Education, gender, and family formation

Hanna Virtanen, *Etla Economic Research*
Mikko Silliman, *Norwegian School of Economics*
Tiina Kuuppelomäki, *Labour Institute for Economic Research LABORE*
Kristiina Huttunen, *Aalto University**

February 29, 2024

Abstract

We study the effect of educational attainment on family formation using regression discontinuity designs generated by centralized admissions processes to both secondary and tertiary education in Finland. At both margins, admission to further education increases the probability that women form families – i.e. have children or cohabit. For men, our point estimates are near zero, and sometimes negative. These results come from a context with strong family policies and relatively weak gender norms, and are consistent with the idea that education may make career and family more compatible for women. Additionally, as higher-order skills are increasingly important in the labor market, and parental inputs are important in shaping these skills, these results fit with the idea that education may make women more attractive as potential spouses.

Keywords: gender, education, family
JEL Classification: J13, I26

*Hanna Virtanen—hanna.virtanen@etla.fi; Mikko Silliman—mikko.silliman@gmail.com; Tiina Kuuppelomäki—tiina.kuuppelomaki@labore.fi; Kristiina Huttunen—kristiina.huttunen@aalto.fi. We are grateful to seminar participants at the London School of Economics (CEP), National Bureau for Economic Research, Norwegian School of Economics (FAIR), Rockwool Foundation (Copenhagen), Stockholm University (SOFI), University of Bergen, and University of Oslo as well as Abi Adams-Prassl, Aline Butikofer, Ciprian Domnisoru, Jarkko Harju, Anna Hochleitner, Kaisa Kotakorpi, Otto Kässi, Katrine Loken, Tuomas Pekkarinen, Kjell Salvanes, Jutta Viinikainen and Alexander Willen for comments. We are also thankful for funding from The Strategic Research Council (grant: 345218); Hanna is grateful for funding from the Research Council of Finland (grant: 356402); and Tiina is also grateful for funding from Palkansaajasäätiö. All errors are our own.

In response to the wide-ranging consequences of falling fertility rates, governments across high income countries are considering how to increase rates of family formation (Harper, 2014; OECD, 2021). A focus of these efforts has often been either on men with low levels of education, who are the least likely to form families (Miettinen et al., 2015; Greenwood et al., 2016; Jalovaara et al., 2019), or on making career and family more compatible for highly educated women (Baudin et al., 2015; Bertrand et al., 2021; Goldin, 2021). Despite significant scientific interest in the relationship between education and family formation (Becker, 1981; Doepke et al., 2023), however, there remains limited empirical evidence on how education shapes family formation across the life-cycle.

If men and women face different opportunities in the labor market or if women hold comparative advantages in household production, the incentives for and returns to investing in education may differ by gender (Becker, 1965). A common view – and a pattern supported by both cross-national and within country historical comparisons – is that while increases in education may be associated with higher rates of family formation for men, the relationship between education and family formation may exhibit a hump-shape for women, whereby highly educated women are less likely to form families (Baudin et al., 2015; Bertrand et al., 2021).

But, the past century has seen a tremendous progress in the labor market opportunities for women and technological changes have weakened the economic incentives for one partner to specialize in household production (Kleven and Landais, 2017; Goldin, 2021). Over this period, the hump-shaped relationship between women's education and family formation has begun to flatten or even reverse in countries with more egalitarian gender norms (Esping-Andersen and Billari, 2015; Bertrand et al., 2021). In addition to changes in gender norms, several governments have implemented family policies that have made it increasingly possible to combine career and family (Bar et al., 2018; Doepke et al., 2023; Hazan et al., 2023). In fact, today, highly educated women in several high income countries are more likely to form families than women with less education (Jalovaara et al., 2019; Doepke et al., 2023).

In Finland, our data show these same patterns. In the past, the relationship between women's educational attainment and family formation was negative. Today, however, increased educational attainment is associated with higher rates of family formation for both men and women. This is not to say that this relationship is causal. Men and women with different educational trajectories are likely to vary in numerous ways – including the types of families they come from as well as their preferences prior to making educational investments.

To isolate the effects of education on family outcomes we use a pair of regression discontinuity designs (RDD) generated by centralized admissions processes to secondary and tertiary education. The first discontinuity increases the probability that first-time applicants to secondary education obtain any secondary educational degree. Likewise, the second design, focuses on first-time applicants to universities of applied sciences, and – as in Hoekstra (2009) or Zimmerman (2014) – increases

the probability that applicants complete any tertiary education. Both designs focus on how access to additional education affects the marginal applicant. We then follow men and women through their late thirties (age 38), tracing the effects of the admissions decisions on whether or not they cohabit or have children.

Prior research attempting to isolate the causal effects of education on family formation has almost exclusively used increases in the length of compulsory education for identification (Currie and Moretti, 2003; Fernández et al., 2004; Lefgren and McIntyre, 2006; Black et al., 2008; Monstad et al., 2008; McCrary and Royer, 2011; Silles, 2011; Cygan-Rehm and Maeder, 2013; Grönqvist and Hall, 2013; Aaronson et al., 2014; Lavy and Zablotsky, 2015; Fort et al., 2016; Geruso and Royer, 2018; Chen and Guo, 2022).[1] These studies typically focus on women and find that increasing the length of compulsory education reduces teenage pregnancy.[2] There remains little evidence on how education shapes life-cycle dynamics in family formation or might shape broader demographic trends. We extend this empirical literature with new insights on how education affects family formation across the board, including for policy relevant groups such as highly educated women and men with low levels of education.

Our regression discontinuity results show that increases in educational attainment increase the probability that women form families by their late thirties. Women admitted to secondary education are about 5 percentage points more likely to have a child by age 38. While these estimates are a little noisy, we obtain similar but more precise estimates at the margin for tertiary education. Women admitted to universities of applied science are about 5 percentage points more likely to have a child by age 38. In contrast, the marginal man admitted to either secondary or tertiary education is no more likely to have children than their peers who are just barely denied admission to further education. While it is possible that these results could change as men enter their forties, our estimates do not show signs of a trend in the prior few years. Further, the descriptive data shows that by about the age of 35, the relationship between education and childbearing already begins to stabilize, while the relationship between education and partnership stabilizes by people's early thirties. Finally, our regression discontinuity estimates show that, if anything, men admitted to further education are less likely to cohabit or marry than their less educated peers while women experience an increase in the rates of cohabitation and marriage.

[1] A handful of papers use other sources of variation to study the effects of education on family formation. For example, Amin and Behrman (2014) compare twin women in the United States with different levels of education, and find that more educated twins have fewer children, but are equally likely to be childless. Tropf and Mandemakers (2017) compare female twins and argue that a large portion of the raw association between education and fertility is likely to be explained by family background. Humlum et al. (2017) use a regression discontinuity design from college admissions to study how the timing of college affects family formation. See Koebe and Marcus (2022) who also study the timing of education and family formation.

[2] Within this literature, Fort et al. (2016) note an important caveat, observing that the negative effects of education on teenage fertility do not extend across national contexts in continental Europe.

To explore potential mechanisms underlying our results, we examine how crossing the admissions cutoffs effects income. We find that admission to secondary education has no effects on income for men or women. More interestingly, we see that admission to tertiary education increases early career incomes for men and women, but while the effects on men's income are large and persistent through age 38, the effects for women quickly diminish in magnitude. If education were to shape men's family formation outcomes by increasing their economic resources, we should expect educational attainment to increase men's probabilities of forming families at the tertiary margin (Becker, 1981). Further, if increased job prospects increase women's opportunity costs of forming families, we might expect negative effects of educational attainment on women's likelihood to form families at the tertiary margin (Baudin et al., 2015). Together, these results challenge the idea that education primarily affects family formation by shifting resources or economic opportunities.

