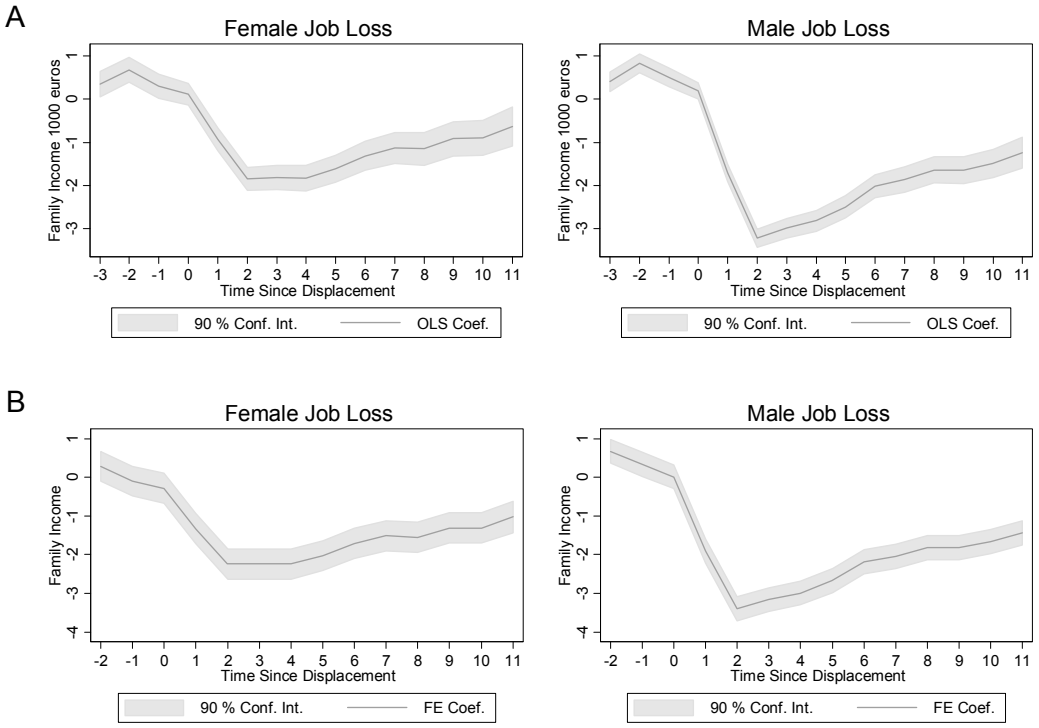
year displaced women have 1.2 % lower family income and males 2.2% lower family income than similar comparison group workers. The fixed effects specification gives similar results, but slightly stronger results. The estimate second year effect is -5.3% (-2 240 euros) for females and -7.9% for males (-3 400 euros).

Figure 3. Effect of job displacement on annual earnings: without individual fixed effects (A) and with individual fixed effects (B)



NOTE: 90% confidence intervals are obtained by clustering standard errors on individuals. Sample consists of women who were 20–40 years old at time 0 (base years 1991–1993), who were working in the end of the year 0 and -1 and who did not give birth during year 0. The additional control variables in specification without individual fixed effects are: worker's age at the time of displacement, age squared, a dummy for education level (6 categories), a dummy for education field (10 categories), pre-displacement years of tenure, tenure squared, pre-displacement marital status, spouse's employment status in base year, spouse's earnings in base year, spouse's age and age squared, the number of children four years before job loss, pre-displacement plant size, pre-displacement region (21 categories) and industry dummies (10 categories), and time dummy*base year dummy interactions. In fixed effects specifications the controls are time dummy*base year dummy interactions, age, age squared and spouse's age and spouse's age squared.

Figure 4. Effect of job displacement on annual family income without individual fixed effects (above) and with individual fixed effects (below)



Note: 90% confidence intervals are obtained by clustering standard errors on individuals. Sample consists of women who were 20–40 years old at time 0 (base years 1991–1993), who were working in the end of the year 0 and -1 and who did not give birth during year 0. The additional control variables are reported under figure 4.

Next we estimate the effect of job displacement on permanent income. Following Davis and von Wachter (2011) we calculate the estimated present discounted value (PDV) earnings losses as

$$PDV_{Loss} = \sum_{s=1}^{11} \delta_s \frac{1}{(1+r)^{s-1}} + \sum_{s=12}^{25} \delta_{11} \frac{(1-\lambda)^{s-11}}{(1+r)^{s-1}}$$

where δ_s is the estimated effect of earnings loss for period s after job displacement. We calculate the present value of earnings loss 25 years after job displacement, and assume that the losses after the 11th year (the last period that we observe) decay with similar rate λ as between years 10 and 11.[14] The percentage effect of the PDV earnings loss is obtained by dividing the PDV of

[14] The rate of decay that we use is 0.009 which the rate at which the effect of job displacement on earnings decreases for males between year 10 and 11.

earnings loss with PDV of counterfactual earnings in the absence of displacement. The counterfactual earnings path is obtained by adding the value of the estimated earnings loss from fixed effects specification back to average level of earnings for displaced group each period. Since workers are on average 45 years old at year 11, and the earnings growth of over 45 year old workers is relatively stable, we assume that earnings stay at the same level from year 11 until year 25.

The estimated PDV earnings and family income losses using 3% interest rate, *r*, are reported in table 2. Female job loss decreases the present value of future earnings by 27 904 euros which corresponds to a -7.72 percent loss on PDV earnings. The effect of male job loss on PDV earnings is higher both in absolute terms (-54 967 euros) and in percentages (-10%). The effect of female job loss on PDV family income (including transfers) is 2.72 % and the effect of male job loss is 3.63%.

Previous research suggests that earnings losses after job displacement differ by pre-displacement tenure (e.g. Topel, 1990) and education (von Wachter and Weber Handwerker, 2010). For this reason we split the sample by pre-displacement tenure and education and report the permanent income losses for these groups in table 2.[15] The corresponding year by year effects of job displacement on annual earnings and family income for each group are reported in table A2. In line with previous research, we find that the income losses are largest for low educated workers and for workers with high pre-displacement tenure.[16] The group that has highest permanent income losses after job loss is low educated high tenure workers.

[15] Low educated refers to group with basic or lower secondary education (max12 years of schooling). High educated have upper secondary degree, such as college degree (more than 12 years). Low tenure means less and high tenure more than 3 years of pre-displacement tenure.

[16] The effect of job displacement on PDV family income for low and highly educated females are larger than the effect for all, although the not discounted cumulative effect for years 1 to 11 is for all females (-3.5%) lies between the effect of low (-4.37%) and high educated groups (.-3.22%). The PDV effects puts more weight to estimates that are closer to period t.

Table 2. The percentage loss in cumulative and PDV permanent own and family income

Present discounted value of loss	Own earnings Female job loss		Male job loss		Family Income Female job loss		Male job loss	
	Euro value	%	Euro value	%	Euro value	%	Euro value	%
All	-27,904	-7.72	-54,967	-10.00	-24,324	-2.72	-33,464	-3.63
Low educated	-32,425	-10.33	-62,167	-13.51	-25,128	-3.13	-40,679	-5.04
High educated	-24,457	-5.32	-63,697	-8.63	-33,286	-3.06	-47,784	-4.12
Low ed. low tenure	-26,157	-9.20	-42,915	-10.06	-16,978	-2.19	-24,451	-3.13
Low ed high ten	-35,041	-10.31	-68,153	-14.36	-30,162	-3.66	-47,375	-10.45
High ed. low ten	-15,834	-3.69	-62,047	-8.69	-32,151	-3.02	-39,570	-5.73
High ed. high ten	-32,181	-6.67	-64,075	-8.51	-33,421	-3.04	-54,422	-7.33

NOTE: % loss is calculated as the percentage of PDV of counterfactual earnings (income) using 3% interest rate. The counterfactual earnings for each period are calculated as average earnings of displaced workers in the current year to which the fe-estimate of the average earnings loss is added. Low educated have no more than lower secondary degree and low tenure workers have three years of tenure at maximum.

4.3 **The Effect of Job Displacement on Fertility**

To examine how a woman's own or her spouse's job loss affects fertility, we first estimate the effect on a cumulative number of children using all pre- and post-displacement years. The estimated coefficients on displacement variables are plotted in figure 5 and in table 3. The dependent variable is the number of children by the end of the year. We use the number of children in year t-4 as a control variable in order to take account of the permanent differences in fertility between displaced and non-displaced.[17] Results indicate that a woman's own job displacement decreases fertility immediately after job loss. The effect is persistent and leads to a significant difference in completed fertility. For every 100 couples with a displaced woman, 3 children less are born by the 11th year after job loss, than what there would have been in the absence of a woman's job loss. This corresponds to a 1.8% decrease in fertility. In contrast, male job loss seems to have no effect on fertility postponement or completed fertility. There is no significant difference in fertility between male workers that were displaced in plant closures and not-displaced males.

Table 3 also presents results from an alternative specification that estimates the effect of female job displacement on the probability of giving birth in the current year. Similar to the results of the regression on cumulative number of children, we find that displaced women are less likely to give birth after job displacement.[18] Women who have lost their job in plant closures are 0.4% less likely to give birth within a year from job displacement than similar non-

[17] We also estimated the model with individual fixed effects and results are reported in appendix b.

[18] The reason for smaller number of observation is that we cannot estimate the effect for years when the outcome variable does not vary. The linear probability model using all years is reported in appendix.

displaced women. This represents a 4% decrease in probability to give birth since the average non-displaced worker has a 10% probability of giving birth during this period. This postponement seems to correspond to effect on the completed fertility as shown in column 1. Male job loss does not affect the probability of their partner giving birth.

Figure 5. Effect of job displacement on cumulative number of children

Note: Sample consists of women (men) who were 20–40 (20–50) years old at time 0 (base years 1991–1993), who were working in the end of the year 0 and -1 and who did not give birth during year 0 and who were married or cohabiting in year 0. The additional control variables are: full set of worker's age dummies, a dummy for education level (6 categories), a dummy for education field (10 categories), pre-displacement years of tenure, tenure squared, pre-displacement marital status, spouse's employment status in base year, spouse's earnings in base year, full set of spouse's age dummies, the number of children four years before job loss, pre-displacement plant size, pre-displacement region (21 categories) and 2-digit-predisplacement-industry dummies, and time dummies*base year dummies interactions. 90% confidence intervals are obtained by clustering standard errors on individuals.

Table 3. Effect of job displacement on fertility

Effect by years since displacement	At least one spouse employed at t				Both spouses employed at t			
	Female Job Loss		Male Job Loss		Female Job Loss		Male Job Loss	
	Number of children	Gave birth	Number of children	Gave birth	Number of children	Gave birth	Number of children	Gave birth
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
dpl_3	.000	-.001	.003	.001	-.001	-.002	-.002	-.002
	(.004)	(.001)	(.004)	(.001)	(.005)	(.002)	(.004)	(.002)
dpl_2	-.004	-.002*	-.003	-.002*	-.004	-.002	-.005	-.001
	(.005)	(.001)	(.005)	(.001)	(.006)	(.002)	(.005)	(.002)
dpl_1	-.000	.001	-.001	.001	-.003	.000	-.002	.002
	(.005)	(.001)	(.005)	(.001)	(.007)	(.002)	(.006)	(.002)
dpl_0	.000		-.002		-.002		-.005	
	(.005)		(.005)		(.007)		(.006)	
dpl1	-.014**	-.004***	-.002	.000	-.018**	-.005***	-.006	-.000
	(.006)	(.001)	(.006)	(.001)	(.009)	(.002)	(.008)	(.001)
dpl2	-.014*	.000	-.003	-.001	-.016*	.001	-.004	.000
	(.007)	(.001)	(.007)	(.001)	(.010)	(.002)	(.008)	(.002)
dpl3	-.014*	.000	-.004	-.001	-.015	.001	-.009	-.002
	(.008)	(.001)	(.007)	(.001)	(.011)	(.002)	(.009)	(.002)
dpl4	-.023***	-.003***	-.005	-.000	-.025**	-.004*	-.009	.001
	(.008)	(.001)	(.007)	(.001)	(.011)	(.002)	(.010)	(.002)
dpl5	-.024***	-.001	-.005	-.001	-.019	.002	-.013	-.003
	(.009)	(.001)	(.008)	(.001)	(.012)	(.002)	(.010)	(.002)
dpl6	-.026***	-.002	-.006	-.000	-.020	-.000	-.014	.000
	(.009)	(.002)	(.008)	(.001)	(.012)	(.002)	(.010)	(.002)
dpl7	-.029***	-.002	-.004	.002	-.021	.001	-.014	.000
	(.009)	(.002)	(.008)	(.002)	(.013)	(.003)	(.011)	(.002)
dpl8	-.032***	-.001	-.004	-.000	-.020	.002	-.015	-.002
	(.009)	(.002)	(.008)	(.002)	(.013)	(.003)	(.011)	(.002)
dpl9	-.030***	.002	-.004	.001	-.017	.003	-.015	-.000
	(.009)	(.002)	(.008)	(.002)	(.013)	(.003)	(.011)	(.002)
dpl10	-.029***	.001	-.007	-.002	-.017	.001	-.017	-.004*
	(.010)	(.002)	(.008)	(.002)	(.013)	(.003)	(.011)	(.002)
dpl11	-.031***	.001	-.007	-.002	-.015	-.000	-.020*	-.002
	(.010)	(.002)	(.009)	(.002)	(.015)	(.004)	(.012)	(.003)
Observations	3,800,222	3,446,543	5,698,233	5,289,862	1,924,981	1,706,471	1,924,981	1,706,471

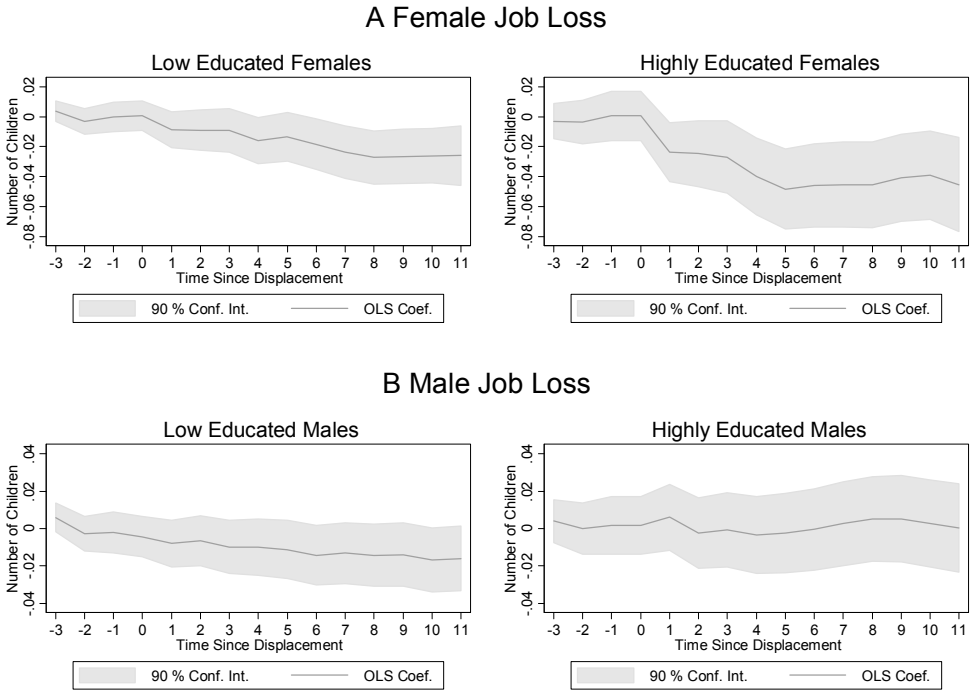
NOTE: OLS coefficients or marginal effects of probit regression in columns 2, 4, 6 and 8. Robust standard errors clustered on individuals are in parenthesis. The years when outcome variable does not vary (e.g. all are employed in years *t – 1* and *t*) are dropped from the regression, which explains why the number of observations varies between columns. Sample consists of women who were 20–40 years old at time *t* (base years 1991–1993), who were working in the end of the year t and *t – 1* and who did not give birth during year *t*.

In the regressions reported in columns 1–4 we have different samples when analyzing the effects of female and male job losses. In the female job loss sample, we have couples where women were employed in year t, and in the male job loss sample, all men were employed in year t. These couples may be very different if, for example, couples with non-working mothers react differently to changes in income than working mothers. In order to better compare the effects of female and male job losses, we restrict the analysis to couples where both spouses were employed in year t and estimate a model where we include dummies for both spouse's displacement status. These results are reported in columns 5–8. Now there seems to be no pre-displacement differences in the likelihood for giving birth, but the immediate effect on the probability to give birth in the year following female job loss is now bigger, 0.005. Male job loss has no immediate effect on fertility, but results to a small reduction in completed number of children in the long run for this sample. This indicates that in couples where women are well attached to labor market, male job loss may also influence fertility.

As argued in section 2 there may be a number of reasons why the effect of job displacement on fertility may differ between skill groups. Figure 6 presents the results where we have split the sample into two groups by education. We find that there is an important heterogeneity in the effect of job displacement on fertility. The effect of job loss is much stronger for highly educated women. The effect remains until the end of the study period. By the 11th post displacement year there are 0.045 less children born for displaced highly educated women than for similar non-displaced women. Highly educated women postpone births after job loss, which corresponds to a 2.6% reduction in completed fertility.[19] When studying how the effect of male job loss varies between highly and low educated males, there seems to be no differences in the response. For both groups male job displacement does not affect fertility. However, when examining how the responses by male job loss vary by *woman's* education in the sample of employed couple's (Figure 7), we find that couples with highly educated employed females react to both male and female job losses.

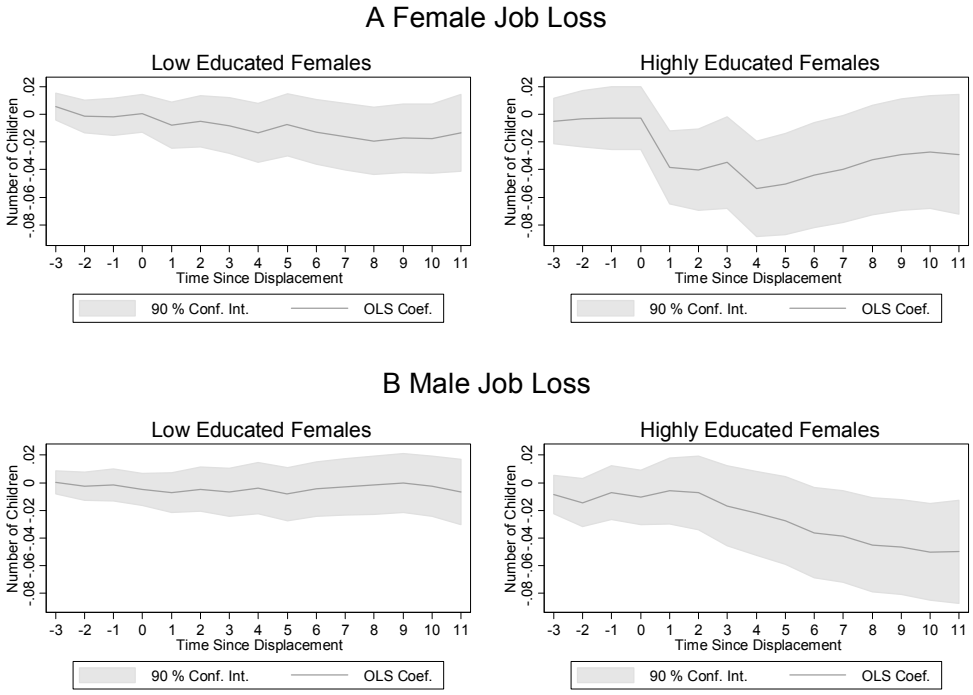
[19] We also examined how the effect varies by pre-displacement wage and the share of a worker's earnings of the total family income (appendix B). A woman's job loss reduces the fertility more strongly for high-wage women and for women in households where the husband's share of household income is low.

Figure 6. Effect of female job displacement on fertility by education



Notes: See text under figure 5.

Figure 7. Effect of female job displacement on fertility by female education in sample of employed couples



Notes: See text under figure 5.

In the previous section we documented that the income loss resulting from a job displacement is highest for low educated workers with high pre-displacement job tenure. To investigate how these income changes are associated with fertility changes we now investigate how the fertility effects differ by pre-displacement tenure and education. We calculate the corresponding income elasticity of fertility using the PDV estimates from table 2. Table 4 shows that the strongest reaction from a female job loss on fertility is from highly educated high tenure women (3.3%). The corresponding income loss is however the smallest one as shown in table 2. In contrast, the only significant effect of male job loss on fertility is for the group for which the associated PDV income loss is largest: high tenure low educated males. For this group male job displacement reduces fertility by 1.4%. The estimated fertility effects are smaller than found by Del Bono et al. (2012) and Lindo (2010), who find that female job loss reduced fertility by 5-10% and male job loss by 4.8%. If we assume that the job loss for males works mainly through the income effect, we can calculate that the estimated own earnings elasticity for fertility is 0.10 and family income elasticity is 0.14. The own income elasticity for this group is smaller than the average elasticity reported by Lindo (0.015). When calculating the income elasticity of fertility, it is important to bear in mind that job displacement may influence income also through some indirect mechanism (even through fertility changes), and fertility may be influenced through other channels than income changes.