However, considering that Finland is a country with relatively weak gender norms and strong family policies, it may not be altogether surprising that there is no negative relationship between educational attainment and women's probabilities of forming families (Bertrand et al., 2021; Doepke et al., 2023). More surprising is that our regression discontinuity results suggest that the effect of education on women's family formation outcomes is positive – even at the tertiary education margin, and education does not increase the probability that men form families. One explanation is that if education provides women entry to more flexible jobs, education may increase women's family formation outcomes. Without mentioning education explicitly, Doepke et al. (2023) highlight the idea that factors which make it easier for women to combine career and family can increase women's fertility.

We offer an additional skill-based explanation for why education might increase the rates of family formation for women in particular. Human capital – and particularly higher order skills – are increasingly important in determining people's economic outcomes (Goldin and Katz, 2009; Deming, 2017). While schools are still learning how to foster non-academic skills, parents have been shown to be crucial in developing these types of higher order skills (Doepke and Zilibotti, 2017; Black et al., 2018). Moreover, recent research from Sweden suggests that parents are aware of these shifts in skill-demand (Hermo et al., 2022). And, in the United States highly educated mothers spend more time with their children in childcare intensive activities – even though they enjoy it less and face higher opportunity costs than their less educated peers (Kalil et al., 2023). We suggest that given the outsize contributions of mothers to child development – particularly in the early years, education may make women more attractive as potential spouses. This could be either because maternal education signals parental ability or if education allows women to enter careers where they are better able to combine career and family.

Our results also provide some of the first evidence on how education shapes men's family formation outcomes. Contrary to common views, we find that education does not increase men's

likelihoods of forming families. One potential reason education may not increase the probability that men form families is if education and earnings increase the value of their leisure time as singles (Becker, 1981; Lerman, 1989). Or, if the earnings premium resulting from higher education makes men more attractive on the marriage market, men may perceive a lower risk to remaining single and delay cohabitation – potentially until it is too late to find a suitable spouse.

Our results extend both the empirical and theoretical literatures on education and family formation in economics. Our regression-discontinuity results suggest that increases educational attainment can increase the probabilities that women form families. These results stand in contrast to traditional models of education and family formation, whereby education might improve the family formation prospects for men, while even hurting those of women (Becker, 1981; Baudin et al., 2015; Bertrand et al., 2021).

1 Institutional setting

Finland shares several key institutional features with other Western countries, making it an interesting context to study the relationship between education, gender, and family formation. First, the structure of education in Finland is typical, with the end of compulsory education (age 16) and application to tertiary education (age 19) representing the two main junctures in the education system. Second, the educational attainment of women has surpassed that of men. And third, fertility rates have declined over the last decades.

1.1 The structure of education in Finland

Compulsory education in Finland begins at age seven, and – for the cohorts we study – continues through age sixteen.[3] Compulsory education is followed by upper secondary school in either general or vocational programs. After secondary education – typically age nineteen – students have the opportunity to continue to higher education (see Figure A.1). Higher education in Finland is formally divided into two types of programs – those offered in universities of applied science and those offered in universities. While it is difficult to draw a precise analogy, in the United States universities of applied science might correspond to public universities outside of state flagships and in the United Kingdom these schools might correspond to polytechnics.

In our main analysis we focus on shifts in educational attainment that occur when students are either granted admission or denied entry to any upper-secondary program or universities of applied science. While we include all secondary programs at the secondary school margin, we focus exclusively on universities of applied science at the tertiary margin. This is because in the cohorts

[3] In 2021 this changed, as the compulsory schooling age in Finland was raised to 18.

we study, admissions scores are only available for universities of applied science – and applications to universities does not take place through a centralized admissions system. Fortunately, as in Hoekstra (2009) or Zimmerman (2014), admission to these schools typically determines whether or not students are admitted to any tertiary program.

Admissions to both upper-secondary and universities of applied science takes place through a centralized application system maintained by the Finnish National Board of Education (FNBE) and follows a deferred acceptance algorithm based on admissions scores and applicants' ranked preferences over various programs. Admissions scores to upper-secondary school are based primarily on grades (GPA) in the last year of compulsory school, while admissions scores to tertiary education are typically based on a combination of secondary school grades, end of high school exams (formally called the matriculation exam), and program-specific entrance exams.

We focus on cohorts born between 1979 an 1985. In these cohorts nearly all apply to upper-secondary education, and a little less than 90 percent obtain a degree from secondary education.[4] Approximately 60 percent apply to higher education by age 23.[5] Of these applicants, 40 percent apply only to universities of applied science, 40 percent apply to both universities of applied science as well as traditional universities, and 20 percent apply only to traditional universities. In these cohorts, close to 45 percent complete higher education degree.

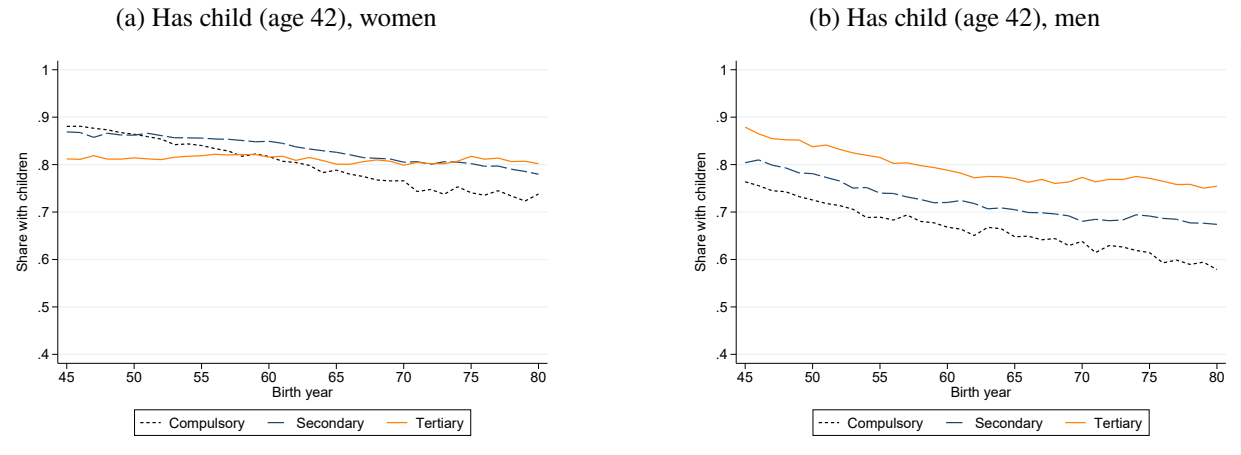
1.2 Education, gender, and fertility today

To situate cohorts born between 1979 and 1985 in time and place, we picture key measures of education and family formation in contemporary Finland, and how they compare internationally. In Finland today, as in most OECD countries, women aged 25-34 are more likely than men to obtain higher educational degrees (Figure A.2). In the cohorts we study, 39 percent of men have earned a tertiary degree by age 37, while 44 percent have a secondary degree but no tertiary degree, and 17 percent do not hold a degree from post-compulsory education. The corresponding numbers are 56, 45, and 9 percent for the women in our sample (Figure A.3).

[4]For additional details on application behavior and admissions processes to secondary education in Finland, see Silliman and Virtanen (2022) and Huttunen et al. (2023).