These results indicate that explanations other than the income effect, such as career concerns, seem to be a much more important determinant after female job loss. We analyze the alternative channels more specifically in next section.

Table 4. Effect of job displacement on cumulative number of children and permanent income elasticity

	Female Job Loss				Male Job Loss			
	Effect	%	Own earnings elasticity	Family income elasticity	Effect	%	Own earnings elasticity	Family income elasticity
All	-.031*	-1.76	.23	.65	-.007	-.36	.04	.10
Low educated	-.026*	-1.54	.15	.49	-.016	-.84	.06	.17
High educated	-.045*	-2.61	.49	.85	.000	.02	-.00	-.00
Low ed. low tenure	-.021	-1.17	.13	.54	-.002	-.13	.01	.04
Low ed high ten	-.032*	-1.99	.19	.54	-.027*	-1.44	.10	.14
High ed. low ten	-.025*	-1.43	.39	.47	-.027	-1.38	.16	.24
High ed. high ten	-.057*	-3.31	.50	1.09	.015	.72	.16	-.10

NOTE: The effect is the estimated effect of job displacement on cumulative number of children by 11the post-displacement year. The percentage % is the effect related to comparison group mean in the 11th year. The elasticity is calculated using the percentage loss in PDV of permanent own earnings and family income that is reported in table 2. * means that the estimate is significant at 10% level.

4.4 **The Effect of Job Displacement on Employment, Job Stability and Divorce**

To further understand the mechanism through which job displacement influences couples' fertility behavior we examine in this section the effect of job displacement on several other outcomes: joint employment decisions, employment stability and divorce probability. The first and fifth columns in table 5 report the estimated marginal effects of job displacement on the probability to be employed in the current year. The results show that female workers who lose their jobs in plant closures are 0.29 percentage points less likely to be employed in the end of the first post displacement year. Comparing to mean employment in comparison group (93%) this corresponds to a 31% decrease in employment probability. A man's job loss has a slightly smaller but long-lasting effect on employment. In the first post displacement year the effect is 24 percentage points; this corresponds to a 25% decrease in employment probability. The effect decreases over time but remains significant until the 11th post-displacement year.

Another important mechanism through which fertility may be affected is the increased job instability after permanent job loss. In columns 2 and 6 we examine how female and male job displacement affects tenure in the post-displacement job. The regression is estimated for post-displacement years only and the dependent variable is the years in the job since base year (t=0). In the first year, the maximum value is also 1 for comparison group workers. In order to distinguish from general employment effects, we restrict the sample to individuals that were re-employed by the end of the first post-displacement year. This creates additional selection problem since displaced workers who manage to be re-employed within a year may be positively selected among displaced workers, and also among all workers who employed in the year 1. The estimates are likely to be the lower bound of the effect. The results show that displaced workers have lower post-displacement tenures in succeeding years than comparison group workers. This indicates that job loss increases job instability.

Table 5. Effect of job displacement on alternative outcomes

Effect by years since displacement	Female jobs loss				Male job loss			
	Employed	Post displacement tenure	Spouse employed	Divorced	Employed	Post displacement tenure	Spouse employed	Divorced
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
dpl_3	.005		.007*		.005***		-.003	
	(.003)		(.004)		(.002)		(.004)	
dpl_2	.005		-.003		.001		-.004	
	(.004)		(.004)		(.003)		(.004)	
dpl_1			-.003	-.000			-.004	.003
			(.004)	(.006)			(.004)	(.004)
dpl_0			-.004				.003	
			(.003)				(.003)	
dpl1	-.288***		-.015***	.003	-.236***		-.014***	.011**
	(.006)		(.004)	(.006)	(.005)		(.004)	(.005)
dpl2	-.151***	-.003	-.011***	-.002	-.120***	.075***	-.005	.007*
	(.005)	(.011)	(.004)	(.005)	(.004)	(.010)	(.004)	(.004)
dpl3	-.095***	-.170***	-.004	.001	-.076***	-.073***	-.005	.004
	(.004)	(.016)	(.004)	(.005)	(.003)	(.013)	(.004)	(.004)
dpl4	-.076***	-.299***	-.010**	.004	-.054***	-.217***	-.004	.006*
	(.004)	(.022)	(.004)	(.005)	(.003)	(.018)	(.004)	(.003)
dpl5	-.050***	-.442***	-.010**	.005	-.038***	-.409***	-.000	.006*
	(.004)	(.027)	(.004)	(.005)	(.003)	(.022)	(.004)	(.003)
dpl6	-.040***	-.589***	-.004	.004	-.026***	-.551***	.002	.007**
	(.004)	(.032)	(.004)	(.004)	(.002)	(.026)	(.004)	(.003)
dpl7	-.029***	-.723***	-.008**	.005	-.018***	-.605***	.006	.005*
	(.004)	(.037)	(.004)	(.004)	(.002)	(.030)	(.004)	(.003)
dpl8	-.025***	-.834***	-.011***	.005	-.016***	-.677***	.003	.005*
	(.004)	(.042)	(.004)	(.004)	(.002)	(.034)	(.004)	(.003)
dpl9	-.016***	-.863***	-.008*	.002	-.008***	-.711***	.001	.006*
	(.003)	(.046)	(.004)	(.004)	(.002)	(.038)	(.004)	(.003)
dpl10	-.011***	-.877***	-.006	.005	-.011***	-.788***	.003	.004
	(.003)	(.051)	(.004)	(.004)	(.002)	(.042)	(.004)	(.003)
dpl11	-.003	-.892***	-.003	.006	-.007***	-.836***	-.003	.004
	(.003)	(.057)	(.004)	(.004)	(.002)	(.046)	(.004)	(.003)
Observations	3,544,204	2,253,215	3,800,222	3,032,206	4,932,193	3,428,876	5,698,233	4,549,253

NOTE: In columns 1, 3, 4, 5, 7, 8 we report the marginal effects of probit regression. In columns 2 and 6 the coefficients from ols regression. Robust standard errors clustered on individuals are in parenthesis. We drop the years when outcome variable does not vary in the regressions (i.e. years -1 and 0 in first column since everyone is employed). Post-displacement tenure regression is estimated for workers that were employed in year 1.

The third and seventh columns show the effect of job displacement on a spouse's employment. We find that both female and male job losses are associated with a slight reduction in a spouse's employment immediately after job loss. Specifically, there is no indication of the "added worker effect"; that is a man's job loss does not increase a woman's employment.[20] The fourth and eight columns report the effect of job displacement on the probability separating from base year spouse in the years following job loss.[21] The results show that male job displacement is associated with increased risk of divorce.

These results suggest that job displacement has severe and long-lasting consequences on employment and employment stability of the affected couples. Since in the previous section we found that only female job displacement significantly affects couples' fertility behavior, the most likely mechanism is the response to a career disruption itself. Females, especially highly educated ones, tend to reduce child bearing after job displacement since they either fear having trouble finding new employment after job loss or they want to secure their careers in new jobs before leaving on maternity leave. Low educated woman are less likely to be re-employed after job displacement as shown in table A1, and thus have much lower opportunity cost of having children.

4.5 **Robustness Analysis**

So far the analysis has focused on married and non-married cohabiting couples. The interesting question is, whether the results hold if we restrict the sample to married couples only. Figure A1 reports the results for birth outcomes for married couples using the number of children by the time period as dependent variable. Female job loss results in a significant drop in fertility in the years immediately following job loss. The magnitude is similar to those of all cohabiting women. As previously, male job loss has no significant effect on fertility.

Another concern with our current analysis is the fact that closing plants are small and the results using workers in smaller plants may not be generalizable for whole workforce. In order to check this we restrict the sample to workers in bigger plants and use an alternative definition of job displacement: a job loss that occurs because a plant closes down or downsizes significantly (mass layoffs).

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[20] The evidence on how changes in spouse's employment affect female labor supply is mixed. Juhn and Murphy (1997) suggest that changes in male employment did not explain the increase in married women's employment in US during last decades. However, Stephens (2002) finds some evidence that a man's job displacement increases a woman's employment.

[21] The first coefficient (for year $t - 1$) captures the pre-displacement difference, i.e. whether displaced workers have shorter relationships than non-displaced workers. The years $t - 3$ and $t - 2$ are excluded from this regression, since we do not have spouse codes for years 1988 and 1989, and we are thus not able to define divorce status for year $t - 3$ and $t - 2$ for base year 1991 workers.

These results are reported in figure A2 in appendix. They are in line with the results when using the plant closure definition: female job loss decreases fertility and male job loss has no effect. Similarly to plant closure results, the effect of female mass layoff on fertility was biggest for highly educated workers.[22] Male workers displaced in mass layoffs seem to have slightly less children than non-displaced workers in the years before displacement. This difference can most likely be explained by employment contract legislations. In some manufacturing industries the employee contracts require that when employers need to lay off workers for productive reasons, they first have to lay off workers with the least tenure and no children.[23]

As a final robustness check we extend the analysis to a recovery period to see whether the results obtained using data from the early 1990's, during which Finland experienced a very deep recessions, hold for other periods. Figure A3 report the results for base years 1996–1998. The results are very similar to recession period. Female job loss during the recovery years decreases fertility, while male job loss has no effect on fertility. Since the earning losses during recovery years were much smaller, the results again indicate that the fertility responses to female job loss are driven by other reasons than income losses.

[22] In earlier version of this study, Huttunen and Kellokumpu (2012), we report all the results using both displacement definitions. The results using mass layoff definitions are very similar to plant closure results. The earlier version uses one third random sample of females in the FLEED data instead of the total FLEED data.

[23] See the Finnish federation for industries and technology
http://www.teknologiateollisuus.fi/fi/tyomarkkina-asiat/tyoehtosopimukset.html

5. Conclusions

In this study we have examined how job loss that is due to plant closure affects couples' fertility patterns by following the same couples for more than 15 years. Because job displacement is an exogenous shock to a worker's career, we can estimate the causal effect of this shock on the fertility behavior of couples. Unlike previous studies, we focus on couples and compare how the effect of job displacement varies with spouses' and couples' characteristics. We also studied how job displacement affects couples' other outcomes, such as permanent family income, joint employment decisions, and employment stability and divorce probability. This helps us to better understand the mechanism through which job displacement affects fertility behavior.

Our results indicate that female job loss decreases completed fertility by 1.8%. The effect is stronger for highly educated women (2.6%). Despite the fact that we find that a man's job loss results in a very long-lasting and even stronger effect on total family income than a woman's own job loss, it has no effect on completed fertility. When splitting the sample further by pre-displacement education and tenure, we find no evidence that groups with larger income losses after female job loss have stronger fertility responses. This suggests that the possible mechanism through which female job displacement affects fertility is not only the income effect, but the difficulties women face in reestablishing their careers after job loss. The only groups for which we find significant responses after male job loss are the couples in which women are well attached to labor market and couples with the largest estimated income loss: the low educated high tenure males.

Our study has contributed to previous research on income and fertility by examining how shocks to permanent family income affect couple's fertility decision at the micro-level. Contrary to studies that use exogenous changes in aggregate male income, we do not find that couple's react strongly to an income loss generated by male job loss. We also contribute to the literature on the effects of job displacement on fertility by explicitly comparing male and female job losses in similar contexts. Our study is also the first that documents how female and male job displacements affect permanent family income. The results are in line with the study on the effects of female job loss using Austrian data by Del Bono et al. (2012) who also find that a woman's job displacement decreases fertility. However, the fact that we do not find any effect of male job loss on average fertility is in contrast with the study by Lindo (2010), which provides some evidence that male job displacement decreases fertility in the U.S. The difference between his and our findings suggests that the effect of job loss on fertility may depend on institutional factors such as the costs of higher education and the access to health care. Also, our study suggests that the mechanism

through which job displacement affects fertility may be much more complex than just an income channel.

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Appendix A

Table A1. Descriptive characteristics of pre-displacement characteristics and post-displacement outcomes by worker's education

	Females				Males			
Variable	Low Educated		Highly Educated		Low Educated		Highly Educated	
Pre-displacement characteristics at *t*	Displaced	Non-displaced	Displaced	Non-displaced	Displaced	Non-displaced	Displaced	Non-displaced
Age	32.67	32.66	32.13	32.02	34.29	34.52	34.97	35.01
Experience	13.24	13.24	8.95	8.58	12.92	13.31	9.06	8.99
Tenure	6.33	6.67	5.87	5.41	7.29	8.80	5.89	6.39
Plant size	50.45	119.56	75.71	121.31	50.43	144.36	89.09	159.08
Annual earnings	16.91	17.12	21.84	21.80	23.04	23.53	34.25	34.20
Family Income	37.59	38.11	47.82	47.60	36.73	37.28	50.39	50.61
Spouse employed	.80	.80	.86	.86	.74	.73	.76	.76
Married	.65	.65	.69	.68	.67	.69	.80	.79
Number of children at *t-4*	1.01	.99	.77	.751	.98	1.00	1.01	1.00
Number of children	1.16	1.15	1.02	1.00	1.30	1.33	1.42	1.42
Observations	4670	168693	2341	81201	7229	251819	3899	121084
Outcome variables at *t+1*	Displaced	Non-displaced	Displaced	Non-displaced	Displaced	Non-displaced	Displaced	Non-displaced
Employed	.61	.91	.77	.94	.62	.93	.75	.95
Earnings	13.82	16.28	20.09	21.03	19.33	23.13	30.62	33.75
Family Income	35.54	37.59	47.03	47.33	35.08	37.74	48.91	51.26
Gave birth	.07	.08	.11	.13	.10	.10	.13	.12
Number of children	1.24	1.24	1.14	1.14	1.41	1.44	1.56	1.56
Observations	4667	168566	2340	81108	7232	252115	3887	120781

Table A2. Effect of job displacement on earnings by tenure and education

Females	All	Low Ed	High Ed	L. Ed L. Ten	L. Ed H. Ten	H. Ed L. Ten	H. Ed H. Ten
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
dpl_2	.253**	.022	.563**	.195	.173	.979**	.0434
	(.126)	(.125)	(.262)	(.189)	(.165)	(.411)	(.338)
dpl_1	.057	-.088	.209	.035	-.046	.486	-.069
	(.126)	(.125)	(.261)	(.188)	(.165)	(.411)	(.338)
dpl1	-1.911***	-2.443***	-1.035***	-2.758***	-2.048***	-1.755***	-.587*
	(.126)	(.125)	(.262)	(.188)	(.165)	(.411)	(.338)
dpl2	-4.025***	-4.588***	-3.097***	-3.969***	-4.924***	-3.220***	-3.095***
	(.126)	(.125)	(.262)	(.188)	(.165)	(.412)	(.338)
dpl3	-3.253***	-3.626***	-2.712***	-2.999***	-3.943***	-2.746***	-2.786***
	(.127)	(.126)	(.262)	(.189)	(.166)	(.413)	(.338)
dpl4	-2.805***	-3.165***	-2.295***	-2.496***	-3.509***	-1.748***	-2.764***
	(.127)	(.126)	(.262)	(.189)	(.166)	(.413)	(.339)
dpl5	-2.377***	-2.803***	-1.759***	-2.358***	-2.967***	-1.319***	-2.156***
	(.127)	(.126)	(.263)	(.189)	(.166)	(.413)	(.339)
dpl6	-1.977***	-2.396***	-1.400***	-1.978***	-2.552***	-.862**	-1.868***
	(.127)	(.126)	(.263)	(.189)	(.166)	(.413)	(.339)
dpl7	-1.609***	-1.973***	-1.171***	-1.658***	-2.055***	-.791*	-1.533***
	(.127)	(.126)	(.263)	(.189)	(.166)	(.414)	(.339)
dpl8	-1.358***	-1.623***	-1.137***	-1.268***	-1.754***	-.879**	-1.407***
	(.127)	(.126)	(.263)	(.189)	(.166)	(.414)	(.339)
dpl9	-1.293***	-1.551***	-1.086***	-1.177***	-1.708***	-.760*	-1.404***
	(.127)	(.126)	(.263)	(.190)	(.166)	(.415)	(.340)
dpl10	-1.203***	-1.374***	-1.177***	-1.071***	-1.483***	-.664	-1.607***
	(.127)	(.126)	(.264)	(.190)	(.166)	(.416)	(.340)
dpl11	-.953***	-1.088***	-1.079***	-0.748***	-1.252***	-.274	-1.752***
	(.133)	(.132)	(.271)	(.195)	(.178)	(.422)	(.353)
Observations	3,811,443	2,571,474	1,239,969	1,056,732	1,514,742	554,232	685,737
Males	All	Low Ed	High Ed	L. Ed L. Ten	L. Ed H. Ten	H. Ed L. Ten	H. Ed H. Ten
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
dpl_2	.555***	-.084	.916***	0.207	.124	.867*	1.081***
	(.152)	(.134)	(.325)	(.234)	(.164)	(.514)	(.418)
dpl_1	.365**	-.236*	.662**	.133	-.258	.440	0.803*
	(.152)	(.134)	(.325)	(.233)	(.164)	(.514)	(.418)
dpl1	-3.189***	-3.671***	-3.141***	-3.491***	-3.603***	-4.013***	-2.595***
	(.152)	(.134)	(.325)	(.233)	(.165)	(.515)	(.418)
dpl2	-6.451***	-6.834***	-6.668***	-5.529***	-7.321***	-6.974***	-6.451***
	(.153)	(.135)	(.325)	(.234)	(.165)	(.515)	(.418)
dpl3	-5.237***	-5.445***	-5.839***	-4.100***	-5.911***	-5.819***	-5.8197***
	(.153)	(.135)	(.325)	(.234)	(.165)	(.516)	(.419)
dpl4	-4.520***	-4.754***	-5.124***	-3.491***	-5.153***	-5.076***	-5.114***
	(.153)	(.135)	(.326)	(.234)	(.165)	(.516)	(.419)
dpl5	-3.893***	-4.240***	-4.393***	-2.912***	-4.674***	-4.170***	-4.485***
	(.153)	(.135)	(.326)	(.234)	(.165)	(.516)	(.419)
dpl6	-3.248***	-3.690***	-3.634***	-2.459***	-4.075***	-3.239***	-3.850***
	(.153)	(.135)	(.326)	(.235)	(.165)	(.516)	(.419)
dpl7	-2.968***	-3.297***	-3.601***	-2.032***	-3.717***	-2.849***	-4.053***
	(.153)	(.135)	(.326)	(.235)	(.165)	(.518)	(.420)
dpl8	-2.622***	-3.060***	-3.131***	-1.798***	-3.498***	-2.844***	-3.279***
	(.154)	(.135)	(.327)	(.236)	(.166)	(.518)	(.420)
dpl9	-2.760***	-3.080***	-3.489***	-1.889***	-3.485***	-3.112***	-3.683***
	(.154)	(.136)	(.327)	(.236)	(.166)	(.520)	(.420)
dpl10	-2.717***	-3.045***	-3.492***	-1.880***	-3.425***	-2.846***	-3.860***
	(.154)	(.136)	(.327)	(.236)	(.166)	(.520)	(.420)
dpl11	-2.466***	-2.941***	-2.995***	-1.874***	-3.260***	-2.929***	-2.989***
	(.154)	(.136)	(.328)	(.236)	(.166)	(.521)	(.421)
Observations	5,825,112	3,928,997	1,896,115	1,103,859	2,825,138	660,254	1,235,861