[5]While the majority of first-time applications to higher education take place at age nineteen and defer admission, some wait a few years to apply. This is particularly true for men, who are required to serve in the Finnish Defence Forces for a minimum of six months.

Figure 1: Cohort trends in fertility by education and gender



Notes: These figures plot the share of cohorts who have children by age 42 by educational levels, for women (a) and men (b) separately.

Traditionally, women with high levels of education were less likely to have children than their less educated counterparts (Goldin, 2021). This is also what we see in data from Finland (Figure 1). However, gender roles as they pertain to work and family have shifted dramatically over the past century (Goldin, 2021; Doepke et al., 2023). Today, both highly educated men and women are most likely to have children.

Strikingly, this change is driven by falling fertility rates amongst all the groups we observe except for highly educated women.[6] The likelihood of having a child has been remarkably stable over this period for women with tertiary education. While women born in 1945 who obtained tertiary degrees were almost 10 percentage points less likely to have kids than their less educated peers, since the cohort born in 1975 women with higher education have been most likely to have children.

2 Data sources and descriptive statistics

2.1 Data sources and outcomes

We link together several administrative registries spanning data on demographic characteristics and family background, educational admissions decisions, education and labor market outcomes, as well as measures of family formation and fertility. So that we can both follow applicants as long as

[6]See research documenting these trends by education and gender in recent work by demographers in Finland (Jalovaara et al., 2019; Jalovaara and Andersson, 2023; Savelieva et al., 2023) as well as in other western countries (Bongaarts, 1999; Sleebos, 2003; Impicciatore and Tomatis, 2020). Although this decline in fertility has coincided with development, research also points out that within countries people at higher economic levels have escaped the most recent declines (Myrskylä et al., 2009).

possible – to their late thirties – and access detailed data on educational admissions decisions, we focus on cohorts born between 1979 and 1985.

Our primary source of data are population-wide administrative registers at Statistics Finland. Demographic characteristics come from the FOLK Basic data module (Statistics Finland, 2023b). We merge this data to the EDUC Student and Degree Registers, which contain information on the year, level, and field of study of all post-compulsory enrollment and degree completion (Statistics Finland, 2023a,g). We identify both parents and children of our sample from the Child- Parent data. The FOLK Income and Employment Modules (Statistics Finland, 2023f,e) provide us with detailed measures of labor market outcomes for both our sample and their parents. We have information on marriage and cohabitation from the FOLK Cohabitation module (Statistics Finland, 2023d).

Our primary outcomes are two key dimensions of family formation – having children and having a partner (Statistics Finland, 2023c). In our preferred measures of these outcomes, we measure these both through binary indicators. Our measure for having a child is simply zero if a person does not have a child by a certain age, and one if the person has had a child by that age. Our measure for having a partner takes a value of one if a person is observed cohabiting with a partner or is married at each age, and zero otherwise. Cohabitation and marriage outcomes are measured annually to take into account both partnerships and separations.

We complement these primary measures with two other measures: the number of biological children each person has, such that having no children is coded as zero; and, a binary indicator for partnership based only on marriage. Compared to our two preferred measures of family formation, these alternative measures focus less exclusively on whether or not people form families, but capture what kinds of families people have.

The application and admissions information we use to construct the regression discontinuity designs comes from the Finnish National Agency for Education. The Secondary Education Application Registry contains information of compulsory school performance, secondary school application preferences, and admissions results (Finnish National Board of Education, 2023a). We focus on first time applicants between the years 1996 and 2000 who are 15-17 years old at the time of applying. For the tertiary margin, we use the Application Registry of University of Applied Sciences that includes information on application scores, application preferences, and admissions results (Finnish National Board of Education, 2023b). Here we focus on 19-23 year old first time applicants in 2003 and 2004.

2.2 Family formation by education level

Merging these data sources together, we are able to follow full cohorts of Finnish men and women born between the years 1979 and 1985 through the year 2022, typically through age 37 (tertiary

sample) or 38 (secondary sample). Restricting our sample to only the two oldest cohorts we lose statistical power necessary for our regression discontinuity design, but are able to follow individuals through age 42. These two oldest cohorts are largely comparable to our full sample, and as shown in Figure 1, higher educated women are already more likely to have children than those with less education in this period.

To provide a first sense of how education and gender relate to our four main measures of family formation, we plot the means of each of our outcomes over the life-cycle separately for men and women. Figures 2a-2b show how the share of people who have children vary by education levels and gender through people's early forties. These figures show that both men and women with the lowest levels of education – only a compulsory degree – have children earlier than people with secondary or tertiary degrees. And, that having children is delayed for both men and women with tertiary degrees. By age 28, however, women with secondary degrees are already more likely to have children than those with only compulsory degrees. The same pattern holds for men, with a two year delay. By age 37, women with tertiary degrees overtake those with either only secondary or compulsory degrees, and are the most likely to have a child. Similarly, higher educated men overtake their lower-educated counterparts by age 34, and are the most likely to have children. Overall, about seventy-five percent of women and seventy percent of men have children by the time they are 42. The descriptive pattern for the number of children people have by education looks qualitatively similar for men, but highly educated women still have fewer kids than their less educated peers at age 42 (Figure A.5).

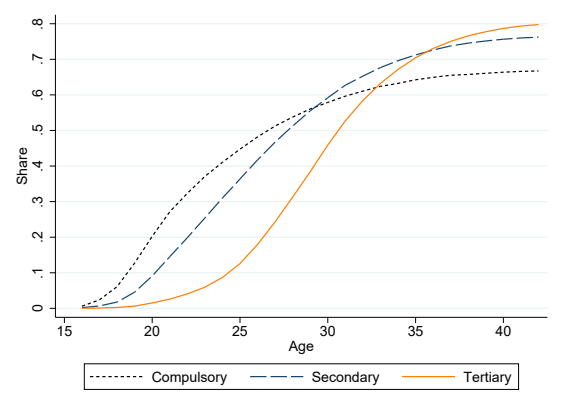
Next, we turn to the relationship between educational attainment and having a partner (Figures 2c-2d). In contrast to having children, men and women with higher levels of education do not appear to significantly delay cohabitation or marriage. For women, rates of cohabitation increase rapidly after age 17 – or 18 for women who go on to obtain higher educational degrees. Already age 20, however, the rate of cohabitation for women with only compulsory school degrees begins to plateau, peaking at around 45 percent at age 30, and decreasing to 40 percent by age 38. The rate of cohabitation for women with secondary degrees plateaus by their mid-twenties, peaking just above age thirty, before declining to just over 60 percent at age 38. While women who obtain higher educational degrees are slightly slower to cohabit, by 26 they are already the group of women who are most likely to live with a partner – and this is the only group of women who experience no decline in cohabitation through their late thirties. By age 38, rates of cohabitation vary drastically by education level, with almost 75 percent of highly educated women are living with a partner – almost double the rate of cohabitation compared to women with the lowest levels of education. While slightly delayed, these patterns look very similar for men. Not surprisingly, both men and women are slower to marry than to cohabit, and fewer people marry than cohabit – even by age 42 (Figures A.5c-A.5d). That said, marriage patterns by education and gender are qualitatively similar to those for cohabitation. For both men and women, marriage rates begin to plateau by

age 35, at which point 50 percent of highly educated men and women, almost 40 percent of those with secondary degrees, and just over twenty percent of those with only compulsory education, are married. Notably, marriage rates across all education groups and for both men and women are below 20 percent through age 25, by which point almost 40 percent of lower educated women already have children. For higher educated women and for men across educational groups, marriage rates diverge less from child-bearing.

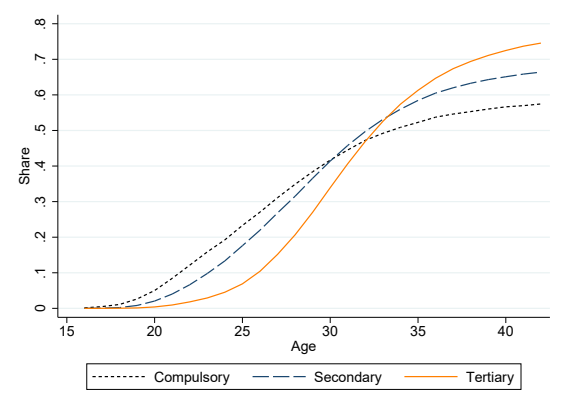
While men and women with different levels of education exhibit distinct patterns of family formation over the life-cycle (Figures 2), these differences may not stem from educational attainment – as these groups of people are different in a number of ways. Notably, men and women with higher levels of education tend to come from richer families, have more highly educated parents, and perform better academically already in middle school (Table 1). In order to isolate the role of education in explaining these gaps, we will turn our focus to individuals at the margin of either compulsory and secondary education – or at the margin of secondary and tertiary education. These are people most likely to be affected by policies that change the relative sizes of each educational sector.

Figure 2: Family formation, by education level and gender

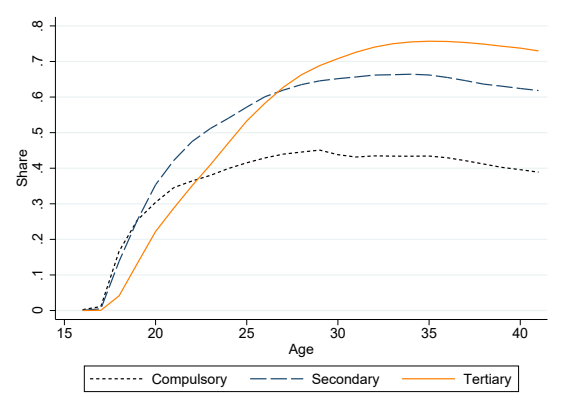
(a) Has child, women



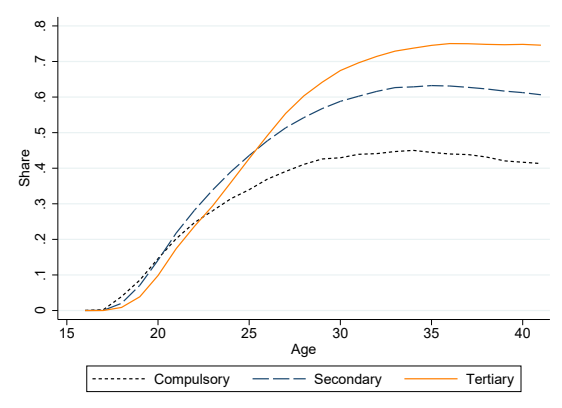
(b) Has child, men



(c) Cohabitation, women



(d) Cohabitation, men



Notes: These figures plot our two main measures of family formation from ages 16 to 42 by each person's highest level of education and gender. Figures (a) and (b) plot the portion which has at least one child at each age. Figures (c) and (d) plot the share who are cohabiting at each age. So we can follow this sample through age 42, these figures are based on cohorts born between 1979 and 1980.

Table 1: Background characteristics and sample

	Women			Men		
	Compulsory	Secondary	Tertiary	Compulsory	Secondary	Tertiary
Panel A: Background characteristics						
GPA	6.7	7.4	8.5	6.3	6.9	8.2
Finnish speaking	0.89	0.94	0.93	0.91	0.94	0.93
Swedish speaking	0.05	0.04	0.06	0.04	0.05	0.06
Other language	0.06	0.02	0.01	0.04	0.01	0.01
Finnish	0.96	1.00	1.00	0.97	1.00	1.00
Urban	0.64	0.52	0.54	0.59	0.50	0.57
Suburban	0.15	0.18	0.18	0.17	0.19	0.18
Rural	0.21	0.29	0.27	0.24	0.30	0.25
Mother's income	17,292	20,378	25,403	18,861	21,523	26,446
Mother NEET	0.22	0.13	0.09	0.18	0.12	0.09
Mother secondary	0.48	0.58	0.66	0.52	0.61	0.67
Mother tertiary	0.03	0.04	0.13	0.03	0.05	0.16
Father's income	22,911	27,890	37,172	24,650	29,398	40,763
Father NEET	0.26	0.16	0.11	0.22	0.14	0.10
Father secondary	0.45	0.53	0.59	0.47	0.55	0.61
Father tertiary	0.05	0.06	0.19	0.05	0.08	0.23
Panel B: Outcomes at age 36						
Has child	0.64	0.72	0.71	0.51	0.58	0.61
Number of children	1.64	1.65	1.45	1.08	1.21	1.22
Age at first birth	23.5	25.7	29.0	26.4	27.9	30.1
Married	0.24	0.40	0.52	0.21	0.34	0.50
Has partner	0.41	0.64	0.74	0.41	0.60	0.73
Months unemployed	3.0	2.9	2.4	3.6	3.7	3.1
Annual income (€)	15,117	24,051	35,303	23,868	35,190	51,905
Observations	14,758	89,286	121,119	32,296	120,613	82,359

Notes: This table shows the background characteristics of the full cohorts of men and women born in Finland between the years 1979 and 1985, divided by their highest completed level of education.

3 Empirical strategy

3.1 Admissions cutoffs and the running variable

We are interested in identifying the causal effect of educational attainment on family formation. In an ideal experiment, we would randomly assign individuals to different educational trajectories – varying the length of post-compulsory education individuals are exposed to. Of course, this is not feasible. To identify the causal effect of educational attainment on family formation, we use

two sets of regression discontinuity designs generated by the centralized admissions processes to oversubscribed programs in secondary and tertiary education. In both designs, scoring above the admissions cutoff increases applicants' educational attainment. We construct admissions cutoffs from the data as follows.

The first of these regression discontinuity designs determines whether or not applicants receive a place in any secondary education program after finishing compulsory education. Admission to secondary programs is based primarily on the grade point average (GPA) in the final year of compulsory education. That said, some programs apply slightly different criteria, weighting particular grades more, or supplementing GPA with other admissions criteria. We have data on the admissions scores for each cutoff, and include them in our construction of the running variable. These are standardized following Silliman and Virtanen (2022) and Huttunen et al. (2023).

The second cutoff determines whether or not applicants to tertiary education receive admission to universities of applied science – the least selective set of tertiary degree programs in Finland. As in Hoekstra (2009) or Zimmerman (2014), admission to universities of applied sciences increases the probability that these students enroll in any tertiary degree program. Admission to universities of applied sciences is based on a combination of secondary school grades, end-of-high school exam scores, and entrance exams – with different programs weighting these differently. In our data we directly observe the admissions scores which combine these several criteria. We then standardize each application score to a rank amongst all applicants who apply to that program, and divide this by the total number of applicants to that program (Abdulkadiroğlu et al., 2014).

At both margins, the admissions cutoff to each program (k) is the standardized admissions score of the lowest-scoring application offered admission that year. The distance each applicant (i) is from the admissions cutoff is,

$$a_{ik} = (c_{ik} - \tau_{ik}), \tag{1}$$

where τ_{ik} is the score of the lowest scoring applicant offered admission, and c_{ik} is the applicants own standardized admissions scores. We exclude applicants that define admissions cutoffs from our estimation sample.