Table A3. Effect of job displacement on family income by tenure and education

Females	All	Low Ed	High Ed	L. Ed L. Ten	L.Ed H. Ten	H. Ed L. Ten	H. Ed H. Ten
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
dpl_2	.282	-.016	.536	.223	.092	.868	.110
	(.236)	(.231)	(.493)	(.345)	(.309)	(.760)	(.647)
dpl_1	-.099	-.322	.018	-.221	-.265	.322	-.232
	(.236)	(.230)	(.492)	(.344)	(.309)	(.759)	(.647)
dpl1	-1.330***	-1.926***	-.508	-2.380***	-1.426***	-1.322*	.089
	(.236)	(.230)	(.493)	(.344)	(.309)	(.759)	(.647)
dpl2	-2.239***	-2.500***	-2.130***	-2.273***	-2.572***	-2.173***	-2.078***
	(.236)	(.230)	(.493)	(.344)	(.310)	(.761)	(.647)
dpl3	-2.243***	-2.376***	-2.402***	-2.237***	-2.354***	-2.575***	-2.271***
	(.236)	(.231)	(.494)	(.344)	(.310)	(.762)	(.648)
dpl4	-2.241***	-2.267***	-2.624***	-1.915***	-2.407***	-2.610***	-2.597***
	(.236)	(.231)	(.494)	(.344)	(.310)	(.762)	(.649)
dpl5	-2.025***	-2.317***	-1.911***	-1.984***	-2.437***	-1.859**	-1.910***
	(.237)	(.231)	(.495)	(.345)	(.310)	(.763)	(.649)
dpl6	-1.713***	-1.971***	-1.712***	-1.548***	-2.175***	-1.406*	-1.892***
	(.237)	(.231)	(.495)	(.345)	(.310)	(.764)	(.650)
dpl7	-1.509***	-1.749***	-1.596***	-1.249***	-2.030***	-0.889	-2.055***
	(.237)	(.231)	(.495)	(.346)	(.310)	(.764)	(.650)
dpl8	-1.549***	-1.621***	-2.000***	-1.187***	-1.859***	-1.918**	-2.015***
	(.237)	(.231)	(.496)	(.346)	(.311)	(.765)	(.650)
dpl9	-1.313***	-1.584***	-1.359***	-1.273***	-1.730***	-0.937	-1.605**
	(.237)	(.232)	(.496)	(.346)	(.311)	(.767)	(.650)
dpl10	-1.308***	-1.349***	-1.834***	-.718**	-1.766***	-1.924**	-1.721***
	(.238)	(.232)	(.497)	(.347)	(.311)	(.768)	(.651)
dpl11	-1.020***	-0.883***	-2.018***	-.215	-1.371***	-1.924**	-2.049***
	(.248)	(.243)	(.511)	(.357)	(.332)	(.779)	(.676)
Observations	3,811,443	2,571,474	1,239,969	1,056,732	1,514,742	554,232	685,737
Males	All	Low Ed	High Ed	L. Ed L. Ten	L.Ed H. Ten	H. Ed L. Ten	H. Ed H. Ten
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
dpl_2	.668***	.114	.704*	.309	.314	.815	.698
	(.187)	(.168)	(.393)	(.293)	(.206)	(.624)	(.505)
dpl_1	.330*	-.263	.438	.137	-.361*	.323	.434
	(.187)	(.167)	(.393)	(.292)	(.206)	(.624)	(.505)
dpl1	-1.903***	-2.250***	-2.306***	-2.112***	-2.215***	-3.225***	-1.813***
	(.187)	(.168)	(.393)	(.292)	(.206)	(.625)	(.506)
dpl2	-3.398***	-3.488***	-4.372***	-2.863***	-3.703***	-4.729***	-4.251***
	(.187)	(.168)	(.393)	(.292)	(.206)	(.624)	(.506)
dpl3	-3.162***	-3.281***	-4.161***	-2.567***	-3.491***	-4.247***	-4.190***
	(.187)	(.168)	(.394)	(.293)	(.206)	(.625)	(.506)
dpl4	-2.991***	-3.191***	-3.903***	-2.439***	-3.386***	-3.930***	-3.946***
	(.188)	(.168)	(.394)	(.293)	(.206)	(.625)	(.507)
dpl5	-2.665***	-2.998***	-3.424***	-2.090***	-3.263***	-2.997***	-3.735***
	(.188)	(.168)	(.394)	(.293)	(.206)	(.626)	(.506)
dpl6	-2.187***	-2.689***	-2.749***	-1.772***	-2.964***	-2.039***	-3.246***
	(.188)	(.168)	(.394)	(.294)	(.207)	(.626)	(.507)
dpl7	-2.042***	-2.447***	-2.850***	-1.469***	-2.771***	-1.964***	-3.460***
	(.188)	(.169)	(.395)	(.294)	(.207)	(.628)	(.508)
dpl8	-1.818***	-2.249***	-2.684***	-1.188***	-2.644***	-2.359***	-2.930***
	(.188)	(.169)	(.396)	(.295)	(.207)	(.629)	(.508)
dpl9	-1.823***	-2.250***	-2.716***	-1.042***	-2.743***	-2.243***	-3.044***
	(.189)	(.169)	(.396)	(.295)	(.207)	(.630)	(.508)
dpl10	-1.668***	-2.148***	-2.548***	-1.054***	-2.578***	-1.574**	-3.203***
	(.189)	(.169)	(.396)	(.296)	(.207)	(.630)	(.508)
dpl11	-1.433***	-1.938***	-2.276***	-0.890***	-2.444***	-1.527**	-2.855***
	(.189)	(.169)	(.397)	(.296)	(.208)	(.632)	(.509)
Observations	5,825,112	3,928,997	1,896,115	1,103,859	2,825,138	660,254	1,235,861

Figure A1. Effect of job displacement on fertility for married couples

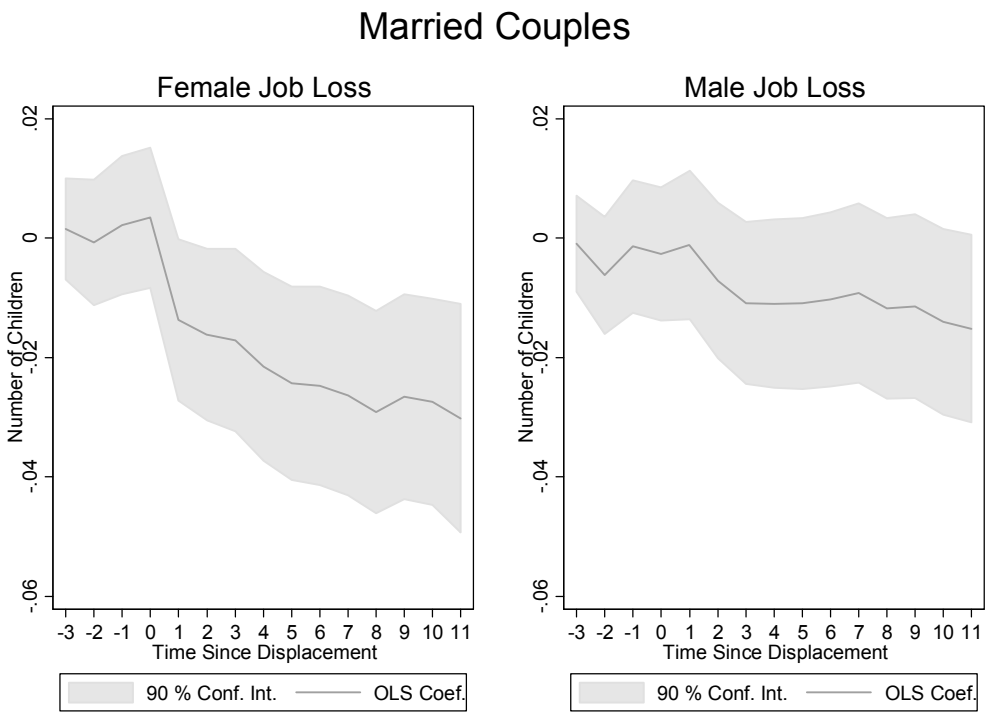
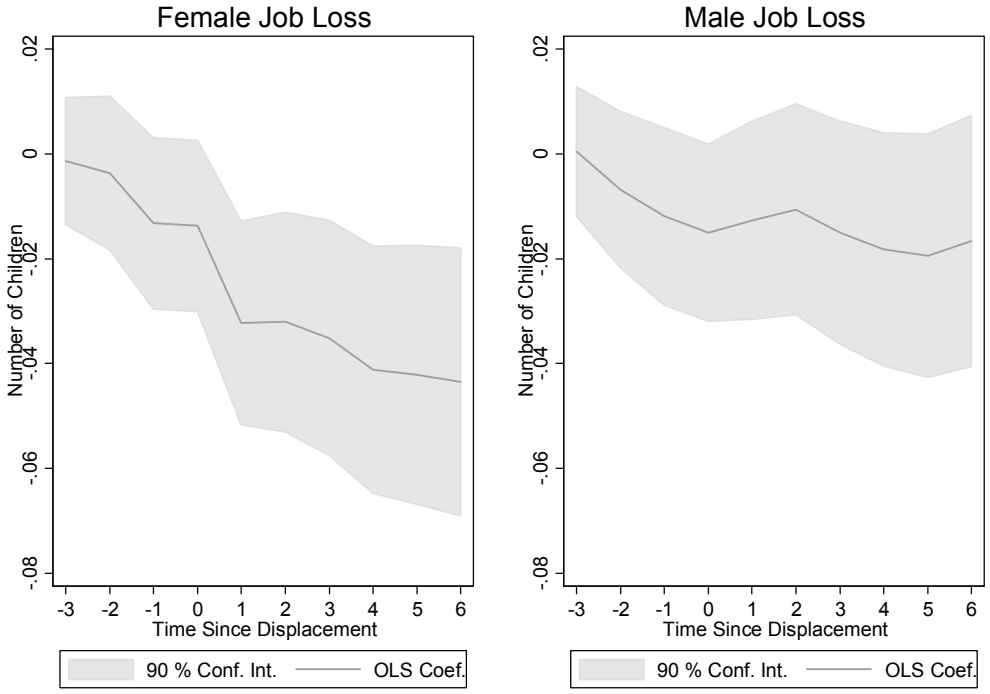


Figure A2. Effect of job displacement due to mass layoff on fertility

Figure A3. Effect of job displacement during recovery period on fertility (years 1996–1998)



Appendix B

Figure B1. Effect of job displacement on annual earnings by education (FE)

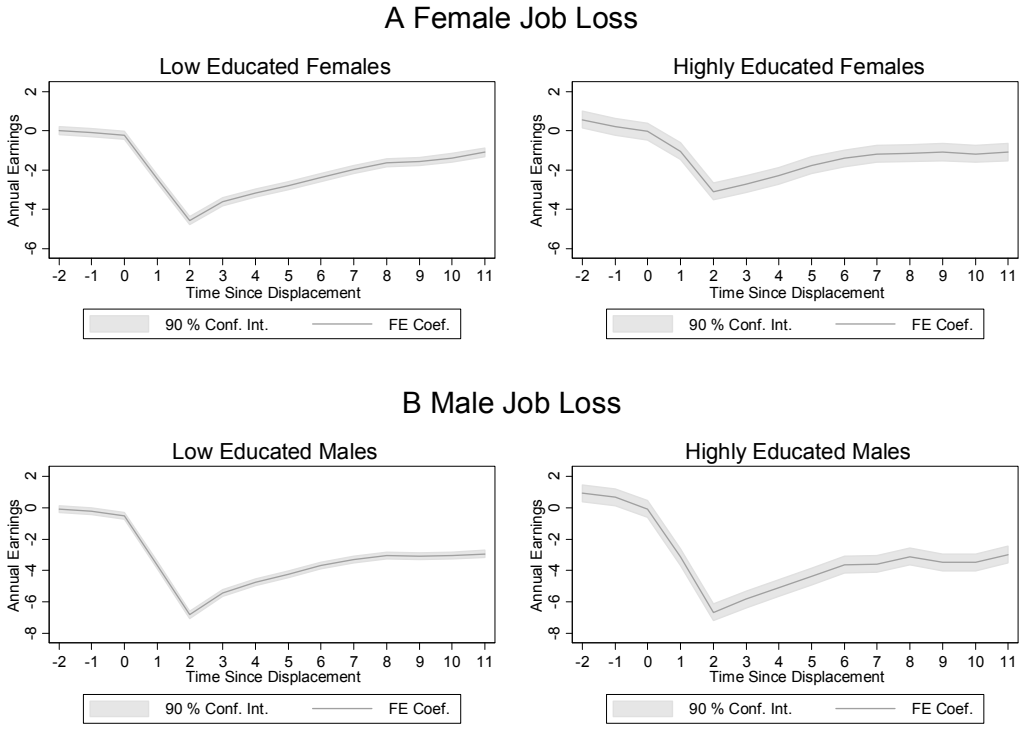


Figure B2. Effect of job displacement on cumulative number of children (FE specification)

Figure B3. Effect of job displacement on fertility by education and tenure

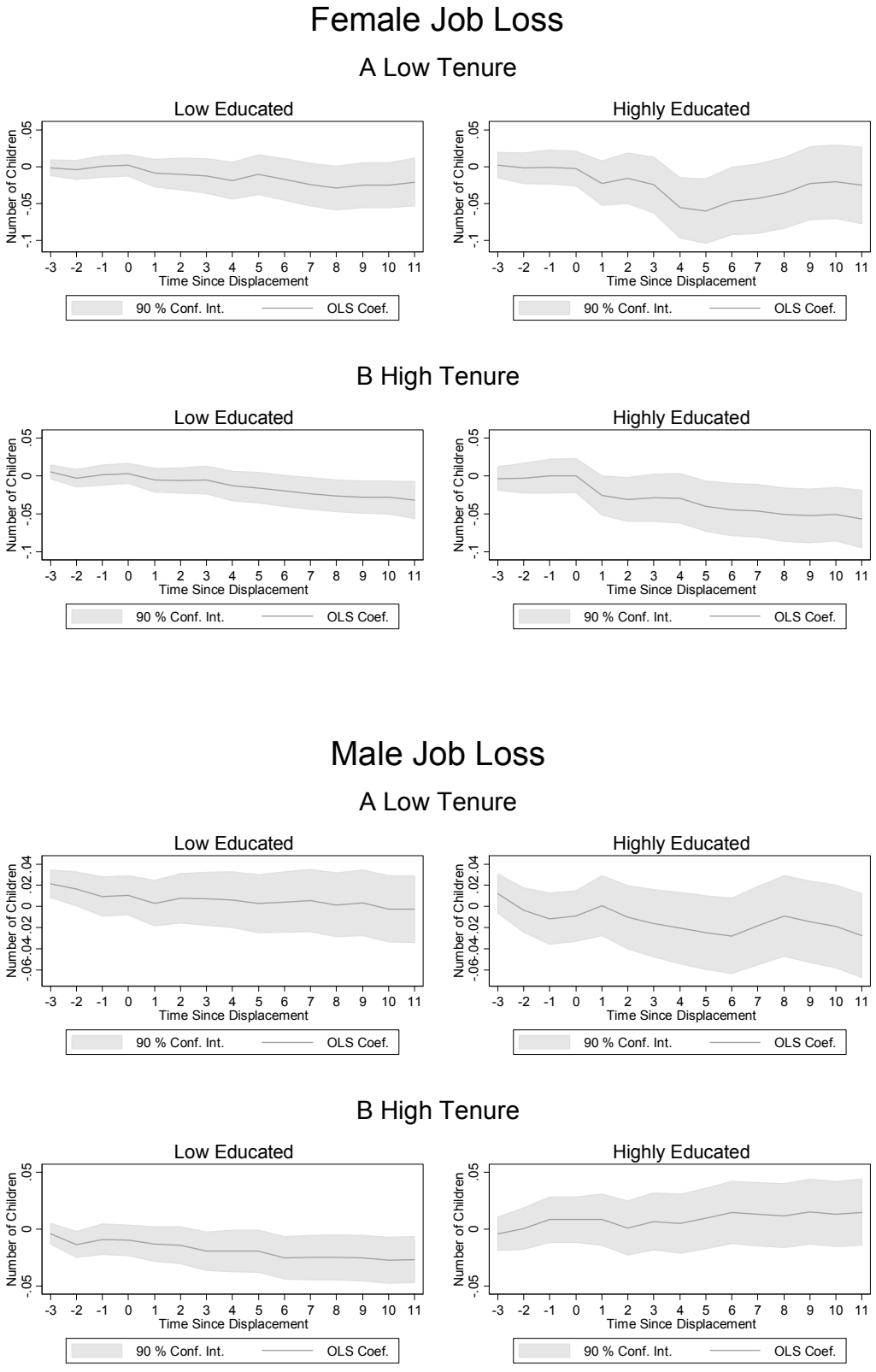


Figure B4. The effect of female job displacement by pre-displacement wage (A) and pre-displacement earnings share (B)

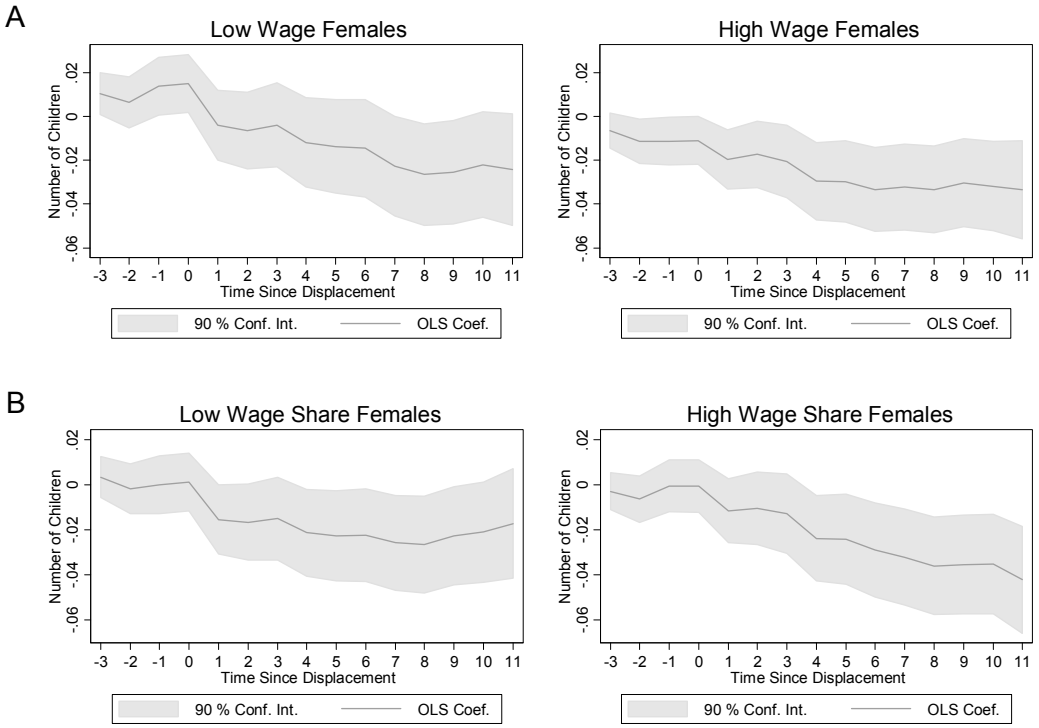


Table B1. Average worker characteristics in the years before plant closure

All workers	Plants that close down between t and t+1				Plants that do not close down btw t and t+1			
	t-3	t-2	t-1	t	t=-3	t=-2	t=-1	t=0
Female	.41	.42	.42	.45	.49	.49	.49	.49
Age	34.28	34.75	35.34	35.78	34.67	35.13	35.76	36.41
Primary	.33	.32	.31	.30	.31	.30	.29	.28
Secondary	.43	.42	.42	.43	.42	.42	.42	.421
Tertiary	.23	.25	.25	.26	.25	.26	.27	.29
Tenure	5.07	5.16	5.59	6.15	6.07	6.25	6.62	7.04
Annual earnings	21.15	21.98	21.88	20.92	20.63	21.18	21.64	21.70
Married	.57	.571	.57	.58	.58	.58	.59	.60
Number of children	.92	.92	.92	.95	.94	.94	.94	.94
Plant size	92.13	78.51	62.98	41.18639	165.88	156.20	145.62	132.85
Observations	52885	55393	53796	51817	2103439	2173720	2184807	2208812

NOTE: Private sector firms. We dropped two digit industries with share of workers that experienced plant closure less than 0.05%.

Table B2. Effect of job displacement on fertility

Effect by years since displacement	At least one spouse employed at t				Both spouses employed at t			
	Female Job Loss		Male Job Loss		Female Job Loss		Male Job Loss	
	Number of children	Gave birth	Number of children	Gave birth	Number of children	Gave birth	Number of children	Gave birth
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
dpl_3	0.000	-0.003	0.003	0.003	-0.001	-0.003	-0.002	-0.004
	(0.004)	(0.003)	(0.004)	(0.003)	(0.005)	(0.004)	(0.004)	(0.003)
dpl_2	-0.004	-0.004	-0.003	-0.005	-0.004	-0.004	-0.005	-0.001
	(0.005)	(0.003)	(0.005)	(0.003)	(0.006)	(0.004)	(0.005)	(0.003)
dpl_1	-0.000	0.002	-0.001	0.003	-0.003	0.000	-0.002	0.003
	(0.005)	(0.003)	(0.005)	(0.003)	(0.007)	(0.004)	(0.006)	(0.003)
dpl_0	0.000		-0.002		-0.002		-0.005	
	(0.005)		(0.005)		(0.007)		(0.006)	
dpl1	-0.014**	-0.013***	-0.002	0.001	-0.018**	-0.016***	-0.006	0.001
	(0.006)	(0.003)	(0.006)	(0.003)	(0.009)	(0.005)	(0.008)	(0.004)
dpl2	-0.014*	0.000	-0.003	-0.002	-0.016*	0.003	-0.004	0.001
	(0.007)	(0.003)	(0.007)	(0.003)	(0.010)	(0.004)	(0.008)	(0.004)
dpl3	-0.014*	0.000	-0.004	-0.002	-0.015	0.002	-0.009	-0.005
	(0.008)	(0.003)	(0.007)	(0.002)	(0.011)	(0.004)	(0.009)	(0.004)
dpl4	-0.023***	-0.007***	-0.005	-0.000	-0.025**	-0.008**	-0.009	0.001
	(0.008)	(0.003)	(0.007)	(0.002)	(0.011)	(0.004)	(0.010)	(0.003)
dpl5	-0.024***	-0.001	-0.005	-0.002	-0.019	0.004	-0.013	-0.005
	(0.009)	(0.003)	(0.008)	(0.002)	(0.012)	(0.004)	(0.010)	(0.003)
dpl6	-0.026***	-0.003	-0.006	-0.001	-0.020	-0.000	-0.014	0.001
	(0.009)	(0.002)	(0.008)	(0.002)	(0.012)	(0.003)	(0.010)	(0.003)
dpl7	-0.029***	-0.002	-0.004	0.001	-0.021	0.001	-0.014	0.000
	(0.009)	(0.002)	(0.008)	(0.002)	(0.013)	(0.003)	(0.011)	(0.003)
dpl8	-0.032***	-0.001	-0.004	-0.000	-0.020	0.002	-0.015	-0.002
	(0.009)	(0.002)	(0.008)	(0.002)	(0.013)	(0.003)	(0.011)	(0.002)
dpl9	-0.030***	0.002	-0.004	0.000	-0.017	0.002	-0.015	-0.000
	(0.009)	(0.002)	(0.008)	(0.002)	(0.013)	(0.003)	(0.011)	(0.002)
dpl10	-0.029***	0.002	-0.007	-0.002	-0.017	0.002	-0.017	-0.004*
	(0.010)	(0.002)	(0.008)	(0.001)	(0.013)	(0.002)	(0.011)	(0.002)
dpl11	-0.031***	0.000	-0.007	-0.001	-0.015	-0.000	-0.020*	-0.001
	(0.010)	(0.002)	(0.009)	(0.001)	(0.015)	(0.002)	(0.012)	(0.002)
Observations	3,800,222	3,800,222	5,698,233	5,698,233	1,924,981	1,924,981	1,924,981	1,924,981

Note: Robust standard errors clustered on individuals are in parenthesis. The years when outcome variable does not vary (e.g. all are employed in years *t – 1* and *t*) are dropped from the regression, which explains why the number of observations varies between columns. Sample consists of women who were 20–40 years old at time *t* (base years 1991–1993), who were working in the end of the year t and *t – 1* and who did not give birth during year *t*.

Essay 3:
Children, Labor Supply and Income: Evidence from Exogenous Variation in Family Size in Finland

Jenni Kellokumpu

Unpublished

Children, Labor Supply and Income: Evidence from Exogenous Variation in Family Size in Finland

Abstract

The well-known study of Angrist and Evans (1998) uses parental preferences for a mixed-sibling sex composition and twins instruments to estimate the causal effect of children on parents' labor supply and income. This study uses the same identification strategy to investigate the impact of children on parental employment outcomes in a Nordic welfare state with high female employment rates and a strong preference for children's home care promoted by the state. Cohabiting and married women adjust their labor supply dramatically after the third child: the likelihood of employment decreases by almost 40 percentage points. Especially pronounced this effect is for women with secondary or higher education. For fathers and for single mothers there is no effect of children on employment.

JEL: J13, J22

Keywords: family gap, children, labor supply, earnings, income, instrumental variables

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1. Introduction

A number of studies have empirically examined the association between family size and labor market outcomes of parents. Others study the effect of family size on labor supply and wages, whereas others examine the effect of earnings and labor supply on fertility. As Angrist and Evans (1998) put it: *"Since fertility variables cannot be both dependent and exogenous at the same time, it seems unlikely that either sort of regression has a causal interpretation."* Besides, there are theoretical reasons to believe that fertility and labor supply are jointly determined.[1] The past empirical work has solved the endogeneity of fertility by using a natural experiment, a policy reform or a fixed effects estimator.

This study uses two sorts of "natural experiments" to study the causal effect of children on female labor supply and wages. Following identification strategy in Angrist and Evans (1998) I use the instrumental variables (IV) strategy based on either, (i) families' preference for sibling sex mix or (ii) the birth of twins in order to identify the causal effect of family size on labor supply, wages and income of women in Finland. The same-sex instrument is based on the observation that parents of same-sex siblings are more likely to go on to have an additional child (see e.g. Westoff et al., 1963, Williamson, 1976, Angrist and Evans, 1998). Because a birth of twins is virtually randomly assigned, the event of twinning creates potentially exogenous variation in the family size.[2] Twinning at first birth has been extensively used in studies estimating the causal relationship between family size and labor market outcomes (e.g. Rosenzweig and Wolpin, 1980a, b; Bronars and Grogger, 1994; Gangadharan and Rosenbloom, 1996; Jacobsen et al. 1999; Vere 2011). Instead of twinning at first birth, Angrist and Evans (1998) focus on second multiple births to be able to compare the estimates of the same-sex instrument to the estimates of the twin instrument.[3] Likewise, in this study twinning at second birth is used as an alternative instrument for change in family size from two to three children.[4]

Angrist and Evans (1998) find that children reduce the labor supply of women by 12 percentage points in 1980 and 9 percentage points in 1990 in the US. Iacovou (2001) uses the same exogenous variation in family size to study the effect of

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[1] See, e.g. Schultz 1981, or Goldin, 1990.

[2] The randomness of twinning may be violated due to infertility treatments.

[3] Vere (2011) uses multiple births both at first birth and second birth to control for unobserved heterogeneity when analysing US census data from 1980, 1990 and 2000.

[4] The effect of change from two to more than two children is particularly interesting since it seems to reduce maternal employment significantly in Finland. Just over 80 percent of mothers with one or two children under age 18 are employed whereas only 67.5% of mothers with three children or more work. For fathers, the employment-to-population ratio is around 90% regardless of the family size. (Statistics Finland, 2008.)

children on maternal employment in the UK. Although there is a negative correlation between maternal employment, she finds no causal relationship between mothers' labor supply and fertility. She suggests, that the differences between the US and the UK labor markets – i.e. policies, which are aimed at helping mothers to return to work – explain why an additional child does not reduce maternal employment in the UK. Also Hirvonen (2010) adopts the same-sex approach and finds that for Swedish mothers a third birth decreases the likelihood of labor force participation by around 10 percentage points in next three years following childbirth, but this effect decreases as the child grows up. Moreover, she cannot find any difference in maternal labor supply effects over a long time period – of women who gave birth to their third child in 1980 and of women who gave birth to their third child in 1995[5] – despite the rapid expansion of family policies over this time period in Sweden.[6] Based on the results of Angrist and Evans, and Iacovou and Hirvonen, it is clear that both differences in the labor market institutions and in family policies lead to differences in parental employment – especially in maternal employment in different countries. Both the US and UK have employment rates of mothers of school-aged children around 70%. This is 10 percentage points less than for mothers with school-aged children in Finland. The difference in maternal employment is even more pronounced for mother, whose youngest child is between the ages of three and five. In the US, the employment rate of mothers, whose youngest child is between the ages of three and five, is only 62% and even less in the UK, whereas in Finland the employment rate is 80%.

The Nordic countries – Finland among them – have been pioneers in developing models for combining work and family. Policies adopted in the Nordic countries have inspired many other European countries to create their own family policies and many countries today are making decisions on their family policies. As in all Nordic countries, Finland has such family policies as job-protected parental leave, low cost-high quality public day care and the right to take time off for the care of a sick child. Despite sharing many of the key features of the family policies common to all Nordic countries, Finland has a very unique model of reconciling maternal employment and care of small children. A key feature that distinguishes Finland from other Nordic countries is the right to extend the job-protected parental leave until the youngest child turns three based on the Employment Contracts Act. The extension of parental leave is supported by the state: a parent who takes child home care leave receives child home care

[5] Hirvonen (2010, 11) describes that "The individuals in the sample are given time to complete the transition to a third birth within a few years before or in the same year I observe their earnings."

[6] Another studies using the same (or similar) identification strategies to study maternal employment in the western countries include Cruces and Galiani (2007) for Latin-America, Daouli, Demoussis, and Giannakopoulus (2009) for Greece, and Maurin and Moschion (2009) for France. Ebenstein (2007) provides evidence of an increase in family size on labor supply by exploiting a preference for sons in Taiwan. Chun and Oh (2002) use son-preference in Korea.

allowance.[7] The allowance is also paid to a parent who stays at home to look after a child and does not have an employment contract. This unique policy is very popular among Finnish families: over half of Finnish children under the age of two are taken care of at home by their mothers. As a result, in Finland the employment of mothers of very young children decreases to US and UK levels. Only half of the mothers with children under the age of three participate in the labor force compared to an over 70% employment rate for the same group in Sweden and Denmark. This raises the question whether the combination of this particular set of policies in Finland actually benefits mothers' employment.

This study adds to the existing literature in following way. I examine how having one more child affects maternal employment in an economy with high female labor force participation rates and a strong preference for home care of very young children. In particular, this paper sheds light on the issue, whether institutions that facilitate reconciling work with family (job-protected parental leave up to three years per child, low cost public day care, a right to take time of for the care of a sick child and child benefits) actually benefit mothers' labor market outcomes. I also link fertility to the employment outcomes of fathers. This aspect of the study is particularly interesting since during the 21st century Finland has attempted to promote gender-equality also in the care of children by expanding the rights of fathers to take leave from work for the care of children.

I find that both cohabiting and married women adjust their labor supply dramatically after the third child: the likelihood of employment decreases by around 35 percentage points. Especially pronounced this effect is for women with secondary education. For women with secondary education, a third child reduces the employment probability by over 40 percentage points. For fathers and single mothers an increase in family size has no effect on employment. These results are much larger than the ones received in the US, the UK and Sweden by using the same identification strategy. However, the relatively large maternal labor supply effects found in this study are in line with the earlier Finnish

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[7] All parents in Finland are eligible for earnings-related parental allowance during maternity, paternity and parental leave. Annual earnings up to 29 393 euros are compensated by 70%. From annual earnings above 29 393 euros the compansation percent is 45 until 45 221 euros. For the part of annual earnings above 45 221 euros 25% is compensated. In case of no previous earnings or very low annual earnings the person is paid a flat minimum allowance. This flat minimum allowance is 15.20 euros/day and it is paid for 6 days a week. The length or parental leave is 263 days (10.5 months). After parental leave, parents have a right to extend their leave until the youngest child turns three. This leave is supported by the Child Home Care Allowance, which includes a care allowance and, depending on the family's income, a care supplement. The care allowance is paid separately for every child eligible for the allowance. The amount of the care allowance is 336.67 euros per month for one child under 3 years and 100.67 euros per month for each additional child under 3 years and 64.77 euros per month for a child over 3 years but under school age. The care supplement depends on the size and gross income of the family. The maximum amount of care supplement is 180.17 per month and it is paid for one child only. Many municipalities also pay an additional supplement on the top of child home care allowance if the child does not use public day care. For more information see, http://www.kela.fi/in/internet/english.nsf/NET/150502155459EH.

research, which has found large response margin for Finnish mothers. Kosonen (2011) examines the effect of Child Home Care subsidies on maternal labor supply and finds a large negative effect on the labor force participation: a monthly increase of 100 euros in the supplement reduces the maternal labor supply by 3%.

The paper is organized as follows. The following chapter reviews the existing literature. The data and the sex-mix intruments' first stage are described in Chapter Three. Chapter Four presents the emprirical framework and discusses the results. Chapter Five concludes.

2. Previous Literature

The inference between fertility and labor market outcomes of women using the same-sex instrument were first drawn by Angrist and Evans (1998). In their study they exploit parental preference for mixed-sibling sex composition and the birth of twins at second birth when estimating the causal effect of children on mothers' labor supply. Their instrumental variables estimates confirm the negative effect that children have on the labor supply of mothers implied by the OLS estimates, although the OLS regressions seem to exaggerate the causal effect of children. They find that children reduce the labor supply of women by 12 percentage points. The finding of Angrist and Evans (later referred as AE) is obtained with the US Census data from 1980 and 1990. Jacobsen, Pearce and Rosenbloom (1999) use 1970 and 1980 US Censuses and the birth of twins at first birth as instrument for family size. They find significant but small effect of children on both labor supply and earnings in the short run, and no effect in the long run. Recently, Vere (2011) uses multiple births at first and second birth when analysing US Census data from 1980, 1990 and 2000. He finds that for single women the causal effect of children on labor supply has declined over time suggesting that incentives for work have improved particularly for this group. In contrast, he finds that the increase in married men's labor earnings in response to multiple births have risen over time. Based on this result Vere (2011) argues that the traditional gender roles within a household have gained new popularity.[8]

The parental preference for 'balanced' families – a preference to have both boys and girls – is also exploited by Iacovou (2001) for the UK. She finds that fertility is associated with a 15% reduction in maternal employment but this effect disappears once the family size is instrumented. She explains this finding by the differences in the labor market conditions in the US and the UK: subsidized day care, more generous maternity leave provisions, right to take time off to look after a sick child, and good availability of part-time jobs mean that more mothers in the UK choose to work. Hence, the negative relationship between fertility and maternal employment in the UK results from heterogenous preferences of mothers rather than children actually preventing mothers to work.

Hirvonen (2010) uses the same identification strategy for Swedish parents. She finds that for Swedish mothers a third birth decreases the likelihood of labor force participation by around 10 percentage points in the next three years following childbirth, but this effect decreases as the child grows up. Moreover, she finds no statistically significant change in the impact of the third birth to

[8] Vere acknowledges the increase in planned multiple births due to fertility treatments and the potential bias in his results based on year 2000 Census files. However, since fertility treatments are more likely for older women and his sample is limited to women aged 21 to 35 he considers the potential bias to be fairly small.

labor supply over a 15-year time period (of women who gave birth to their third child in 1980 and of women who gave birth to their third child in 1995), in which the Swedish family policies expanded rapidly.

Both the sex-preference and twins-based instruments are used to investigate the influence of children on marital stability. Vuri (2001) uses the sex-mix preference and finds that children have a positive effect on divorce probability. Cáceres-Delpiano (2006) instruments family size with multiple births and finds an increase in the probability of divorce.[9]

There is also a large literature on family policies and their labor market consequences. The reduction in child-care prices in Sweden had no effect on employment (Lundin et al. 2008), while in Canada (Baker et al. 2008, Lefebre and Merrigan 2008) there was a positive effect on employment. The availability of school slots for two-year-olds had a positive impact on employment of single mothers in France (Goux and Maurin 2010). Ruhm's (1998) cross-country comparison finds a positive association between the maternity leave and female employment. A study on the effect of an extension of parental leave in Austria finds a negative impact on employment (Lalive and Zweimüller 2009). The results also suggest that both cash transfers and job protection are important for employment decisions. Also Baker and Milligan (2008) find that long expansions in job-protected leave result in reductions in maternal employment in Canada. Similarly, the policy of job protected child home care leave has a large negative impact on maternal employment in Finland (Kosonen 2011).

[9] Bedard and Deschenes (2005) use the sex of the firstborn child to instrument divorce and study the causal effect of divorce on economic status of women.

3. Data Sources and Descriptive Statistics

3.1 **Sample and Variable Definitions**

The estimation is implemented using a 1/3 random sample of women and their spouses of all Finnish residents aged 16–70 from the year 1988 to 2004. The information on individuals is based on the Employment Statistics Database (ESD), which includes information on the labor market status of individuals and their background characteristics from different administrative registers.[10] For instance, various earnings and income information in the data are based on tax registers. With individual identification codes these data can be merged to other data sources. Information about spouses of the women in the sample is linked using an identifier. ESD has no retrospective fertility information other than the number of children under the age of 18 living in the same household. Therefore, fertility information for these women is supplemented from the Population Information System of the Population Register Centre (PIS). This information includes the birth year, the birth month and the gender of all children born to these women since 1988.

In order to replicate the set-up used in AE (1998) I use the latest year in these data, 2004, to estimate the causal impact of family size on labor market outcomes. Moreover, the sample is limited to mothers aged 21–35 with two or more children and whose oldest child was less than 18 years old in 2004. In addition, I exclude women who are entrepreneurs from the sample and those who give birth in 2004.[11] In addition to the total sample, the emprical analysis is conducted on several subsamples: on (i) single mothers, (ii) cohabiting mothers and (iii) married mothers and also on (iv) spouses of the latter two groups. The reason to be interested in all of these subgroups is that the labor supply responses might differ depending on the marital status of the woman. For instance, single mothers may be more credit constrained than the ones of two-earner families. Two-earner families may also have differential gender roles depending whether the parents are married or not. Fathers are also of particular interest since the main focus in the development of family leave policies in Finland has been to increase the fathers' use of these leaves.

Varible definitions are the following. The variable of main interest is *Worked for pay*. ESD reports the main economic activity of an individual based on data on the person's main type of activity during the last week of a given year. A person is classified as employed if she has a valid, statutory-earnings-related pension

[10] In practice, Statistics Finland provides Finnish Longitudinal Employer-Employee Data (FLEED) for the use of researchers. Employment Statistics Database is one part of FLEED.

[11] Also women whose first birth was a multiple birth are excluded from the sample.

insurance[12] in the last week of the year and has earned income during that year based on the registers of income taxation of individuals.[13] The data also report annual *Labor income* and annual *Taxable earned income*. The annual labor income refers to earned income received by income recipients during the year excluding entrepreneurial income.[14] The measure of annual taxable earned income is income that is subject to state taxation. It includes (i) wage income, (ii) entrepreneurial income and (iii) other income subject to state taxation – such as other earned income (e.g. dividends, which are taxed as earned income), (iv) pension income, (v) social security transfers subject to state taxation – such as unemployment benefit, sickness benefit, maternity and paternity allowance, child home care allowance, study grant and adult education subsidy and other social security benefits.[15] Because I have excluded women, who are entrepreneurs (for spouses no such restriction is made) the main difference for women between Labor income and Taxable earned income is that the latter includes social security transfers.[16] The final variable is *Family income*, which includes the annual taxable earned income of both spouses.

The classification of main economic activity is problematic in regard to my research question. Mothers who are on a job-protected maternity leave have a valid, statutory earnings-related pension insurance. Hence, they are classified as employed. For this reason, I redefine my variable of main interest *Worked for pay* in another way. A person is defined to have worked for pay if she satisfies the following condition: (i) the sum of child related allowances (maternity/paternity leave benefit and home care allowance) is less than 50% of the annual taxable earned income and share of benefits in total (child related allowances, unemployment benefits and sickness benefits) is less than 50%. In sensitivity analysis, I also use two alternative measures of *Worked for pay* variable: (i) the sum of child related allowances is less than 40% and share of benefits in total less than 40% (ii) the sum of child related allowances is less than 30% and share of benefits in total less than 30%. To see how the composition of women classified as *Worked for pay* changes as I change the criteria is presented in Table 1. I also show the number of women employed based on Statistics

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[12] Employers have to take occupational pension insurance for all 18-68 year-old employees, when their monthly earnings exceed a certain amount. Earnings-related pensions are paid for working incapacity, long-term unemployment and old age, see http://www.stm.fi/en/insurance/statutory_insurance.

[13] For more information, see http://www.stat.fi/meta/kas/tyovoima_ulkopu_en.html and http://www.stat.fi/meta/kas/amm_toimi_en.html

[14] For a more thorough description, see http://www.stat.fi/meta/kas/tyotulot_en.html.

[15] Social security benefits, which are not subject to state taxation are child benefit, general housing allowance and other forms of housing assistance, and labor market subsidy.

[16] This restriction does not make much of a difference in the sample size since self-employment is very rare among women in Finland.

Finland's classification of person's main economic activity and positive labor income.

Table 1. Number of Women Classified as Worked for Pay by Different Criteria

	Definition of the *Worked for pay* variable:			
	(1) Share of child related allowances of total annual income:			(2) Main economic activity classified as employed and annual labor income more than zero
	<50%	<40%	<30%	
Sample:				
All women	17 160	16 158	14 941	17 036
Single mothers	2 451	2 305	2 138	2 162
Cohabiting mothers	14 709	13 853	12 803	14 874
Married women	11 478	10 827	10 027	11 602

3.2 **Descriptive Statistics**

Descriptive statistics and variable definitions for covariates, instruments, and dependent variables are given in Table 2. The variable of main interest is the indicator *More than 2 children*. The first instrumental variable for *More than 2 children* is the indicator *Same sex*. In Table 2 is also shown the two components of *Same sex*, the indicators *Two boys* and *Two girls*. Among all women with two children 30% had a third child in my sample, the share being the same for cohabiting women and two percentage points higher for married women, whereas only 28% of single mothers had a third child. In both couples and married samples, 50% of all families had children of the same sex and over 51% of first births were boys.

Demographic variables include measures for mother's age and age at first birth. At first sight, the mean age of the sample may seem high. This can be explained with the restriction to mothers aged 21–35 in 2004 in the sample. Moreover, they all have to have at least two children, which explains why the mean age is 31 years for all women in the sample. Single women have, on average, their first child two years younger than cohabiting and married women. Their youngest child is also more than one year older than the youngest child of cohabiting and married mothers – both due to having children earlier and having more likely only two children instead of three. Values for the spouses of the *Couples* and *Married* sample are also reported. Not surprisingly, men are older (27-years-old) than women (24-years-old) at the time of the first child's birth. The age of the spouse at first birth in my data refers to spouses at the time of the first birth and hence may not necessarily be the age of the current spouse in 2004. Besides, not all of the cohabiting and married women in 2004 had a spouse at the time of their first birth. In addition, the spouse identifier is available only from 1990 onwards, hence for first births occurring in 1988 or 1989 I cannot observe the age of the father. For these reasons, the age of the first time fathers is based on 20 145 observations in the Couples sample and 15 727 observations in the Married

sample. As expected, the share of fathers who are employed is high: 94 percent of cohabiting and 95 percent of married fathers work. Of cohabiting and married mothers around 66 percent are employed. The mean annual labor income of both cohabiting and married fathers is reasonably higher than the mean earnings of their spouses. Cohabiting fathers' annual labor income is almost 28 000 euros and annual taxable income is near 31 000 euros while their spouses have annual labor income of less than 13 000 euros and taxable income around 16 000 euros. Married fathers' annual labor income is 29 000 euros and taxable income is over 32 000 euros while their wifes have roughly 13 000 euros of labor income and less than 17 000 euros of taxable income.