Scoring just above the minimum admissions requirements increases the probability of admission to secondary education by approximately 55 percentage points for both men and women (Panel A of Figure 3). Scoring above the minimum requirements for admission to tertiary education increases the probability of admission by over 30 percentage points for men and by 50 percentage points for women (Panel B of Figure 3). Differences in the jumps in admissions probabilities for men and women are driven by differences in the set of programs each applies to. So that our estimates of effects are comparable between men and women, we scale our estimates of family formation outcomes by admissions rates for men and women.

At the secondary school margin, crossing the admissions cutoff increases the probability of enrolling in secondary education that year by about 30 percentage points, and the probability of graduating with a secondary degree within the following 15 years by 7 percentage points (Figure A.7). At the tertiary margin, admission increases enrollment in any higher education by about 15 percentage points for men and by 30 percentage points for women (Figure A.8). It also increases the probability of graduating with a tertiary degree within 15 years by close to 10 percentage points for men and by over 5 percentage points for women. However, since enrollment and graduation are both endogenous to being admitted, we prefer to scale our reduced form results by admission.

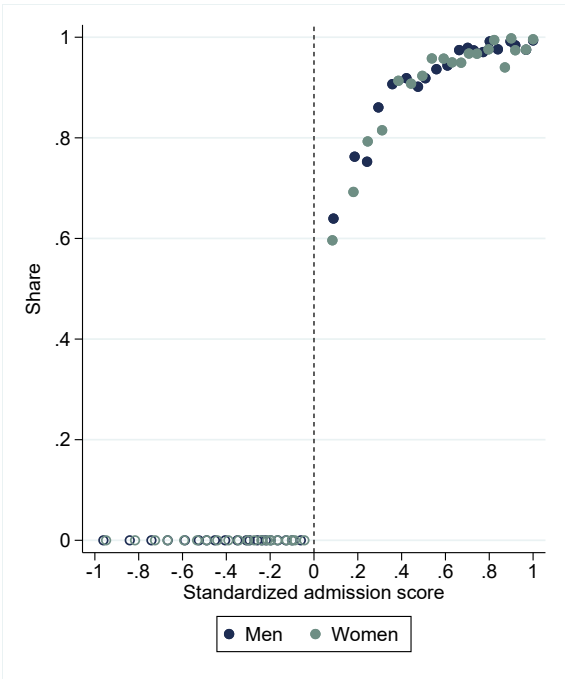
3.2 Estimation samples

In our regression discontinuity estimates, we focus on first-time applicants to oversubscribed secondary school programs between the years 1996 and 2000 and oversubscribed programs in universities of applied sciences between the years 2003 and 2004. Applicants in our secondary school sample are between 15 and 17 years old (most typically 16), and applicants in our tertiary sample are 19-23 years old (but mostly 19). Further, we limit the majority of our analysis to programs with at least two applicants on either side of each admissions cutoff.

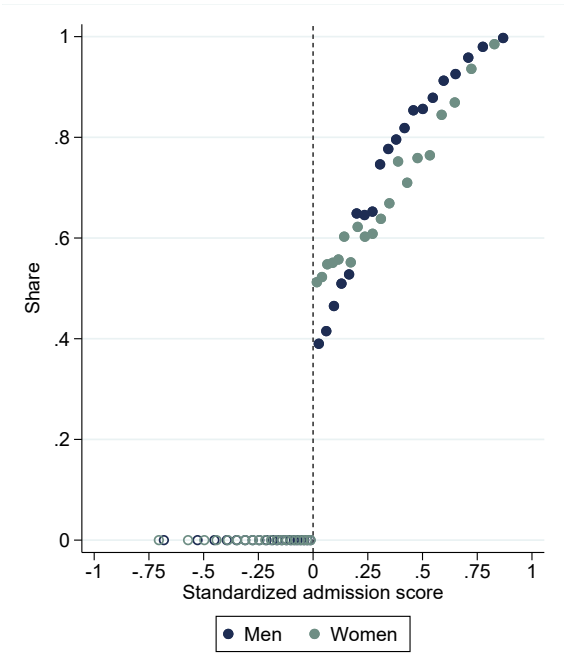
While interpreting our results, it is also important to recall that our estimates apply to the marginal applicant – i.e. they are estimates of local average treatment effects (LATE). These sets of applicants are an interesting group because they are people most likely to be affected by policy-changes which shift the number of places in secondary or tertiary education. Still, there may be several reasons to think that our estimates might not extend to applicants farther away from admissions cutoffs – those who would have attended further education no matter what, or those who would not attend further education even if spots were made available to them. In both samples, the marginal admitted applicant would likely be the weakest student in the program they are admitted to – which could have consequences on family formation. For example, a man just about admitted to higher education may struggle in their coursework and thereby be perceived as an unattractive partner amongst their peers. In contrast, the top of the class in higher education may be a particularly attractive partner. In this sense, the local nature of our regression discontinuity estimates may bias our estimates downward – compared to the effects for an infra-marginal applicant.

Figure 3: Admissions probabilities at the secondary and tertiary margins

(a) Admissions threshold to secondary education



(b) Admissions threshold to tertiary education



Notes: These figures plot the share of applicants admitted to secondary (a) and tertiary (b) education based on their admissions scores. At each margin, we set the number of bins based on admissions scores to 40 equally sized groups, and show these plots without fit lines (Korting et al., 2023).

3.3 Specification

To overcome selection bias, we focus on shifts in educational attainment caused by the unpredictable admissions cutoffs described above. We estimate how admission to secondary and tertiary education shape family formation outcomes using the specification described below.

$$Y_{igk} = \beta_1 Z_{ik} + \gamma_{0k} Score_{ik} + \gamma_{1k}(Score_{ik} \times Z_{ik}) \tag{2}$$

$$+\beta_2(Z_{ik} \times Male_i) + \rho_{0k}(Score_{ik} \times Male_i) + \rho_{1k}(Score_{ik} \times Z_{ik} \times Male_i)$$

$$+\alpha_{kg} + \lambda Male_i + \sum_{x=1}^{10} \delta_x P_{x,ikg} + \epsilon_{ik}$$

The variable Y_{igk} is the outcome variable (e.g. has a child, is married) for applicant i, with gender g, to cutoff k; Z is a binary variable which measures whether the applicant's score is positive and places them above the cutoff. An interaction between the applicant's score ($Score$) and the indicator variable allows the slope relating the admissions score and outcome (γ) to vary on either side of the cutoff. In our most flexible specification, we also allow the slope to vary by cutoff. To estimate the

effects of admission on family outcomes simultaneously for men and women, we interact each of the variables in our specification with the sex of the applicant ($Male_i$) (Row two of Equation 2) and also include the uninteracted variable for sex in the equation. An indicator variable for each cutoff by sex pair allows the baseline levels of each outcome to vary by sex (g) and cutoff (α_{kg}).

For women, the effect of admission on family outcomes is measured by β_1. For men, the effect of admission on family outcomes is measured by $\beta_1 + \beta_2$. Estimating the effects simultaneously for men and women allows us to assess whether any effects we uncover are distinct for men and women. We use a fuzzy RDD strategy where we define the treatment as admission to either secondary education or a university of applied science (D_i). This allows us to incorporate any differences in the effects on admissions probabilities as we assess the differential magnitudes for men and women.