Table 2. Descriptive Statistics, Women Aged 21–35 with 2 or More Children in 2004

			Couples		**Married**	
Variable:	**All women**	**Single women**	**Women**	**Men**	**Women**	**Men**
Children ever born	2.39	2.36	2.40		2.44	
More than 2 children (0/1)	0.297	0.276	0.300		0.320	
Boy 1st (0/1)	0.514	0.521	0.513		0.517	
Boy 2nd (0/1)	0.513	0.516	0.512		0.514	
Two boys (0/1)	0.261	0.261	0.262		0.264	
Two girls (0/1)	0.234	0.224	0.236		0.232	
Same sex (0/1)	0.495	0.485	0.497		0.496	
Twins-2 (0/1)	0.011	0.012	0.011		0.012	
Age of the youngest child	3.75	4.81	3.55		3.50	
Age	31.41	30.95	31.50	34.42	31.70	34.57
Age at first birth	23.65	22.05	23.94	27.18	24.20	27.28
Worked for pay	0.647	0.599	0.655	0.940	0.668	0.951
Labor income	12 302	10 224	12 681	27 648	13 149	29 004
Taxable income (inc. transfers)	16 072	13 998	16 450	30 945	16 889	32 184
Family income (inc. transfers)	42 242	13 998	47 395	47 395	49 073	49 073
Obs.	**26 534**	**4 094**	**22 440**	**22 440**	**17 187**	**17 187**

Notes: The couples sample refers to women who were cohabiting in 2004 and to their spouses. Age of the spouse at first birth refers to spouses at the time of the first birth and hence may not necessarily be the age of the current spouse. Besides, not all of the cohabiting women in 2004 had a spouse at the time of their first birth. Also, spouse identifier is available only from year 1990 onwards. Hence for first births occurring in 1988 or 1989 I cannot observe the age of the father. For these reasons, the age of the first time fathers is based on 20 145 observations in the Couples sample and 15 727 observations in Married sample.

4. Results

4.1 First Stages

Parental preference for a mixed sibling-sex composition in western countries is reported, for instance, in a study of Ben-Porath and Welch (1976). Table 3 reports the similar estimates of the impact of the child's sex and the sex mix on fertility in my data. Table 3 shows the relationship between the fraction of women who have a third child and the sex of the first two children. The first three rows show the sample charasteristics of women in the following groups: those with one boy and one girl, those with two girls and those with two boys. The fraction of sample having a third child is slightly higher, when the first two children are girls instead of boys – albeit the difference is not statistically different from zero. This is in line with the evidence of Andersson et al. (2006), who find that Finnish families have a significant preference for having a son as third child. The next two rows report estimates for women with one boy and one girl and for women with two children of the same sex. The final row reports the differences between the same-sex and mixed-sex means.

Table 3. Fraction of Families that Had Another Child by Parity and Sex of Children

Sex of first two children in families with two or more children:	**All women**		**Single women**		**Couples**		**Married**	
	Fraction of sample	Fraction that had another child	Fraction of sample	Fraction that had another child	Fraction of sample	Fraction that had another child	Fraction of sample	Fraction that had another child
boy and girl	0.505	0.276	0.515	0.258	0.503	0.279	0.504	0.297
		(0.004)		(0.010)		(0.004)		(0.005)
two girls	0.234	0.319	0.224	0.297	0.236	0.323	0.232	0.346
		(0.006)		(0.015)		(0.006)		(0.008)
two boys	0.261	0.316	0.261	0.294	0.261	0.320	0.264	0.341
		(0.006)		(0.014)		(0.006)		(0.007)
(1) boy and girl	0.505	0.276	0.515	0.258	0.503	0.279	0.504	0.297
		(0.004)		(0.010)		(0.004)		(0.005)
(2) both same sex	0.495	0.318	0.485	0.295	0.497	0.322	0.496	0.343
		(0.004)		(0.003)		(0.004)		(0.005)
difference(2)-(1)		0.042		0.038		0.042		0.046
		(0.006)		(0.014)		(0.006)		(0.007)

Notes: Samples are the same as in Table 2. Standard deviations are in parantheses.

All subsamples suggest that women with two children of the same sex are more likely to have a third child than the mothers of one boy and one girl. In the *All women* sample only 27.6% of mothers with one boy and one girl have a third child compared to 31.9% for mothers with two girls and 31.6% with two boys.

In their study, Angrist and Evans claim that the virtual random assignment of the sex of a child makes the relation from fertility instrumented with Same sex to labor market outcomes most likely causal. Following AE, I illustrate the random assignment of the instrument Same sex in Table 4 which reports the difference in demographic charasteristics by the sex compositition of the first two children. The differences in demographic variables are small and insignificant by Same sex in all demographic variables except one. Women whose first two children are of the same sex are younger than mothers of one boy and one girl (at 5% level). The differences are larger by *Twins-2*.[17]

As expected, twins are more likely for older women (e.g. Waterhouse, 1950.) They were also older at the time of their first birth. The difference in the years of schooling is not, however, statistically significant.

Table 4. Differences in Means for Demographic Variables

	Differences in means (standard errors)	
Variable:	**By *Same sex***	**By *Twins-2***
Age	-0.0784	0.3192
	(0.0384)	(0.1818)
Age at first birth	-0.0509	0.3778
	(0.0414)	(0.1956)
Years of education	0.0015	0.1587
	(0.0309)	(0.1462)

Notes: Samples are the same as in Table 2. Standard errors are in parantheses.

4.2 **Wald Estimates**

Following AE, I illustrate how the the same sex strategy identifies the effect of fertility on parents' labor supply and income at this particular child parity.

$$y_i = \propto + \beta x_i + \varepsilon_i$$

[17] The randomness of twinning may be violated due to infertility treatments. These programs were introduced in the late 1980s and increased the incidence of multiple births in many countries. In the US, the proportion of multiple births attributable to ovulation induction or assisted reproductive treatment is 33% (Lynch et al., 2001). In Finland, the share of multiple births has gradually increased from 10.5% in 1992 to a peak of 28.9% in 1997 (most likely as a result of infertility treatments) and come down to 16.1% by 2007. Due to various medical reasons (e.g. premature birth, perinatal death, low birthweight) multiple births are not preferred in vitro fertilization treatments (IVF). The only method to limit the number of twin births in IVF treatments is to transfer only one embryo. Two-embryo transfer became the policy in the largest IVF clinic in Finland in 1993. However, already in 1997 they introduced an elective single embryo transfer (eSET) programme, which in 2000 became their primary policy, while the two-embryo transfer is carried out only for specific reasons. According the clinic's retrospective study eSet programme decreases the twinning rate to less than 10%. (Tiitinen et al. 2003.) Since 2001 one-embryo transfer is progressively being introduced in all Finnish IVF clinics (Martikainen et al., 2001). (THL 2008: http://www.stakes.fi/tilastot/tilastotiedotteet/2010/Tr08_10.pdf). The natural twinning rate is 1.5%.

where y_i is a measure of labor supply and x_i is the endogenous fertility measure. Let z_i denote the binary instrument, Same sex. The IV estimate of β in this equation is

$$\beta_{IV} = (\bar{y}_1 - \bar{y}_0)/(\bar{x}_1 - \bar{x}_0)$$

where $\bar{y}_1$ is the mean of y_i for those observations with $z_i = 1$ and other terms are similarly defined. The numerator and denominator capture the reduced-form relationships between y_i and z_i and between x_i and z_i.

The IV method attributes any effect of z_i n y_i to the effect of z_i on x_i. The estimate, β_{IV}, can be interpreted as a local average treatment effect (LATE) specific to the instrument, z_i. This means that β_{IV} estimates the average effect of x_i on y_i only for individuals whose fertility has been affected by the sex of their first two children. In other words, the effect is estimated only for those, who had a third child *because* their first two children were of the same sex. Similarly, when the instrument of twinning at second birth, Twins-2, is used, the effect is estimated for those who have had more children than they otherwise would have because of twinning. Since the complier groups are different, these two different instruments do not necessarily identify the same average effect. Do these instruments have an effect on the More than 2 children variable, in other words, is there a first stage? The first stage, the effect of Same sex on More than 2 children is presented in Table 5. The effect of the Same sex instrument on More than 2 children (equal to the difference in means reported in Table 3 is 0.042. The effect of Same sex on Number of children is 0.060. Angrist and Evans estimated the same effects to be 0.060 (0.063) and 0.077 (0.084) in 1980 (in 1990). The effect of the Twins-2 on More than 2 children is 0.711, and on Number of children is 0.808 in my data. For US women, the same results of Twins-2 instruments were 0.603 and 0.809 in 1980.

To begin with calculating the Wald estimate, one needs the difference in the means of the outcome of interest, for instance Worked for pay, between those who had their first two children of the same sex and those who did not. In other words, the difference in Worked for pay variable when the instrument Same sex is switched on and off, $\bar{y}_1 - \bar{y}_0$. This is referred as reduced form. This difference is then divided by the difference in the More than 2 children (or in Number of children) between the same groups. Hence, Wald estimate is the reduced form divided by the first stage. Put it more formally, the Wald estimate is calculated by dividing $\bar{y}_1 - \bar{y}_0$ by $\bar{x}_1 - x_0$.

The first three columns of Table 5 report the components of β_{IV} when Same sex is used as the instrument. In the last three columns the instrument is Twins-2. The first two rows of the table show the denominator of the Wald estimate, $\bar{x}_1 - x_0$, for two possible choices of x_i. One is an indicator for having had a third child, More than 2 children. The other is the total Number of children.

Table 5. Wald Estimates of Labor-Supply Models

		Wald estimate using as covariate:			Wald estimate using as covariate:	
Variable:	**Mean difference by *Same sex***	**More than 2 children**	**Number of children**	**Mean difference by *Twins*-2**	**More than 2 children**	**Number of children**
More than 2 children	0.0417 (0.0056)			0.7114 (0.0262)		
Number of children	0.0598 (0.0089)			0.8076 (0.0418)		
Worked for pay	-0.0134 (0.0059)	-0.321** (0.141)	-0.224** (0.098)	0.0168 (0.0278)	0.024 (0.039)	0.021 (0.035)
Out of labor force	0.0126 (0.0054)	0.302** (0.131)	0.210** (0.091)	-0.0147 (0.0255)	-0.021 (0.036)	-0.018 (0.032)
Labor income	-204.08 (140.36)	-4 899.4 (3 327.1)	-3 409.9 (2 307.0)	-207.93 (663.77)	-292.3 (931.3)	-257.5 (819.6)
ln(Family income)	0.0051 (0.0085)	0.122 (0.206)	0.085 (0.143)	-0.0600 (0.0401)	-0.084 (0.056)	-0.074 (0.050)

Notes: Samples are the same as in Table 2. Standard errors are in parantheses. There are 92 zero family incomes, hence the last row is estimated with 26 442 observations. Significance level: *** 1 %, ** 5 %, * 10 %

Table 5 also reports $\bar{y}_1 - \bar{y}_0$ for alternative outcomes – employment, labor force participation, labor income and family income – using Same sex instrument. These results show that in addition to having more children than women with one boy and one girl, women with two children of the same sex are less likely to be employed and more likely to be outside of labor force.

The Wald estimate calculated by dividing $\bar{y}_1 - \bar{y}_0$ by $\bar{x}_1 - x_0$ when x_i is More than 2 children imply that having more than two children reduced maternal employment by 32.1 (-0.0134/0.0417) percentage points, increased withdrawal from the labor force by 30.2 (0.0126/0.0417) percentage points, and decreased labor income by 4 899 (-204.08/0.0417) euros per year. However, the estimate on Labor income is statistically insignificant. In AE the Wald estimate for Worked for pay is -0.133 in 1980 and -0.084 in 1990. Hence, the labor supply effect of Finnish mothers in 2004 is much larger than the ones of US mothers in 1980 and 1990. What might explain this large difference in maternal employment between these two countries? The most likely explanation would be the policy of Home Care Allowance in Finland and other institutional reasons in the labor market, which will be discussed more in detail in Chapter 5.

The Wald estimates calculated using the effect of Same sex on Number of children put these effects in per child terms. In per child terms (column 3), the Wald estimates are 0.70 as large as the estimates produced with More than 2 children.

The last three columns in Table 5 show the estimates of Twins-2 instrument. All Wald estimates based on Twins-2 are much smaller in magnitude than the ones based on Same sex. Moreover, either one is statistically significant. However, since the randomness of twinning is violated due to infertility treatments the main focus in this study will be in the results provided by the same sex instrument.

4.3 **Two-Stage Least Squares Results**

Wald estimates provide a simple illustration of how the instruments indentify the causal effect of children on various labor market outcomes. With two stage least squares (2SLS) and ordinary least square techniques I can relate labor market outcomes to fertility and a variety of exogenous variables.

The most relevant advantages of 2SLS (described in AE) in regard to this study are the following. First, controlling for exogenous variables improves the efficiency of the estimation leading to more precise estimates if the treatment effects are roughly constant across groups. Second, 2SLS estimation allows to control for any secular additive effects of the sex of the child. Because there is a slightly higher probability of birth of boys, the Same sex instrument is positively correlated with the sex of each child. The following examples illustrate why this might be a concern. For example, the sex of a child can affect labor supply decisions of parents if (i) boys affect the father's commitment to the family in a different way than girls (see e.g. Morgan et al. 1988), (ii) the time or money parents devote to rearing depends on the sex of a child (see e.g. Butcher and Case, 1994; Thomas, 1994), (iii) the likelihood that boys have more disabilities is correlated with parents' use of time (see e.g. Angrist and Lavy, 1996). Adding s_1 , an indicator for whether the first child was a boy, and s_2 , an indicator for whether the second child was a boy, as regressors reduces the potential of omitted variable bias from the above reasons.

The model linking labor market outcomes of mothers and fathers to the endogenous More than 2 children, x_i, variable and exogenous variables including additive effects for the sex of each child is the following:

$$\overline{y_i} = \propto_0' w_i + \propto_1 s_{1i} + \propto_2 s_{2i} + \beta x_i + \varepsilon_i$$

where w_i is a vector of demographic variables, Age and Age at first birth, and s_{1i} and s_{2i} are indicators for the sex of the first two children of mother i. In the just idenfied model, where Same sex is the only instrument, the first stage relating More than 2 children to sex composition is the following:

$$x_i = \pi_0' w_1 + \pi_1 s_{1i} + \pi_2 s_{2i} + \gamma * (Same\ sex) + \eta_i$$

where x is the first-stage effect of the instrument. The alternative specification uses the two components of Same sex – Two boys and Two girls – as instruments for More than 2 children. Either s_{1i} or s_{2i} must be dropped from the list of exogenous variables because s_{1i}, s_{2i} and (1-s_{1i})(1-s_{1i}) are linearly dependent. I choose to drop s_{2i}. The model becomes the following:

$$y_i = \pi_0' w_i + \propto_1 s_{1i} + \beta_1 x_i + \varepsilon_i$$

The first stage relationship between x_i and sex mix is:

$$x_i = \pi_0' w_1 + \pi_1 s_{1i} + \pi_2 s_{2i} + \gamma_0 (Two\ boys) + \gamma_1 (Two\ girls) + \eta_i$$

where Two boys = $s_{1i}s_{2i}$ and Two girls=(1-s_{1i})(1-s_{1i}).

The first-stage results are reported in Table 6. The instrument Same Sex has a statistically significant impact on the More than two children variable. The first two children of the same sex increase the probability of having more than two children by 4.3 percentage points. The point estimate is larger for girls (0.0459) than for boys (0.0391) – although the estimates do not differ in statistical sense. Moreover, there is no statistically significant relationship between having a boy as firstborn and childbearing at higher parities (More than two children variable).

In Table 7 I present both the OLS and 2SLS estimates. The association between the More than 2 children variable and mothers' labor supply is negative as expected. Having more than two children is associated with a 26 percentage points decrease in the employment probability of all mothers. For cohabiting mothers, the point estimate is slightly larger, -0.280, and of the same magnitude for married women. For single women, the association between employment and increase in family size is not as large, the point estimate being -0.218.

Turning into 2SLS estimates, the instrumental variable estimate is of the same size as the OLS estimate in the All women sample. Instead, both for cohabiting and married mothers the 2SLS estimates are even larger than the OLS estimates. Another child reduces maternal employment by 36 to 40 percentage points. This is in contrast to the results of AE, who find that the OLS estimates exaggerate the causal effect of children on employment. It is not clear why the bias in OLS estimates in Finland is of opposite sign than in the US. For some reason, Finnish cohabiting and married mothers whose fertility is affected by the sex of their first two children have a stronger labor supply response than would be implied by the simple OLS regressions. One explanation could be the differences in labor market institutions between these two countries: a job-protected maternity leave up to three years per child perhaps the most important one. Another reason could be that the compliers – women whose fertility is affected by the sexes of their first two children – are different in a way which affects their labor supply decisions. It is also worth remembering, that the US results are from 1980 and

1990 whereas I have analysed data from 2004. The society in both countries must have developed in since 1980s and 1990s. It would be interesting to see if the labor supply effects of US women would be different today. The 2SLS estimate in the single women sample is statistically insignificant.

There is a positive association between More than 2 children and Out of labor force status in the whole sample and in all subsamples. Again, in the Single women sample the 2SLS estimate is statistically insignificant. In the Couples sample, mothers of three children are 32 percentage points more likely to be outside the labor force compared to mothers of two children only. For married mothers the estimated impact is even higher: they have a 46 percentage points higher probability to be outside the labor force compared to mothers of two children.

The negative association between family size and female earnings is quite sizeable, 6 000 euros. This is 50% of the mean annual labor earnings reported in Table 2. Once the More than 2 children is instrumented by the Same Sex in All women sample, there is no statistically significant impact on earnings. Interestingly, for Cohabiting and Married women, the negative effect remains in the 2SLS estimations. The 2SLS estimate is around 6 000 euros and statistically significant for women in both the Couples sample and Married sample. When taking into consideration the negative impact on labor supply the magnitude of this effect is not surprising. Typical for a Nordic welfare state, the negative earnings loss due to children is compensated (at least partly) by the state which explains why the 2SLS estimate of Taxable income is insignificant. The annual taxable income was a measure of income that is subject to state taxation. It includes (i) wage income, (ii) entrepreneurial income and (iii) other income subject to state taxation – such as other earned income (e.g. dividends, which are taxed as earned income), (iv) pension income, (v) social security transfers subject to state taxation – such as unemployment benefit, sickness benefit, maternity and paternity allowance, child home care allowance, study grant and adult education subsidy and other social security benefits. In addition, for Family income (joint annual taxable income of both spouses) there is no impact.

Surprisingly, for spouses of cohabiting and married women the OLS estimates between the More than 2 children and Worked for pay variables are also negative, although the magnitude is not large. However, according to the 2SLS results in Table 8, fathers do not adjust their labor supply once family size increases, at least not in the extensive margin (whether to work or not). It would be interesting to see if there is a labor supply response of fathers on the intensive margin (how many hours they work) and if so, whether the adjustment is positive or negative. Unfortunately, the data do not report hours worked. An indirect way to look at this is to estimate the effect of family size on the earnings of fathers. However, there is no evidence of a positive (or negative) effect of family size on men's earnings or income.