Finally, we control for applicant type by including a propensity score measuring the application rank that is binding for each student ($\delta_x P_{ikg}$) (Abdulkadiroglu et al., 2022). So that our estimates are as local to the cutoff as possible, we use triangular kernel weights (Hahn et al., 2001). Since we estimate effects across several outcomes and years, we fix the bandwidth to 0.5 for all outcomes, which is close to optimal across different outcomes (Calonico et al., 2014). We cluster standard errors at the applicant level (Abadie et al., 2023).

3.4 Validity

Our identification assumption is that the potential outcomes of applicants develop smoothly across the admissions threshold for both samples (Lee and Lemieux, 2010). Two institutional features of the admissions processes support this assumption. First, the deferred acceptance algorithm used in both admissions procedures provide few incentives for strategic behavior. Second, since the application often takes place before people know even their own admissions scores, it is impossible for applicants to strategically manipulate their scores to gain an edge in admissions.

We also perform two types of tests to assess for whether the identifying assumption is satisfied. First, we test for whether we can observe any differences in observable characteristics of applicants across the cutoff by testing for balance in covariates across the admissions threshold. First, we replace the outcome variable (Y_{ik}) in our main specification (Equation 2) with each available background characteristic, and run separate regressions to test for covariate-level balance. These results are reported in Table 2 for each of our samples and for men and women separately, and show no evidence of discontinuities in observable characteristics at the cutoffs to secondary or tertiary education.

While the institutional features make manipulation of the admissions scores difficult, we test for any potential evidence of manipulation of these scores across the cutoff by plotting our data in histograms and running a McCrary bunching test. Figure A.6 shows no evidence of bunching at the admissions thresholds – and the results from the McCrary test support these visual results (Table 2).

Table 2: Covariate balance

	Women			Men		
	Below	Above	Discontinuity	Below	Above	Discontinuity
Panel A: Secondary education margin						
GPA	6.7	7.3	0.0 (0.0)	6.5	7.1	0.0 (0.0)
Finnish speaking	0.94	0.96	0.01 (0.01)	0.94	0.95	0.01 (0.01)
Swedish speaking	0.03	0.02	-0.01* (0.01)	0.03	0.03	0.00 (0.01)
Other language	0.03	0.02	-0.00 (0.01)	0.03	0.02	-0.01 (0.01)
Finnish	0.99	1.00	-0.00 (0.01)	0.99	0.99	-0.01 (0.01)
Urban	0.81	0.79	-0.01 (0.02)	0.77	0.79	0.04** (0.02)
Suburban	0.09	0.11	-0.00 (0.02)	0.11	0.10	-0.01 (0.01)
Rural	0.08	0.09	0.00 (0.01)	0.09	0.09	-0.02 (0.01)
Mother's income	22,652	24,338	-264 (1,054)	24,510	26,367	2,599** (1,125)
Mother in NEET	0.13	0.10	-0.01 (0.03)	0.11	0.09	-0.03 (0.02)
Mother secondary	0.62	0.66	0.01 (0.04)	0.66	0.71	0.04 (0.04)
Mother tertiary	0.06	0.09	-0.00 (0.02)	0.11	0.15	-0.01 (0.03)
Father's income	30,308	32,930	-1,088 (1,831)	32,911	36,502	-369 (1,989)
Father in NEET	0.18	0.16	-0.04 (0.03)	0.18	0.12	-0.06* (0.03)
Father secondary	0.53	0.59	0.03 (0.04)	0.58	0.65	0.08** (0.04)
Father tertiary	0.11	0.14	-0.03 (0.03)	0.17	0.24	0.05 (0.03)
Applicants/McCrary	1,389	3,911	-23 (56)	1,736	4,359	-30 (65)
Panel B: Tertiary education margin						
GPA	8.0	8.3	-0.0 (0.0)	7.5	7.8	0.0 (0.0)
Finnish speaking	0.96	0.94	0.01 (0.00)	0.96	0.95	0.00 (0.00)
Swedish speaking	0.02	0.05	0.00 (0.00)	0.03	0.04	-0.00 (0.00)
Other language	0.01	0.01	-0.01* (0.00)	0.02	0.01	-0.00 (0.00)
Finnish	1.00	1.00	0.00 (0.00)	1.00	1.00	0.00 (0.00)
Urban	0.51	0.51	0.03** (0.01)	0.58	0.55	-0.01 (0.02)
Suburban	0.20	0.19	-0.03*** (0.01)	0.17	0.19	0.02 (0.01)
Rural	0.29	0.30	0.01 (0.01)	0.24	0.26	-0.00 (0.01)
Mother's income	24,067	25,094	345 (391)	25,543	26,421	3,856 (3,620)
Mother in NEET	0.10	0.08	-0.01 (0.01)	0.09	0.09	0.00 (0.01)
Mother secondary	0.69	0.70	-0.01 (0.01)	0.68	0.70	0.02 (0.02)
Mother tertiary	0.09	0.10	-0.02* (0.01)	0.11	0.11	0.00 (0.01)
Father's income	33,988	35,591	-224 (845)	37,668	37,412	-1,794 (1,598)
Father in NEET	0.12	0.10	-0.01 (0.01)	0.11	0.10	0.01 (0.01)
Father secondary	0.61	0.62	0.01 (0.01)	0.62	0.63	0.01 (0.02)
Father tertiary	0.13	0.15	-0.01 (0.01)	0.16	0.17	-0.00 (0.01)
Applicants/McCrary	8,758	10,967	21 (53)	5,425	10,017	-26 (55)

Notes: Columns 1, 2, 4, and 5 show the mean background characteristics above and below the cutoffs from both the secondary and tertiary regression discontinuity designs above. Columns 3 and 6 report results from a test for balance in these characteristics at the cutoff (p-values: * < 0.10, **< 0.05, and *** < 0.01).

4 Results

4.1 Main results

Using admissions cutoffs that increase the educational attainment of marginal applicants to both secondary and tertiary education, we study the causal effect of education on men's and women's family formation outcomes.

We start by examining the effects of education on the probability that men and women have a child through their late thirties (Figure 4 and Tables A.1-A.2). For women, admission to further education increases the probability of having a child by age 37 by about 5 percentage points at both the secondary or tertiary margins. In contrast, for men the point estimates of the effects of increased educational attainment on the probability of having a child are close to zero. Although we lack statistical power to rule out that the estimates are different from zero or different across genders each year – these estimates are consistent across both the secondary and tertiary margins and present regardless of the specific age we look at. This gender differential is also present when we look at the effects of education on number of children (Figure A.9).

Still, it is possible that education could have a positive effect on childbearing for men – if we could follow them long enough. Men admitted to higher education experience an initial delay in childbearing, and at age 30 are 8 percentage points less likely to have a child than their less educated peers, but catch up by age 38. Nonetheless, these estimates are stable over the last observation years and the descriptive figures suggest that gaps in both men's and women's fertility rates by education levels have stabilized by age 35 (Figure A.5).

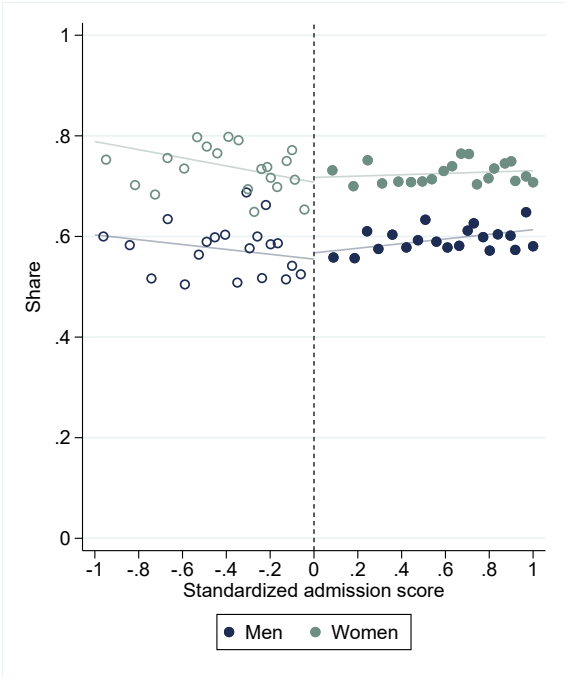
Next, we study the effects of educational attainment on cohabitation (Figure 5 and Tables A.1-A.2). As for fertility, education increases the probability of cohabitation by about 5 percentage points for women. Our results do not suggest a positive effect between education and cohabitation for men. This gendered pattern even more pronounced when we look at marriage (Figure A.10).

For women, these estimates of local average treatment effects (LATE) correspond quite closely to the mean gaps in family formation outcomes by education level (see Figure 2). In contrast, while mean differences in family formation by educational attainment appear about as large for men as for women – our estimates suggest that, at least for the marginal applicant, this relationship is not driven by educational attainment itself.

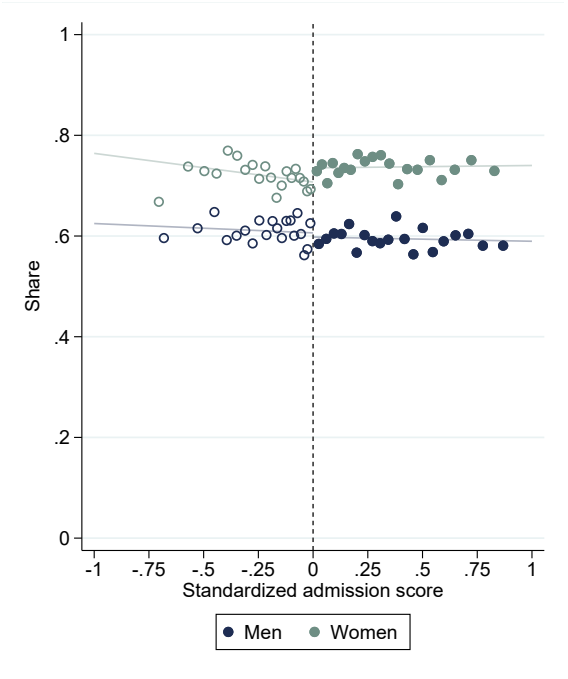
Together the results from the secondary and tertiary margins suggest that educational attainment can affect family formation outcomes – and do so in divergent ways based on gender. These results stand in contrast to prior research which argues that education may make women less attractive on the marriage market while the strengthening the prospects of family formation for men (Baudin et al., 2015; Bertrand et al., 2021).

Figure 4: Effects of admission to further education on having a child

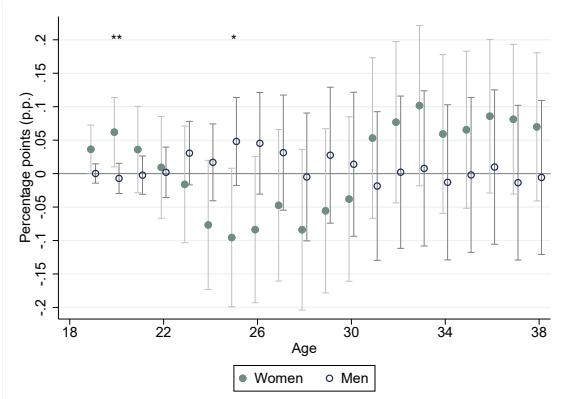
(a) Has child by age 38, admission to secondary



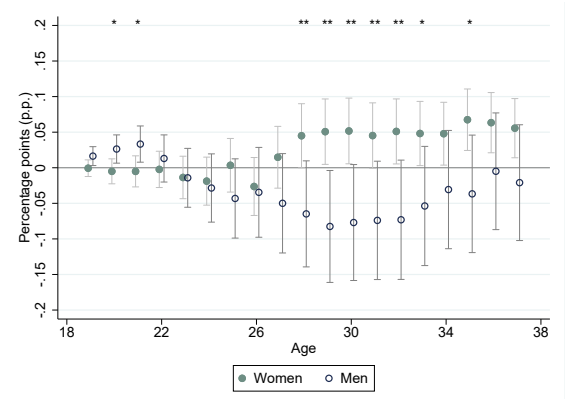
(b) Has child by age 37, admission to tertiary



(c) Has child, admission to secondary



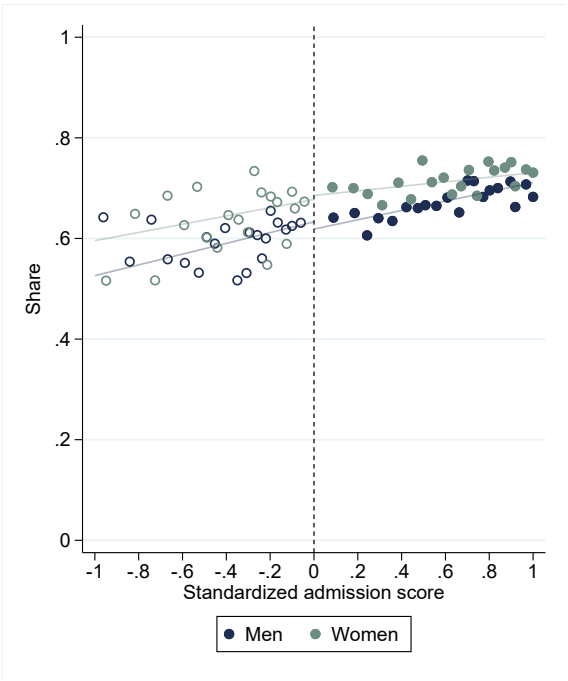
(d) Has child, admission to tertiary



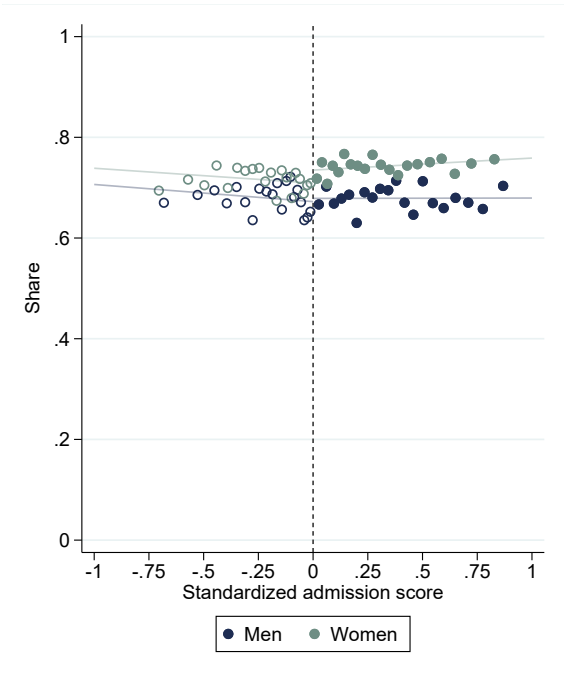
Notes: Figures (a) and (b) plot the probability men and women have a child by standardized admissions score. Figures (c) and (d) show the RDD estimates of the effects of admission to further education on having a child over the life-cycle, as well as their 90-percent confidence intervals. Figures (a) and (c) focus on students at the margin of admission to secondary education, while Figures (b) and (d) focus on students on the margin of admission to tertiary education. Results are reported separately for men and women. Significance stars are used to denote whether we are able to detect statistically significant differences in the effects for men and women (p-values: * < 0.10, **< 0.05, and *** < 0.01).