Table 6. OLS Estimates of More than 2 Children

Independent variable:	**All Women**			**Single Women**			**Couples**			**Married Women**		
Boy 1st		-0.0000			-0.0102	-0.0167		0.0025	0.0075		0.0012	0.0068
		(0.0051)			(0.0130)	(0.0181)		(0.0055)	(0.0078)		(0.0064)	(0.0090)
Boy 2nd		-0.0034			0.0065			-0.0050			-0.0056	
		(0.0051)			(0.0130)			(0.0055)			(0.0064)	
Same sex	0.0417***	0.0425***		0.0377***	0.0412***		0.0422***	0.0416***		0.0464***	0.0471***	
	(0.0056)	(0.0051)		(0.0140)	(0.0130)		(0.0061)	(0.0055)		(0.0071)	(0.0064)	
Two boys			0.0391***			0.0476***			0.0366***			0.0416***
			(0.0071)			(0.0180)			(0.0077)			(0.0089)
Two girls			0.0459***			0.0347*			0.0466***			0.0527***
			(0.0074)			(0.0188)			(0.0079)			(0.0092)
With other covariates	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes
R^2	0.0021	0.1659	0.1659	0.0018	0.1365	0.1365	0.0021	0.1804	0.1804	0.0025	0.1918	0.1918
Obs.	**26 534**	**26 534**	**26 534**	**4 094**	**4 094**	**4 094**	**22 440**	**22 440**	**22 440**	**17 187**	**17 187**	**17 187**

Notes: Other covariates in the models are indicators for Age and Age at first birth. The variable Boy 2nd is excluded from columns (3) and (6). Standard errors are reported in parantheses. Significance level: *** 1 %, ** 5 %, * 10 %

Table 7. OLS and 2SLS Estimates of Labor-Supply Models

	All women		Single women		Co-habiting women		Married women	
Estimation method	**OLS**	**2SLS**	**OLS**	**2SLS**	**OLS**	**2SLS**	**OLS**	**2SLS**
Instrument for More than 2 children		**Same sex**		**Same sex**		**Same sex**		**Same sex**
Dependent variable:								
Worked for pay	-0.262***	-0.255**	-0.218***	0.363	-0.281***	-0.390***	-0.290***	-0.356**
	(0.007)	(0.130)	(0.018)	(0.401)	(0.007)	(0.143)	(0.008)	(0.142)
Out of labor force	0.265***	0.243**	0.187***	-0.186	0.280***	0.323**	0.287***	0.461***
	(0.006)	(0.116)	(0.014)	(0.311)	(0.006)	(0.130)	(0.007)	(0.133)
Labor income	-6 084.1***	-2 716.4	-4 521.5***	12 497.3	-6 661.4***	-5 997.2*	-6 971.7***	-5 949.2*
	(155.2)	(23 080.5)	(376.6)	(9 344.6)	(170.1)	(3 400.4)	(196.6)	(3 510.0)
Taxanble income	-4 092.5***	-1 795.6	-3 022.0***	9 463.6	-4 513.4***	-4 253.9	-4 747.0***	-4 747.0
	(132.4)	(2 620.4)	(311.4)	(7 447.7)	(146.1)	(2 919.8)	(171.2)	(3 054.2)
ln(Family income)[1]			-0.239***	0.734	-0.116***	-0.066	-0.114***	-0.016
			(0.024)	(0.601)	(0.007)	(0.139)	(0.008)	(0.138)
Obs.	**26 534**	**26 534**	**4 094**	**4 094**	**22 440**	**22 440**	**17 187**	**17 187**

Notes: The Table reports estimates of the coefficient on the More than 2 children variable in equation (4) in the text. Other covariates in the models are indicators for Age and Age at first birth of the mother, plus indicators for Boy 1st and Boy 2nd. Standard errors are reported in parantheses. Variable Income includes labor income, entrepreunial income and social transfers.[1] Number of observations is 4 017 in Single women -sample, 22 425 in Couples-sample and 17 172 in Married-sample. Significance level: *** 1 %, ** 5 %, * 10 %

Table 8. OLS and 2SLS Estimates for Fathers

	Spouses of cohabiting women		Husbands	
Estimation method	**OLS**	**2SLS**	**OLS**	**2SLS**
Instrument for More than 2 children		**Same sex**		**Same sex**
Dependent variable:				
Worked for pay	-0.013***	0.108	-0.010**	0.105
	(0.004)	(0.077)	(0.004)	(0.072)
Out of labor force	0.005***	-0.042	0.005**	-0.024
	(0.002)	(0.039)	(0.002)	(0.039)
Labor income	-487.1*	-275.6	-463.3	261.8
	(271.3)	(5 421.1)	(315.4)	(5 628.8)
Taxanble income	-223.8	30.9	-39.9	3 319.9
	(254.8)	(5 091.0)	(296.5)	(5 310.6)
Obs.	**22 440**	**22 440**	**17 187**	**17 187**

Notes: The Table reports estimates of the coefficient on the More than 2 children variable in equation (4) in the text. Other covariates in the models are indicators for Age and Age at first birth of the mother, plus indicators for Boy 1st and Boy 2nd. Standard errors are reported in parantheses. Variable Income includes labor income, entrepreunial income and social transfers.[1]Number of observations is 4 017 in Single women -sample, 22 425 in Couples-sample and 17 172 in Married-sample. Significance level: *** 1 %, ** 5 %, * 10 %

4.4 **Labor Supply Effects by Family Type**

In order to examine whether the effect of children on labor supply differs by family status I present the heterogenous labor supply responses by the spouse's earnings or woman's education in Table 9. In Panel A, the estimates of the first column show that the effect of Same Sex on fertility is small and insignificant for those women whose spouse has earnings in the bottom third of the earnings distribution.

The negative association between family size and employment status of women increase with spouse's earnings. The 2SLS estimates, however, are statistically different from zero only for women whose spouses' earnings belong to the middle and top third of the earnings distribution. The OLS estimates of Outside labor force also indicate that a high-wage spouse increases the probability of a woman to be outside labor force. Once family size is instrumented, another child increases the probability to be outside labor force by 42 percentage points for mothers whose spouse has earnings in the top third of the earnings distribution.

Table 9. Heterogenous Labor Supply Responses: 2SLS Estimates for Couples

			Worked for pay			Outside labor force	
	More than 2 children First stage	**Mean of dependent variable**	**OLS**	**2SLS**	**Mean of dependent variable**	**OLS**	**2SLS**
			A. Results for women by spouse's earnings distribution				
Bottom third	0.019	0.589	-0.243***	-0.649	0.289	0.262***	0.330
	(0.012)		(0.016)	(0.603)		(0.014)	(0.637)
Middle third	0.048***	0.658	-0.273***	-0.324*	0.267	0.272***	0.231
	(0.009)		(0.011)	(0.197)		(0.010)	(0.179)
Top third	0.048***	0.689	-0.304***	-0.388**	0.265	0.297***	0.417**
	(0.009)		(0.011)	(0.190)		(0.011)	(0.179)
			B. Results for women by woman's education				
Primary	0.054***	0.508	-0.258***	-0.452	0.336	0.262***	0.166
	(0.016)		(0.019)	(0.325)		(0.017)	(0.293)
Secondary	0.038***	0.629	-0.275***	-0.425*	0.287	0.282***	0.394*
	(0.009)		(0.010)	(0.234)		(0.009)	(0.212)
Tertiary	0.042***	0.732	-0.285***	-0.354*	0.232	0.279***	0.343*
	(0.008)		(0.011)	(0.205)		(0.010)	(0.194)
			C. Results for women by woman's education for women whose spouse's earnings are in middle third				
Primary	0.050**	0.538	-0.285***	-0.412	0.326	0.270***	0.062
	(0.025)		(0.028)	(0.515)		(0.025)	(0.477)
Secondary	0.057***	0.631	-0.269***	-0.328	0.283	0.280***	0.380*
	(0.013)		(0.016)	(0.234)		(0.014)	(0.212)
Tertiary	0.035**	0.751	-0.251***	-0.358	0.215	0.244***	0.041
	(0.014)		(0.019)	(0.427)		(0.018)	(0.409)
			D. Results for spouses by woman's education				
Primary	0.054***	0.860	-0.032**	0.272	0.022	0.010*	0.083
	(0.016)		(0.014)	(0.252)		(0.006)	(0.102)
Secondary	0.038***	0.938	-0.007	0.030	0.015	0.001	-0.065
	(0.009)		(0.006)	(0.126)		(0.003)	(0.065)
Tertiary	0.042***	0.969	-0.005	0.108	0.012	0.008***	-0.068
	(0.008)		(0.005)	(0.090)		(0.003)	(0.056)

Notes: The table reports estimates of the coefficients on More than 2 children in equation (4) in the text. The equation is estimated seperately by woman'sschooling and spouse's earnings. Other covariates in the models are indicators for Age and Age at first birth of the woman, plus indicators for Boy 1st and Boy 2nd. Sample includes cohabiting couples. Standard errors are reported in parantheses. Significance level: *** 1 %, ** 5 %, * 10 %

In Panel B, the labor supply responses are studied by the education level of the mother. The reason for why education is used instead of wages is that naturally the wages of non-working women are not observed. Education, however, serves as a good proxy for the earnings potential. The relationship between Same Sex and fertility is declining by woman's education. The OLS estimates of Worked for pay for women drop (in absolute terms) by their education. Interestingly, there is a large and statistically significant labor supply response of women with more than two children for those with a secondary or a higher degree. The association between More than 2 children and Outside labor force is highest for those women who have a secondary degree. Again, the 2SLS estimates are even higher than the OLS estimates and statistically significant for more educated women. For women with only primary education, the 2SLS estimates show no impact of family size on employment probability or on likelihood to be outside labor force. Panel C investigates the labor supply response of women by their schooling for women, whose spouse's earnings are in middle third of the earnings distribution. Women with a secondary degree and medium-earning spouses are almost 40 percentage points more likely to be outside labor force.

The last panel, Panel D, presents the labor supply responses of men by their wives' schooling. There is a negative association between the family size and employment of spouses of the least educated women. The association between family size and outside-labor-force status is positive for spouses of women with primary of higher education. However, 2SLS estimates do not indicate that there exist any causal relationship between children and fathers' labor supply.

4.5 **Labor Supply Response of Mothers after the Eligibility for Child Home Care Allowance Expires**

Previously, I have shown that cohabiting and married mothers adjust their labor supply dramatically due to an increase in family size. To see whether this negative effect of one more child on maternal employment is permanent I estimate the employment outcomes for women whose youngest child is older than three years old. The job-protected maternity leave by the support of home care allowance can be extended until the youngest child turns three. Moreover a parent, whose child of under three does not use public day care, is eligible for child home care allowance even if she does not have a permanent employment contract. Table 10 shows that once the youngest child turns three, cohabiting and married mothers are still less likely to be employed or more likely to be outside labor force. Since those on a job-protected leave should be employed again, this result implies that especially those mothers who stay at home without a job in which to return, have difficulties in finding employment. These are mothers who either have no previous work history or mothers whose temporary employment contract has ended before or during the maternity leave. In fact, according to Hämäläinen (2005) 40% of Finnish mothers receiving Home Care Allowance have no work to return to (Hämäläinen, 2005).

Table 10. Labor Supply Response of Mothers: Youngest Child is Older than Three

	All women		**Single women**		**Co-habiting women**		**Married women**	
Estimation method	**OLS**	**2SLS**	**OLS**	**2SLS**	**OLS**	**2SLS**	**OLS**	**2SLS**
Instrument for More than 2 children		**Same sex**		**Same sex**		**Same sex**		**Same sex**
Dependent variable:								
Worked for pay	-0.076***	-0.148	-0.129***	0.288	-0.072***	-0.387*	-0.069***	-0.031
	(0.008)	(0.173)	(0.022)	(0.322)	(0.009)	(0.228)	(0.009)	(0.239)
Out of labor force	0.018***	0.048	0.023**	-0.095	0.018***	0.126	0.018***	0.213*
	(0.003)	(0.070)	(0.009)	(0.127)	(0.004)	(0.093)	(0.004)	(0.122)
Labor income	-3 032.1***	2 138.5	-3 080.6***	14 326.1*	-3 296.6***	-4 299.3	-3 394.7***	-2 047.8
	(238.7)	(5 050.2)	(520.2)	(8 643.1)	(266.1)	(6 576.3)	(307.1)	(7 847.5)
Taxanble income	-2 353.8***	-830.0	-2 180.5***	10 912.6	-2 604.8***	-7 012.5	-2 731.4***	-9 061.3
	(205.2)	(4 266.3)	(428.6)	(6 934.8)	(232.2)	(5 846.5)	(273.5)	(7 246.9)
ln(Family income)[1]			-0.159***	0.505	-0.087***	-0.392	-0.083***	-0.390
			(0.032)	(0.464)	(0.011)	(0.283)	(0.012)	(0.323)
Obs.	**11 567**	**11 567**	**2 478**	**2 478**	**9 089**	**9 089**	**6 844**	**6 844**

Notes: The Table reports estimates of the coefficient on the More than 2 children variable in equation (4) in the text. Other covariates in the models are indicators for Age and Age at first birth of the mother, plus indicators for Boy 1st and Boy 2nd. Standard errors are reported in parantheses. Variable Income includes labor income, entrepreunial income and social transfers.[1]Number of observations is 4 017 in Single women -sample, 22 425 in Couples-sample and 17 172 in Married-sample. Significance level: *** 1 %, ** 5 %, * 10 %

The results for fathers are presented in Table 11. Since no labor supply effects of fathers have been found so far, one should not expect to find them later on either (unless one would expect fathers to adjust their labor supply once children are older). The results show that there is no causal impact of one more child on fathers' labor supply in the long run.

Table 11. Labor Supply Response of Fathers: Youngest Child is Older than Three

	Spouses of cohabiting women		**Husbands**	
Estimation method	**OLS**	**2SLS**	**OLS**	**2SLS**
Instrument for More than 2 children		**Same sex**		**Same sex**
Dependent variable:				
Worked for pay	-0.013**	-0.071	-0.012*	0.000
	(0.006)	(0.153)	(0.006)	(0.165)
Out of labor force	0.000	-0.049	0.000	-0.039
	(0.003)	(0.068)	(0.003)	(0.077)
Labor income	-1233.7***	-4 027.5	-1 303.2**	-7 688.2
	(437.7)	(10 831.0)	(514.4)	(13 271.4))
Taxanble income	-818.5**	-7 631.63	-688.1	7 443.1
	(410.3)	(10 285.0)	(479.2)	(12 402.2)
Obs.	**9 089**	**9 089**	**6 844**	**6 844**

Notes: The Table reports estimates of the coefficient on the More than 2 children variable in equation (4) in the text. Other covariates in the models are indicators for Age and Age at first birth of the mother, plus indicators for Boy 1st and Boy 2nd. Standard errors are reported in parantheses. Variable Income includes labor income, entrepreunial income and social transfers.[1]Number of observations is 4 017 in Single women -sample, 22 425 in Couples-sample and 17 172 in Married-sample. Significance level: *** 1 %, ** 5 %, * 10 %

4.6 **Comparison with Estimates Using Multiple Births**

A twin second birth can be used similarly as Same Sex to identify the exogenous change from two to three children. The 2SLS estimates using Same Sex and Twins-2 are compared in Table 12. The estimates provided by Twins-2 are significantly smaller in absolute value than the ones provides by the Same Sex instrument. In addition, they are quite unprecisely estimated. As noted earlier, the randomness of twin births has been violated due to the availability of infertility treatments, which has increased the incidence of multiple births since the late 1980s. Therefore, the results based on the Twins-2 instrument are discussed only briefly.

Table 12. Comparison of 2SLS Estimates Using SAME SEX and TWINS-2 Instruments

	All women		**Single women**		**Cohabiting women**		**Spouses**	
Instrument for More than 2 children	**Same sex**	**Twins-2**	**Same sex**	**Twins-2**	**Same sex**	**Twins-2**	**Same sex**	**Twins-2**
Dependent variable:								
Worked for pay	-0.289**	0.020	0.369	0.074	-0.452***	0.017	0.121	-0.049**
	(0.137)	(0.036)	(0.381)	(0.097)	(0.157)	(0.039)	(0.086)	(0.020)
Out of labor force	0.282**	-0.025	-0.209	-0.1043	0.386***	-0.012	-0.046	0.003
	(0.122)	(0.033)	(0.296)	(0.079)	(0.142)	(0.035)	(0.043)	(0.010)
Labor income	-3 162.5	-641.3	12 256.4	-454.9	-6 956.5*	-524.1	-106.9	-2 478.1*
	(3 277.8)	(842.2)	(8 812.8)	(2 042.9)	(3 740.5)	(916.45)	(6 002.8)	(1 423.8)
Taxanble income	-2 009.7	68.7	9 227.3	-651.3	-4 782.8	281.5	-127.4	-2 651.6**
	(2 797.0)	(716.2)	(7 016.8)	(1 679.5)	(3 224.8)	(784.0)	(5 637.6)	(1 338.1)
ln(Family income)[1]	0.263	-0.123**	0.714	-0.124	-0.071	-0.084**		
	(0.205)	(0.051)	(0.565)	(0.129)	(0.154)	(0.037)		

Notes: The table reports 2SLS estimates of the coefficients on More than 2 children in equation (4) in the text using Same sex and Twins-2 as instruments. Other covariates in the models are indicators for Age of the woman, ages of the first two children, and Boy 1st and Boy 2nd. [1]26 442 obs. in All women -sample, 4 017 in Single women -sample, and 22 425 obs. in Couples-sample. Variables Family income and Spouse income include both labor income, entrepreunial income and social income transfers. Standard errors are reported in parantheses. Significance level: *** 1 %, ** 5 %, * 10 %

4.7 **Sensitivity Analysis**

The outcome of main interest Worked for pay is defined thus: a person has been working for pay if the share of child related allowances (CRA) is less than 50% of her total taxable annual income. To see whether the results are sensitive to this particular restriction, I change this limit to 40% and 30%. The results are shown in Table 13. In Table 13 I also show the results using the classification of the main economic activity from Statistics Finland and positive annual labor earnings.

The results are not very sensitive to the criteria of a share of CRA from the total annual income when defining the Worked for pay variable. However, the point estimates are remarkably smaller and even have a different sign when the Statistics Finland's classification of main economic activity and positive annual labor income are used in defining the Worked for pay status. This is because mothers who are on a job-protected maternity leave have a valid pension insurance (and have at least some labor earnings during the year) and hence are classified as employed.

Table 13. Robustness of the results

	All women				**Single women**				**Cohabiting women**				**Married women**			
Definition of the *Worked for pay* variable:	(1) Share of child related allowances of total annual income:			(2) Main economic activity classified as employed and annual labor income more than	(1)			(2)	(1)			(2)	(1)			(2)
2SLS estimates:	<50%	<40%	<30%	zero	<50%	<40%	<30%		<50%	<40%	<30%		<50%	<40%	<30%	
Worked for pay	-0.255**	-0.316**	-0.301**	0.048	0.363	0.257	0.166	0.697	-0.390***	-0.444***	-0.409***	0.209	-0.356**	-0.398***	-0.357**	-0.198
	(0.130)	(0.132)	(0.133)	(0.134)	(0.401)	(0.390)	(0.381)	(0.455)	(0.143)	(0.146)	(0.147)	(0.145)	(0.142)	(0.145)	(0.146)	(0.144)
Out of labor force	0.243**	0.330***	0.359***	0.123	-0.186	-0.076	-0.032	0.485	0.323**	0.412***	0.441***	0.240*	0.461***	0.522***	0.487***	0.337***
	(0.116)	(0.123)	(0.128)	(0.118)	(0.311)	(0.330)	(0.347)	(0.377)	(0.130)	(0.137)	(0.142)	(0.129)	(0.133)	(0.140)	(0.143)	(0.131)

Notes: The Table reports estimates of the coefficient on the More than 2 children variable in equation (4) in the text. Other covariates in the models are indicators for Age and Age at first birth of the mother, plus indicators for Boy 1st and Boy 2nd.Standard errors are reported in parantheses. Significance level: *** 1 %, ** 5 %, * 10 %

5. Conclusions

The well-known study of Angrist and Evans (1998) using parental preference for sibling sex mix finds that children have a negative causal impact of 12 percentage points on maternal employment in the US in 1980. The evidence of their study should, however, be interpreted in the context of labor market institutions and family policies of the US three decades ago. In fact, Iacovou (2001) has found that in the UK the third child does not affect maternal employment once this increase in family size is instrumented with the sexes of the first two children. She explains this contradiction between the US and the UK by the differences in the labor market conditions. Results based on the families preference to have both boys and girls from Sweden are similar to the ones found in the US: a third birth decreases the likelihood of mothers' labor force participation by around 10 percentage points (Hirvonen, 2010). Interestingly, the impact of an additional child on maternal labor supply does not change between 1980 and 1995 – despite the rapid expansion of family policies in Sweden over this time period. In this paper, I provide evidence from another Nordic welfare state with a strong preference of home care of small children promoted by the Home Care Policy: the right to take leave from work up to three years to look after a child and receive financial compensation.

Using the Employment Statistics Database for 2004 combined with birth registers, and applying the IV-estimation techniques of Angrist and Evans (1998), I identify the effect of fertility on maternal employment in Finland – a high-fertility/high female employment economy. I find that having more than two children is associated with a 26 percentage points decrease in the employment probability of mothers. This effect remains when I instrument the family size with the sexes of the first two children.

Moreover, an increase in family size has a heterogenous labor supply response by marital status and spouse's earnings and by mother's education. Cohabiting and married women adjust their labor supply dramatically after the third child: the likelihood of employment decreases by almost 40 percentage points. Especially pronounced this effect is for women with secondary education. For these women, a third child reduces the employment probability by over 40 percentage points. Also highly-educated mothers have a sizeable decrease in employment after another child: the likelihood of employment decreases by almost 35 percentage points. For single mothers there is no effect of an increase in family size on employment. Mothers whose spouse has earnings in the top third of the earnings distribution are 42 percentage points more likely to be outside labor force after another child. These results could be interpreted in the spirit of the traditional theory of household time allocation (Becker, 1960, 1981). Single mothers and mothers with primary education are often credit constrained and have no choice other than market work. In families, where the spouse's earnings belong to the

middle or top third of the earnings distribution, mothers are able to take time off from work to look after their children. Reasons related to a child's development in early childhood might also play a role in maternal labor supply decisions – especially for more educated mothers.

The labor supply responses of Finnish mothers are remarkably larger than the ones found in the US, in the UK and in Sweden. There are several possible reasons for larger effects in Finland. One explanation could be the differences in labor market institutions between these countries and Finland: mainly a job-protected maternity leave up to three years per child. Another reason could be that the compliers – women whose fertility is affected by the sexes of their first two children – are different in a way which affects their labor supply decisions. It is also worth noting that the US results are from 1980 and 1990, the UK results from 1991 and the Swedish results from 1980 and 1995, whereas I have analysed data from 2004.

These results are particularly interesting in the context of Nordic type gender-equal family policies and equal labor market opportunities for mothers and fathers. The results indicate that Finland has not succeeded in promoting equal parenting: there is no effect of an increase in family size on fathers' labor supply. On the contrary, the policy of Child Home Care – a family policy that is unique to Finland and where a parent is given a relatively generous allowance for taking care of her children at home and a right to return to one's employment if she has a permanent employment contract – has pushed mothers outside labor force. Cohabiting and married mothers are still less likely to be employed or more likely to be outside labor force once the youngest child turns three. For those women the use of Child Home Care Allowance might have been an alternative for unemployment (Hämäläinen, 2005). In addition, Finnish labor markets can be described as *in or out* -markets: whether you work total hours or you do not work at all. In other words, part-time jobs, which could be preferred by mothers of small children, are seldom available. The results are in line with Kosonen's (2011) evidence from the effect of Finnish Child Home Care subsidies on maternal labor supply. He finds a large negative effect on the labor force participation: monthly increase of 100 euros in the supplement reduces the maternal labor supply by 3%.

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Essay 4:
Baby and Pay: The Family Gap in Finland

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Baby and Pay: The Family Gap in Finland

Abstract

The effect of career interruptions due to parental leave is estimated based on a longitudinal data set covering the years 1995–2002. The estimated model controls for hours worked. There appears to be a significant negative relation between career interruptions due to childbirth and subsequent wages for women in Finland. The effect for men is quite the opposite. The estimation results imply that human capital depreciation could be one explanation when explaining the family gap in wages.

JEL: J65, J13, J12

Keywords: children, parental leave, career interruptions, family gap, gender gap

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1. Introduction

The gender wage gap has been in the centre of wage inequality research in Finland, whereas the family gap, the differences in wages between mothers and childless women, has not. However, one reason to gender wage gap may be the long career interruptions of women because of having children (Datta Gupta and Smith, 2000). Women suffer from the loss of accumulation of work experience and job tenure during maternity and parental leave periods, which may affect their wage and career profiles.

Although family policies, such as job-protected maternity leave and childcare, in general are considered to decrease the gender wage gap by allowing mothers to maintain continuity of employment and good job matches, especially maternity leave may in fact have the opposite effect on the gender gap (Waldfogel, 1998). In other words, the maternity leave clearly does help to diminish the gender gap by enabling women to return to employment, but there are many reasons why these benefits may also weaken the labor market position of women.

First, family leaves are used mainly by women causing women to accumulate less work experience compared to men. Second, job-protected maternity leave may induce women to spend more time out of work due to childbirth than otherwise (Waldfogel, 1998). Third, maternity/parental leave imposes costs (direct and indirect) on employers, and in theory these costs would be passed along to the affected employees in the form of lower wages or lower employment (Summers, 1989).

Several empirical studies, for instance in the US and in the UK, have found that the number of children has a negative effect on women's wages, but no or even a positive effect on the wages of men (Korenman and Neumark, 1991, 1992; Waldfogel, 1997, 1998; see for Finnish results Kellokumpu, 2006). The negative effect of children on mothers' wages may reflect reduced work effort or previous periods out of labor market due to childbirth and child-rearing. Career interruptions due to childbirth and child-rearing (or some other reason for that matter) are found to reduce the human capital and earnings capacity of mothers (e.g. Ruhm, 1998). However, the results are not unambiguous. Empirical evidence from Sweden (Albrecht et al., 1999) and Denmark (Naur and Smith, 1997; Datta Gupta and Smith, 2000) finds that there is no wage penalty for mothers who enter into maternity leave. Different results in different countries probably reflect differences in institutional characteristics of the labor markets: Scandinavian countries have a long tradition of working mothers and thus universal maternity leave schemes and children's day care.

In this paper, I analyse the effect of career interruptions due to parental leave both on mothers' and on fathers' subsequent wages. Having children causes

different labor market outcomes, especially for women. Most women withdraw themselves completely from labor markets in order to care for the child. However, the purpose of this study is to examine the effect of career interruptions due to childbirth for those women who remain in the labor force and return to work after the formal maternity leave. The data set is a unique panel data set covering almost the entire private sector in Finland during the years 1995–2002. Thus, it is possible to control for unobserved time constant heterogeneity among individuals in the data. Besides, the data allows me to use the accurate hourly wage along the monthly wage. By using the hourly wage I am able to control for the hours worked. When hourly wage is not used the possible differences in monthly (or yearly) earnings can be due to different number of hours worked. If it is more likely for women than men to cut down their working time when there are little children in the family, it is very important to control for hours worked.

2. Theoretical Background

According to the human capital theory, there has been several explanations why becoming a mother weakens the earnings capacity of women. (Mincer and Polachek, 1974.) First, prospective discontinuity may influence young women to choose less on-the-job training than men, especially if the cost of training is relatively high. The employer can also choose to train women less because of the expected career interruption. Second, the time off from work for childbearing and child-rearing does not accumulate work-related human capital. Furthermore, the time out of the labor market can even expose a person to human capital depreciation (skill atrophy). In case of multiple children born in a short period of time, a woman could spend several years at home or return to employment only briefly leading to even more human capital depreciation.

Becker (1985) claimed that childcare and housework responsibilities are one of the main reasons for earnings and occupational differences between men and women. He argued that married women spend less energy on market work than married men working the same number of hours. Mothers could be less productive at work than childless women or men if they are exhausted by home duties or thinking and taking care of family obligations during the working hours. Furthermore, they seek less demanding jobs for better reconciliation between work and family life duties. This self-selection into jobs that are easier to combine with family but less paid is, according to Becker, a major reason behind mothers' lower wages. However, the voluntary nature of this selection is not that clear: family-related obligations are seen to be an obstacle for women to get promotions (Goldin, 1990).

The possibility to work part-time is seen as the most obvious non-pecuniary, "family-friendly" job characteristic (Budig and England, 2001). Working part-time enables mothers (and fathers too, for that matter) better to combine family-life obligations and work. Part-time work among mothers is very typical especially in countries that have no or only poor public childcare available, such as in Germany and in the UK[1] Part-time jobs in general are often less paid also on an hourly basis. However, the family gap in pay persists even when controls for part-time and full-time work are included (Waldfogel, 1997).

An interesting interpretation about the impact of parental leave on wages was presented by Albrecht et al. (1999) when they found that taking parental leave has a serious negative effect on wages of men in Sweden but not those of women. They suggested that taking parental leave has a signalling effect: men's

[1] Although working part-time is more typical for women than men in Finland, the most common reasons for working part-time are working while studying and part-time pension, not childcare (Suomalainen lapsi, 2007).

parental leave tells about their lower commitment to their careers. Because (almost) all mothers take parental leave it is a less important signal about their degree of commitment to the employer.

The discrimination theory, on the other hand, suggests that mothers are treated differently just because they are mothers. In economic theory, discrimination is based either on taste or statistics. In the taste-based model the employer has no assumptions about mothers' lesser productivity but she simply finds working mothers unpleasant workers, which would be the reason for treating them differently (e.g. paying them less or promoting them less, etc.). Statistical discrimination suggests that mothers are paid according to their average productivity. This means that mothers who are more productive than the average mother are paid less than would be commensurate with their productivity. In the taste-based discrimination model, the average pay is less than the average productivity among mothers. Sex-based discrimination, on the other hand, is based on the probabilistic assumption that all women are potential future mothers. Sex-based discrimination creates a gender gap in pay while taste-based and statistical discrimination leads to a gap between mothers and other women (although taste-based and statistical discrimination affects the gender wage gap, too). (Budig and England, 2001.)

The family gap in wages can also simply be due to unobserved heterogeneity between those who have children and those who remain childless. Therefore, it is important to control for this possible heterogeneity in characteristics that are correlated with wages and that we cannot observe from the data (such as career orientation, motivation, work effort, etc.). However, according to Waldfogel (1997) mothers and childless women do not systematically differ from each other in ways that would affect wages.

Last, the economic theory of fertility suggests that children (and therefore career interruptions due to childbirth) could actually be an endogenous variable in the wage equations (Korenman and Neumark, 1994). The price of children is often measured by the earnings level of the mother. The higher the earnings of the mother, the higher is the forgone value of her time spent at childcare, i.e. the cost of children. Therefore an increase in the earnings of the mother increases the relative price of children and thus decreases the demand for children (substitution effect). However, the effect is not that straightforward; an increase in the earnings of the mother increases the joint income of the household, thus the family can afford to have more children (income effect). Depending on which one of these two opposite effects is the dominant one, the increase in wages could lead to an increase in family size.

3. Finnish Parental Leave and Childcare System

It is typical to all Nordic countries to have universal and rather generous benefits to mothers and families in purpose to enable women with children to participate in the labor market. Despite many common features, the Finnish family leave and childcare system is different from those of other Nordic countries. Finland has a relatively short parental leave compared to other Nordic countries and a long childcare leave, which does not exist in other countries.

The Finnish parental leave consists of maternity leave and parental leave. In total, the duration of Finnish parental leave is 263 workdays (10.5 months). The first 105 days are addressed only to the mother (maternity leave). The last 158 days (parental leave) can be used either by the mother or by the father, or the parents can divide those days. Typically it is the mother who uses the last 158 days. During these leaves parents receive maternity and parental allowances paid by the Social Insurance Institution of Finland.[2] Annual earnings up to 29 393 euros are compensated by 70%. From annual earnings above 29 393 euros the compensation percent is 45 until 45 221 euros. For the part of annual earnings above 45 221 euros 25% is compensated. In case of no previous earnings or very low annual earnings, the person is paid a flat minimum allowance. This flat minimum allowance is 15.20 euros/day and paid for 6 days per week. Maternity and parental allowances are paid regardless whether the parent works at the same time or not. However, if she works during the time she is entitled for parental allowance, she receives a flat minimum allowance instead of earnings-related allowance. If the employer continues to pay salary during the leave (or during part of the leave) allowance from these days is paid to the employer to compensate the payroll.[3]

In addition to the parental leave, fathers have the right to take paternity leave up to three weeks to spend time at home together with the mother and the newborn when the mother is on maternity leave. The paternity leave is very popular amongst Finnish men: two out of three fathers take paternity leave. Paternity leave is an exception: receiving paternity allowance requires an absence of work. The compensation scheme is the same as in the case of maternity and parental allowance. Paternity leave can be a paid leave paid by the employer as well. However, it is not known how often the employer continues to pay salary during the paternity leave.

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[2] The Social Insurance Institution of Finland pays from parenthood not only to wage earners, but also to students, unemployed persons and housemothers and fathers.

[3] In 2005 only half of the mothers whose maternity allowance was based on earnings received salary during the leave. In most cases the duration of paid maternity leave is 50–72 days.

All the children under six years are entitled to public day care. However, the public childcare is not the only choice for how to arrange the caring of children. The most distinctive feature of the Finnish system from other Nordic countries is the child home care allowance, which is received by the family if the child, who is not yet three years of age, does not use public childcare. The allowance is paid until the youngest child in the family reaches the age of three or transfers to municipal day care, or until the family chooses to receive private day care allowance instead. In other words, if the other parent stays at home to take care of the children (or uses a private provider), the government supports it financially. However, the financial compensation is relatively small compared to earnings-related maternity, paternity and parental allowances. Child home care allowance is a flat fee. Perhaps a more important feature of the home care allowance is that parents who have a permanent employment contract and who take leave from work to care for a child at home by the support of the home care allowance maintain their employment. This job-protected home care leave makes Finland a very unique country – even among the Nordic countries. Moreover, the entitlement for the job-protected leave is renewed every time when a child is born to the family.

Taking care of your own children at home is more typical in Finland than in the other Nordic countries, mostly due to this unique childcare system. From under six-years-olds only 50% used public day care in 2002, while the same figure for Sweden and Denmark was 69% and 77%, respectively (under one-year-olds are excluded) (Haataja, 2006). Mainly it is the mother who stays at home; only few percent of home care allowance receivers are men. Although parents may take care of under three-year-old children and still maintain their work, staying at home may not be that voluntary: for 40% of these mothers it is an alternative to unemployment (Hämäläinen, 2005).

4. Data

The data sets employed in this study were obtained from a variety of sources. The master data used in this study is a Finnish Longitudinal Employer-Employee Data (FLEED) provided by Statistics Finland. The data links employees to their employer at business and company level. Thus, the FLEED has crucial information about the characteristics of both the employee and her employer considering the wage setting. There are several variables concerning employees, such as their age, sex, marital status, presence of children and the age of the children, education, occupational status, months worked in a year, annual earnings, time spend out of the labor force due to unemployment, military service, study or for some other reasons (parental leave, etc.). Variables describing employers are, among other things, the industry in which the firm practises, the age of the firm, the size of the firm, the share of female workers in the place of business/firm, the net sales per employee and the total wage bill. This kind of data allows researchers to explain wages not only by the characteristics of the employee, but by the characteristics of the firm in which the employee is working. It is obvious that wages differ not only because individuals are different but because firms are too.

Concerning this study, essential information needed is not just the presence and the age of children in the family, but the actual incident of family leave. Therefore, information about parental leave from Social Insurance Institution of Finland has been combined to FLEED data base. This information tells if the observed person has received maternity, paternity or parental allowance during the year and for how many days. It should be recognised that this kind of data is very seldom available for researchers. In addition, registered data about person's hourly earnings provided by the Confederation of Finnish Industries has been linked to this formed data set.[4]

The data set is a representative sample of the Finnish private sector. The data set includes employees aged 16–46 who have been working in the private sector at least once during the years 1995–2002. The formed data set is very unique in many ways. First of all, it is a data set that combines the characteristics of employees to the characteristics of their employers. Second, it has the information about the actual usage of maternity, paternity or parental leave and the duration of those leaves. Last, but not least important, the data includes the actual hourly wage paid to the employee. The possible differences in monthly (or yearly) earnings can be due to different number of hours worked. If it is more

[4] The fact that the hourly earnings are available only for those individuals whose employers belong to the Confederation of Finnish Industries makes my sample not completely representative sample of Finnish Private Sector.

likely for women than men to cut down their working time when there are little children in the family – or for fathers to work overtime – it is very important to control for hours worked. In fact, according to Statistics Finland, fathers do work longer hours than their childless counterparts (Suomalainen lapsi, 2007). It is interesting to see, whether this different working pattern between fathers and mothers explains the wage effects of having children.

The sample selected to my study consists of women and men aged 20–39 who were still childless in the year 1995. I consider this age-restriction to be appropriate for two reasons. First, individuals under 20 years of age have relative low labor force participation rates and weak labor force attachment so they have not gained that much working experience. If these individuals were included to estimation it could bias the results. Second, although age 39 could seem to be quite high for women to give their first birth, the first birth givers in Finland are on average 28 of age (and the male is usually few years older than his partner).

The sample is balanced so that each individual is observed during all eight years of observation. At the end of the observation period individuals are 27–46 years old. All the selected individuals are childless for the first two years of the observation period. I divide the sample into two groups: to those who remain childless and to those who have children. In this way I am able to analyze what kind of effect (if any) the parental leave has on an individual's subsequent earnings when there is no previous history of taking parental leave. The total sample size is 14 343 individuals of whom 4 713 are women and 9 630 are men. The sample is restricted so that all the individuals are employed in the beginning of the observation period, meaning years 1995 and 1996, and have the hourly earnings observation, and the same should hold for years 2001 and 2002.[5] In addition, the observed individuals cannot receive either Parental Allowance or Home Care Allowance in 2001 and 2002. This restriction is made in purpose of to exclude those individuals who take care of their children at home by the protection of childcare leave part of the year. From 4 713 women 545 have at least one child during the years 1997–2000 and 4 168 remain childless. For men the same numbers are 1 550 and 8 080, respectively. Table 1 reports the means and standard deviations of variables age, education (measured in the year 1996) and the total sum of parental leave (reported in months) between the years 1997–2000 separately for each gender and for those who have children and for those who remain childless. Future mothers are some what younger than other women. The same holds for future fathers and other men. Surprisingly, future mothers seem to be more educated than other women, as are future fathers, too, compared to other men. The length of the parental leave is for women

[5] The employment status is measured in the last week of the year. This means that the person may have been out of employment (e.g. on childcare leave) at some point during the year.

significantly longer than for men: women on average spend 12 months on leave while men are on leave less than one month.

Table 1. Means and Standard Deviations of Variables Age, Education and Length of Parental Leave by Gender and Future Family-Status in 1996

	Females				**Males**			
	Mothers-to-Be		Other Women		Fathers-to-Be		Other Men	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Age	29.58	4.278	31.74	5.288	29.93	4.297	31.52	5.236
Education:								
Primary	0.101	0.302	0.141	0.348	0.105	0.307	0.142	5.236
Secondary	0.361	0.481	0.406	0.491	0.535	0.499	0.581	0.349
Lowest Level Tertiary	0.471	0.493	0.341	0.474	0.176	0.381	0.141	0.494
Lower-Degree Tertiary	0.050	0.217	0.050	0.218	0.103	0.304	0.076	0.349
Higher-Degree Tertiary	0.070	0.255	0.061	0.240	0.079	0.269	0.057	0.265
Doctorate or Equivalent	0.002	0.043	0.001	0.038	0.001	0.036	0.003	0.232
Length of Parental Leave in Months	12.272	4.015			0.832	0.624		0.054
Obs.	**545**		**4 168**		**1 550**		**8 080**	

Note: The length of parental leave is the total sum of parental leave between years 1997–2000 (reported in months).

5. Empirical Model

The sample is restricted so that the individuals are all childless in the beginning of the observation period. This is a matter that most likely biases the results. Another selectivity problem is that for many women having children causes them to leave the labor market permanently or at least for a significant period of time. However, this study is about women who are fairly strongly attached to labor markets and return to work relative quickly after the parental leave. For this reason I have excluded women who leave labor markets permanently (or at least for several years after becoming a mother) from the wage equations. This sample selection could cause some bias in the results. However, according Napari and his results (2007) this sample selection is not a great problem. In addition, it should be recognised that women who remain childless (used as a comparison group) can be a selected group. Suppose there exists unobserved heterogeneity between childless women and mothers that is correlated with wages, which causes bias in the estimates. However, according Korenman and Neumark (1994) and Waldfogel (1997) there is only a slight or no effect at all in the results due to unobserved heterogeneity. Also Napari (2007) using Finnish data finds no serious bias in the results due to unobserved heterogeneity between mothers and non-mothers.

The wage equations are estimated two years before and two years after the four-year period (years 1997–2000) when the childbirth, and thus, the parental leave can take place. The estimates are conditional for the matter that the individuals selected to my sample were all childless in the beginning of the sample period. To correct for this I use the Heckman selection model as my estimation method (Heckman, 1976). The wage regression is specified as follows:

$$lnW_{it} = \beta_0 + \beta_1 X_{it} + \varepsilon_{it}$$

Where X_{it} is a vector of explanatory variables: age, age squared, education (six categories), field of education (nine categories), industry (seven categories), tenure and tenure squared. The subscripts *i* and *t* indexes the individual and time, respectively. β_0 is the intercept, ε_{it} the error term. The dependent variable, W_{it}, is the natural logarithm of calculated monthly or hourly earnings.[6] The model is estimated conditional on the fact that the individuals do not have children at year *t*. The selection equation is:

[6] Monthly earnings are calculated from the FLEED data so that the annual wage is divided by months worked in that year. Wages are converted into 2002 money using the Cost-of-Living index of Statistics Finland. Hourly earnings are formed for white-collar and service workers by dividing the monthly earnings (reported by Confederation of Finnish Industries) with 4.333 (5/12) and regular weekly working hours. For manufacturing workers the total wage of the wage period is divided by the total working hours in that period. Wages are converted into 2002 money using the Cost-of-Living index of Statistics Finland.

$$z_{it}^{*} = \gamma_0 + \gamma_1 married + \gamma_3 age_{it}^2 + \mu_{it} > 0$$

if an individual is childless in year *t*. Where z_{it}^{*} is an underlying unobserved variable, which is related to the decision of having children. Because we cannot observe z_{it}^{*}, the information about whether the individual was married in year *t* is used as an identifying variable of being childless in that year (*t=1995*). I am aware of the fact that being married could not only affect the decision of having children, but also wages. However, according the results of Napari (2007) marriage does not have any effect on wages of women in Finland. However, there is a possibility that for men marriage could affect also wages, see Korenman and Neumark (1991). Another concern of using information on marriage to identify the selection equation is that it probably is not a very good predictor for having children. Nevertheless, due to lack of a more appropriate identifying variable the information on marriage is used.

The error terms of wage equation and selection equation are assumed to be distributed as follows:

$$\varepsilon_{it} \sim N(0, \sigma)$$

$$\mu_{it} = N(0,1)$$

where

$$corr(\varepsilon_{it}, \mu_{it}) = \rho$$

when $\rho \neq 0$. Standard regression techniques applied to the first equation yield biased results. The Heckman selection model provides consistent, asymptotically efficient estimates.

6. Estimation Results

The estimates of the parental leave wage-effects are given in Tables 2, 3 and 4. Table 2 presents Heckman's selection-model results when the dependent variable is the log of calculated monthly earnings.[7] The first three columns present estimated earnings functions for women; the final three columns present equivalent results for men. The first column for each gender presents the basic earnings function in the year 1996 (before the parental leave).[8] This estimation includes Parent to Be dummy in order to see whether the initial wages differ between those who have children and those who remain childless. In fact, those having a baby in the future have better initial wages, though for women this effect is very modest. This result implies that mothers and childless women do not seem to differ from each other in ways that cannot be observed and which would affect wages. The future fathers, on the contrary, earn significantly better wages compared to other men. It probably reflects the result received in previous studies: married men receive a "marriage premium" in pay. The future fathers are more likely to be married in the year 1996 than those who remain childless during the observation period.

The second column for each gender presents the basic earnings function estimates after the parental leave in the year 2001. The coefficient of the Parental Leave dummy is significantly negative for mothers. For men the estimated coefficient is positive and the same as Parent to Be dummy. It is evident that mothers suffer significant negative wage penalties as a result of taking parental leave (almost 7% lower compared to the earnings before the parental leave). The wage for men is unchanged when becoming a father and taking parental leave. An explanation for the negative wage-effect of taking parental leave for women and no effect for men is probably the different amounts of parental leave by gender (see Table 1). Women take long periods of parental leave, most more than 10 months, while men take only 3 weeks or less. The third column for each gender presents the same estimates for the year 2002. The negative wage effect of taking parental leave is one percentage point lower for women than in previous year implying that the wage penalty is only temporary.

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[7] The monthly earnings are calculated from the data so that yearly earnings are divided by the months worked per year.

[8] The basic earnings function before the parental leave is also estimated in year 1995, but not presented here because the results in year 1995 and 1996 are very similar. The estimation results from year 1995 are available by request from the author.

Table 2. The Effect of Parental Leave on Log Monthly Earnings

	Females			Males		
Year	**1996**	**2001**	**2002**	**1996**	**2001**	**2002**
Parent to Be	**0.022***			**0.045*****		
	(0.010)			**(0.007)**		
Parental Leave		**-0.044*****	**-0.031****		**0.045*****	**0.046*****
		(0.014)	**(0.011)**		**(0.009)**	**(0.007)**
Controls:						
Age	0.048***	0.046***	0.039***	0.036***	0.046***	0.031***
	(0.008)	(0.013)	(0.010)	(0.007)	(0.009)	(0.008)
Age2/100	-0.056***	-0.059***	-0.047***	-0.043***	-0.063***	-0.041***
	(0.013)	(0.018)	(0.013)	(0.011)	(0.013)	(0.011)
Level of Education (Omitted group: Secondary)						
Primary	-0.011	0.017	0.015	-0.019	-0.023	-0.010
	(0.012)	(0.016)	(0.013)	(0.015)	(0.019)	(0.020)
Lowest Level Tertiary	0.080***	0.149***	0.142***	0.086***	0.154***	0.152***
	(0.011)	(0.013)	(0.011)	(0.008)	(0.012)	(0.010)
Lower-Degree Tertiary	0.235***	0.303***	0.310***	0.175***	0.318***	0.312***
	(0.018)	(0.023)	(0.018)	(0.010)	(0.014)	(0.010)
Higher-Degree Tertiary	0.399***	0.586***	0.580***	0.304***	0.495***	0.497***
	(0.020)	(0.029)	(0.018)	(0.011)	(0.017)	(0.013)
Doctorate or Equivalent	0.413***	0.545***	0.647***	0.363***	0.564***	0.567***
	(0.074)	(0.078)	(0.122)	(0.040)	(0.052)	(0.041)
Field of Education (Omitted group : Services)						
General Education	0.078***	0.134***	0.146***	0.041*	0.166***	0.183***
	(0.014)	(0.020)	(0.015)	(0.019)	(0.027)	(0.026)
Teacher Education and Educational Science	0.017	-0.163	-0.293***	0.252***	-0.171	-0.257
	(0.089)	(0.105)	(0.056)	(0.019)	(0.100)	(0.158)
Humanities and Arts	-0.055	-0.099**	-0.086**	-0.050	-0.085	-0.078
	(0.031)	(0.035)	(0.033)	(0.042)	(0.051)	(0.059)
Social Sciences and Business	-0.013	0.002	0.004	-0.027	0.002	0.012
	(0.013)	(0.016)	(0.013)	(0.017)	(0.023)	(0.022)
Natural Sciences	0.212***	0.252***	0.271***	0.100***	0.174***	0.147***
	(0.036)	(0.032)	(0.035)	(0.026)	(0.052)	(0.032)
Technology	0.043***	0.072***	0.061***	0.053***	0.052**	0.055**
	(0.013)	(0.016)	(0.014)	(0.014)	(0.018)	(0.019)
Agriculture and Forestry	-0.097**	-0.110***	-0.070*	-0.040*	-0.086**	-0.033
	(0.032)	(0.032)	(0.033)	(0.020)	(0.030)	(0.025)
Health and Welfare	-0.005	-0.033	0.007	-0.033	-0.006	-0.030
	(0.019)	(0.021)	(0.014)	(0.033)	(0.052)	(0.034)

Industry (Omitted group : Wholesale and retail trade, hotels and restaurants)						
Agriculture, hunting and forestry, fishing, mining and quarrying	-0.083 (0.050)	-0.086** (0.035)	-0.092*** (0.026)	0.123*** (0.031)	0.085* (0.036)	0.071* (0.032)
Manufacturing	0.104*** (0.009)	0.089*** (0.012)	0.113*** (0.010)	0.130*** (0.009)	0.131*** (0.013)	0.117*** (0.011)
Electricity, gas and water supply, construction	0.088*** (0.024)	0.092** (0.030)	0.125*** (0.027)	0.163*** (0.013)	0.171*** (0.017)	0.155*** (0.014)
Transport, storage and communication	0.116*** (0.012)	0.111*** (0.016)	0.131*** (0.014)	0.118*** (0.015)	0.166*** (0.024)	0.148*** (0.018)
Finance	0.171*** (0.011)	0.172*** (0.018)	0.184*** (0.013)	0.260*** (0.021)	0.302*** (0.033)	0.276*** (0.025)
Public administration and defence; social security, education, health and social work	0.086*** (0.012)	0.114*** (0.017)	0.116*** (0.013)	0.107*** (0.014)	0.068** (0.022)	0.092*** (0.016)
Tenure	0.009*** (0.002)	-0.001 (0.002)	-0.001 (0.002)	0.017*** (0.001)	-0.002 (0.002)	-0.002 (0.002)
Tenure2 /100	-0.040*** (0.010)	0.000 (0.009)	-0.001 (0.007)	-0.048*** (0.007)	0.026*** (0.007)	0.024*** (0.006)
Constant	6.400*** (0.126)	6.635*** (0.236)	6.728*** (0.173)	6.729*** (0.102)	6.793*** (0.164)	7.063*** (0.143)

Note: Dependent variables are log of calculated monthly earnings . White's robust standard errors are in parentheses. *Significant at 5%, **significant at 1%, ***significant at 0,1%

When I take into account that there could have been career interruptions during the years 1997–2000 for other reasons than only having children, namely unemployment, studying, military service or for some other reasons the results do not change.[9] Adding controls for different types of career interruptions besides parental leave does not make any difference: there is no change in the coefficient of the Parental leave variable (see Appendix). In addition, when some plant and firm characteristics (share of female workers, sales/worker and total factor productivity) are included, it does not change the results dramatically (see Appendix). Table 3 presents the same estimates as Table 1, only the dependent variable is log hourly earnings. Now the estimated "bonus" for future parents becomes significantly smaller (though for men it is still relatively high). Moreover, the wage penalty of mothers for taking parental leave decreases remarkably to only 3 percent. For fathers, the wage-effect of taking parental leave is now positive, though quite modest (one percentage point higher hourly earnings than before the parental leave). The smaller magnitude in the negative

[9] Although one could argue that it is unnecessary to control this because becoming a parent, especially a mother, could affect these.

wage-effects for mothers and positive for fathers, when log hourly earnings are used instead of log monthly earnings as dependent variable, are consistent with the explanation that women cut down their working hours when there are small children in the family while men tend to increase their work load. However, the negative effect of taking parental leave on wages of women and positive for men remains even when log hourly earnings are used as a dependent variable. For women, the most obvious explanation would be human capital depreciation: women suffer from skill atrophy during the parental leave and therefore are less productive at work after the career break. For men, the positive effect of having children on wages, even after controlling for the hours worked, is much more challenging to explain. It could reflect the unobserved heterogeneity: men who are successful at work, are also successful in other parts of their lives, for instance in the marriage market.

The result that mothers suffer a wage penalty for taking parental leave while men do not and the fact that the duration of the parental leave is much longer for women than for men is in line with the human capital depreciation explanation of negative wage effects for having children. Long career interruptions due to childbearing and child-rearing cause women to suffer from skill atrophy, while men take only such little amounts of parental leave that no human capital depreciation can occur. The result that the negative wage effect of having children for women decreases in time also supports the human capital explanation: after returning to employment the human capital starts to recover and accumulate further.

Table 3. The Effect of Parental Leave on Log Hourly Earnings

	Females			Males		
Year	**1996**	**2001**	**2002**	**1996**	**2001**	**2002**
Parent to Be	**0.015**			**0.030*** **		
	(0.009)			**(0.006)**		
Parental Leave		**-0.019***	**-0.010**		**0.040*** **	**0.038*** **
		(0.009)	**(0.010)**		**(0.006)**	**(0.007)**
Controls:						
Age	0.024***	0.033***	0.036***	0.014*	0.026***	0.025***
	(0.007)	(0.008)	(0.009)	(0.006)	(0.007)	(0.007)
Age2/100	-0.022*	-0.039***	-0.043***	-0.010	-0.034***	-0.034***
	(0.011)	(0.012)	(0.012)	(0.009)	(0.009)	(0.010)
Level of Education (Omitted group: Secondary)						
Primary	-0.011	0.002	-0.001	-0.032*	-0.029	-0.030
	(0.010)	(0.011)	(0.012)	(0.014)	(0.016)	(0.016)
Lowest Level Tertiary	0.078***	0.120***	0.130***	0.072***	0.140***	0.151***
	(0.009)	(0.009)	(0.009)	(0.007)	(0.008)	(0.009)
Lower-Degree Tertiary	0.228***	0.289***	0.314***	0.188***	0.325***	0.349***
	(0.015)	(0.016)	(0.018)	(0.008)	(0.009)	(0.010)
Higher-Degree Tertiary	0.423***	0.556***	0.580***	0.346***	0.513***	0.555***
	(0.016)	(0.016)	(0.017)	(0.009)	(0.010)	(0.011)
Doctorate or Equivalent	0.493***	0.523***	0.566***	0.408	0.511***	0.592***
	(0.040)	(0.069)	(0.068)	(0.032)	(0.030)	(0.033)
Field of Education (Omitted group : Services)						
General Education	0.082***	0.138***	0.133***	0.060***	0.144***	0.163***
	(0.011)	(0.014)	(0.015)	(0.016)	(0.022)	(0.023)
Teacher Education and	-0.037	-0.171*	-0.160	-0.107***	-0.206***	-0.343*
Educational Science	(0.079)	(0.079)	(0.101)	(0.017)	(0.023)	(0.156)
Humanities and Arts	-0.059*	-0.074*	-0.090**	-0.041	-0.078*	-0.083*
	(0.030)	(0.031)	(0.033)	(0.036)	(0.038)	(0.041)
Social Sciences and Business	-0.010	0.017	0.016	-0.012	-0.003	-0.003
	(0.010)	(0.011)	(0.011)	(0.016)	(0.018)	(0.018)
Natural Sciences	0.179***	0.275***	0.273***	0.094***	0.151***	0.155***
	(0.028)	(0.028)	(0.032)	(0.023)	(0.027)	(0.028)
Technology	0.020	0.038***	0.038**	0.026	0.022	0.016
	(0.011)	(0.012)	(0.012)	(0.013)	(0.015)	(0.015)
Agriculture and Forestry	-0.075**	-0.079*	-0.093***	-0.032	-0.063**	-0.072***
	(0.028)	(0.031)	(0.029)	(0.018)	(0.021)	(0.021)
Health and Welfare	-0.001	-0.036**	-0.002	0.007	-0.048	-0.033
	(0.013)	(0.014)	(0.014)	(0.029)	(0.032)	(0.031)

Industry (Omitted group : Wholesale and retail trade, hotels and restaurants)						
Agriculture, hunting and forestry, fishing, mining and quarrying	-0.104* (0.051)	-0.085*** (0.024)	-0.136*** (0.027)	0.085** (0.029)	0.016 (0.032)	0.012 (0.031)
Manufacturing	0.060*** (0.007)	0.078*** (0.008)	0.083*** (0.008)	0.107*** (0.008)	0.081*** (0.010)	0.077*** (0.010)
Electricity, gas and water supply, construction	0.021 (0.021)	0.071** (0.025)	0.076** (0.026)	0.092*** (0.011)	0.101*** (0.013)	0.088*** (0.014)
Transport, storage and communication	0.084*** (0.010)	0.120*** (0.012)	0.116*** (0.012)	0.075*** (0.013)	0.133*** (0.016)	0.120*** (0.017)
Finance	0.151*** (0.010)	0.163*** (0.012)	0.159*** (0.012)	0.251*** (0.021)	0.268*** (0.025)	0.261*** (0.026)
Public administration and defence; social security, education, health and social work	0.072*** (0.010)	0.104*** (0.012)	0.092*** (0.013)	0.084*** (0.012)	0.056*** (0.014)	0.056*** (0.015)
Tenure	0.007*** (0.002)	0.001 (0.002)	0.000 (0.002)	0.013*** (0.001)	0.001 (0.001)	0.000 (0.001)
Tenure2 /100	-0.033*** (0.008)	-0.010 (0.006)	-0.006 (0.006)	-0.041*** (0.006)	0.007 (0.005)	0.011* (0.005)
Constant	1.769*** (0.101)	1.651*** (0.146)	1.608*** (0.159)	2.044*** (0.084)	1.963*** (0.120)	1.995*** (0.126)

Note: Dependent variables are log of calculated hourly earnings . White's robust standard errors are in parentheses. *Significant at 5%, **significant at 1%, ***significant at 0,1%

When I distinguish between whether the year 2001 is the first, second, third or fourth year back in employment, it is even more evident that the negative wage effect of having children is decreasing in time.[10] Table 4 presents the estimates of taking parental leave by taking into account when the person had returned to work before the year 2001. The dependent variable is log of hourly earnings in 2001 and 2002 (as in all Models presented in Table 4).[11]

Table 4 also presents the effect of multiple career interruptions due to having children. Last, it is examined how the duration of the parental leave affects wages. For mothers one extra month of parental leave causes a 0.4% loss in wage. Interestingly, the coefficient of the length of parental leave is also negative for fathers indicating that leaves long enough held by fathers are affecting their level of human capital (skill atrophy) leading to lower wages. Alternative

[10] For those who had multiple parental leaves during the years 1997–2000, the year of the latest parental leave is used when calculating the return year.

[11] The results from otherwise the same earnings functions but where the dependent variable is log monthly earnings are very similar. They are available upon request from the author.

interpretation would be, in accordance with Albrecht et al. (1999), that taking a significant, long parental leave signals from lower commitment to work and career (and higher commitment to family life), which is shown in the wage of the father.

It could be assumed that negative wage effects of parental leave are higher for highly educated women than for women with less education. One might expect that skill atrophy during the time out of work is more severe for highly skilled workers. Ellwood et al. (2004) found that indeed highly skilled women suffer greater wage losses of having children than other women. Although the results are not unambiguous, for instance Budig and England (2001) found no evidence that more skilled women would suffer higher penalties for having children. In this study there were no significantly different effects by education level either.

Table 4. Alternative Ways of Estimating the Effect of Parental Leave on Log Hourly Earnings

	Females		**Males**	
	2001	**2002**	**2001**	**2002**
Year 2001 is the first year after the parental leave	-0.022	-0.019	0.034***	0.027**
	(0.015)	(0.016)	(0.009)	(0.010)
Year 2001 is the second year after the parental leave	-0.031	-0.020	0.052***	0.054***
	(0.016)	(0.017)	(0.011)	(0.012)
Year 2001 is the third year after the parental leave	0.001	0.023	0.040**	0.039**
	(0.016)	(0.018)	(0.013)	(0.013)
Year 2001 is the fourthyear after the parental leave	-0.037	-0.058	0.031	0.033*
	(0.030)	(0.031)	(0.016)	(0.017)
One parental leave period between 1997–2000	-0.009	-0.001	0.041***	0.043***
	(0.011)	(0.012)	(0.007)	(0.008)
Two parental leave periods between 1997–2000	-0.057***	-0.046**	0.038***	0.027*
	(0.015)	(0.017)	(0.011)	(0.011)
Three (or more) parental leave periods between 1997–2000	0.064	0.111	0.024	0.002
	(0.075)	(0.083)	(0.040)	(0.044)
Parental leave	0.029	0.042	0.050***	0.061***
	(0.028)	(0.030)	(0.010)	(0.011)
Total amount of parental leave (in months) during 1997–2000	-0.004	-0.004	-0.010	-0.028**
	(0.002)	(0.002)	(0.009)	(0.010)

7. Conclusions

In this paper, I have analysed the effect of taking parental leave on the wages of mothers compared to other women, and on the wages of fathers compared to other men. There appears to be a significant negative relation between career interruptions due to childbirth and subsequent wages for women in Finland. The relative loss in earnings of mothers is almost 7%. The effect for men is quite the opposite: their wages are either unaffected or even increased. However, this result is mainly due to the fact that men take only short leaves (less than 18 days). For those men, who take significantly longer periods of parental leave, the effect is actually negative.

The estimates from wage equations are higher when log monthly earnings are used instead of log hourly earnings. This indicates that a remarkable part of the cost of having children comes in the way that women when becoming mothers cut down their working hours (or do not take extra hours). Men, on the other hand, tend to work longer hours when there are children in the family, which explains the positive effect of a short parental leave on wages. However, the negative effect of taking parental leave on wages of women and positive for men remains even when log hourly earnings are used as a dependent variable. For women, the most obvious explanation would be human capital depreciation: women suffer from skill atrophy during the parental leave and therefore are less productive at work after the career break. For men, the positive effect of having children on wages, even after controlling for the hours worked, could reflect unobserved heterogeneity: men who are successful in the labor market are also successful in the marriage market.

However, the results show that when the parental leave of the father lasts a substantially long time, the effect of the leave turns from positive into negative. This effect is easy to understand: if long breaks cause women to suffer from human capital depreciation, the same should happen to men too. Along Albrecht et al. (1999) there is also a possibility that men's long parental leave is a negative signal for employers: "Too much" family-oriented men are penalized in pay.

The result that mothers suffer a wage penalty for taking parental leave while men do not and the fact that the duration of parental leave is much longer for women than for men are in line with the human capital depreciation explanation of negative wage effects related to having children. Long career interruptions due to childbearing and child-rearing cause women to suffer from skill atrophy, while men take only such little amounts of parental leave, so that no human capital depreciation can occur. The result that the negative wage effect of having children for women decreases in time also supports the human capital explanation: after returning back to employment the human capital starts to recover and accumulate further.

Moreover, the negative effect of taking parental leave on wages of mothers is stronger when there is more than one career interruption. This result is very much in line with the human capital depreciation interpretation. Multiple career interruptions lead the human capital to accumulate less when the level of human capital is measured by the amount of work experience. Furthermore, several career breaks in short period of time dispose human capital to depreciate (skill atrophy).

The main findings of this study give support for the human capital depreciation hypotheses. Women have, on average, a one-year career interruption per child leading to severe human capital depreciation. Men, on the other hand, take only a short period of family leave (if any) when becoming a father causing no human capital depreciation. The more children the woman has, the more time she will spend out of work causing even more human capital depreciation. During the childcare period women do not only suffer from skill atrophy but do not gain any new skills related to work.

On the basis of the results, it is very likely that maternity and parental leave schemes are not only beneficial for those who use them (maintaining a good employer-employee match) but also harmful when used for a significantly long time (causing human capital depreciation). When these benefits are used mainly by the mothers the earning capacity of women is clearly negatively affected.

If mothers would receive the same pay as other women the gender wage gap would narrow substantially. There are 40 000 working mothers on parental leave every year in Finland and because of the negative effect of leave on pay remains for years (though decreasing in time) it means enormous losses in the total wage sum of women and thus affects the overall gender wage gap. Thus, it would be beneficial both for mothers and employers if tools existed for avoiding human capital depreciation during the maternity leave. Moreover, if fathers took more parental leave, the career interruptions of mothers would not be that long causing less human capital depreciation for mothers.

The obvious pitfall of this study lies in the estimation method. The Heckman selection model, and particularly the chosen identifying variable to estimate the model is outdated: being non-married is a poor predictor of being childless in the 1990s Finland. The use and discovery of more appropriate estimation methods and idenfication strategies is left for future work.

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