Figure 5: Effects of admission to further education on cohabitation

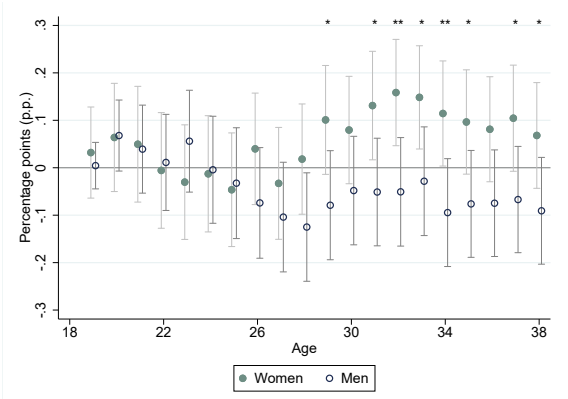
(a) Cohabiting at age 38, admission to secondary



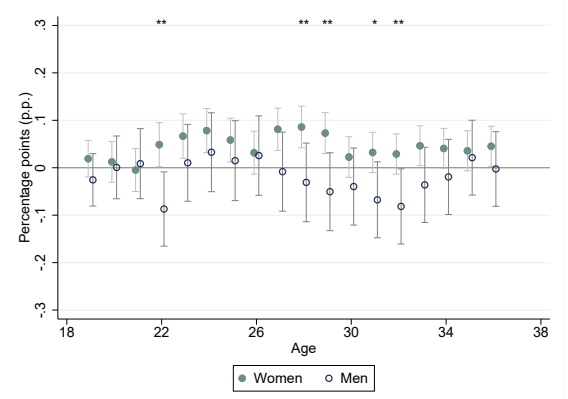
(b) Cohabiting at age 36, admission to tertiary



(c) Cohabitation, admission to secondary



(d) Cohabitation, admission to tertiary



Notes: Figures (a) and (b) plot the probability men and women are cohabiting by standardized admissions score. Figures (c) and (d) show the RDD estimates of the effects of admission to further education on cohabiting over the life-cycle, as well as their 90-percent confidence intervals. Figures (a) and (c) focus on students at the margin of admission to secondary education, while Figures (b) and (d) focus on students on the margin of admission to tertiary education. Results are reported separately for men and women. Significance stars are used to denote whether we are able to detect statistically significant differences in the effects for men and women (p-values: * < 0.10, **< 0.05, and *** < 0.01).

4.2 Robustness

We check to see that our results are not sensitive to the specific model we use. Estimates from alternative specifications are plotted alongside those from our main results in Figure A.11. First, while the current understanding in applied econometrics argues that standard errors should be clustered at the individual – rather than cutoff – level in designs like ours (Abadie et al., 2023), we also estimate our results with more conservative standard errors. While clustering standard errors at the cutoff level leads to slightly larger confidence intervals, these changes are small and do not push the new p-values across any thresholds for statistical significance.

We also re-estimate our regression discontinuity model, allowing there to be different slopes on either side of the admissions threshold – not just for both genders – but also for every single cutoff. If anything, the results from these specifications suggest that we slightly under-estimate the magnitudes of our main effects. That said, the results from these more flexible models do not change the statistical significance or qualitative nature of our main results. Since we cannot rule out that the results from the much more computationally demanding mode are any different from those from a sparser model, we choose to use the more sparse model in our main results. This speeds up the computational time required to run our estimates by several orders of magnitude. Moreover, while the fully interacted model does provide a more flexible design, it is more empirically demanding – and rests on the assumption that any differences in slopes that vary by both gender and cutoff are real – something we do not have statistical power to ensure.

Even though Table 2 shows no signs of imbalance observable characteristics of applicants at the cutoff, we re-estimate our model including a rich array of controls. These estimates do almost nothing to change our main results, suggesting that our results are not driven by differences in the characteristics of individuals across the cutoffs.

Next, we study whether our choice of estimation sample might drive our main results. In our main estimates, we require that there are at least two applicants of the same gender on each side of the cutoff. When we tighten this requirement by including cutoffs with more applicants on either side of the threshold our results remain remarkably stable. This is despite the sample size changing from 10,599 to 6,304 when we jump from two to five applicants on either side at the secondary margin, and from 35,120 to 30,237 when we jump from two to five applicants on either side at the tertiary margin.

Finally, we test for sensitivity to the bandwidth we use for our regression discontinuity design (Figure A.12). To ensure that our sample is consistent both across outcomes as well as across years within outcomes, in our main estimates we fix our bandwidth to 0.5 in both the secondary and tertiary education samples. The results are robust for the range bandwidths, suggesting that our estimates are not sensitive to the choice of bandwidth.

4.3 Explaining our main results

Our results suggest that education increases family formation outcomes for women, but not men. Hypotheses concerning the relationship between education, gender, and family formation typically center around themes of labor market opportunities, comparative advantage in household specialization, gender norms, and family policy.

A common finding has been that the relationship between education and family formation is linear and increasing for men, while hump-shaped for women (Baudin et al., 2015). An explanation for this pattern has been that while education strengthens men's position as the family breadwinner, highly educated women face greater opportunity costs from specializing in household production (see also Becker (1981) or Bertrand et al. (2015)).

To understand if the effects of education on economic resources might explain our results on family formation, we re-estimate our main equation, replacing the outcome with income. Admission to secondary education has no effect on income for either men or women (Figure A.13). Admission to tertiary education, however, has large positive effects on men's income. In contrast, women experience an initial income boost from access to tertiary education, but this quickly disappears. If education were to increase family formation outcomes by increasing family resources, we should expect to see positive effects of increased educational attainment on men's family formation outcomes at the tertiary margin. Further, if anything, our results show that increased educational attainment increases women's earnings, and thereby their opportunity costs of specializing in household production. As such, theories centered around opportunity costs or economic resources are unlikely to explain our results.

For women, the empirical patterns underlying these theories have begun to shift. For example, Isen and Stevenson (2010) show that the skilled-unskilled marriage gap amongst women in the United States has reversed, and today highly educated women are more likely to marry than their less educated counterparts. And, Goldin (2021) argues that highly educated women in the United States today are increasingly likely to want both a career and family. As discussed in Section 1.2, we see these same patterns in our data.

A focus of recent research has been to explain these changes. Bertrand et al. (2021) observe that these shifts do not extend to countries with strong gender norms, and suggest weakened gender norms regarding household specialization may explain the changes in the relationship between women's education and family formation. As they also point out, the Nordic countries stand out in terms of gender equality, even compared to other European countries (Figure A.14). Alongside weaker gender norms, Doepke et al. (2023) highlight the importance of policies promoting the well-being of families and improving women's job security as important factors making it possible for women to have both successful careers and help raise a family. Both these channels suggest that women in relatively egalitarian societies with strong family policies may not experience a penalty in

terms of family formation.

Still, neither of these channels explains why we see positive effects of education on family formation for women but not for men. However, if education shifts women into more flexible jobs or those with more family supports, education may also signal that women are better positioned to combine career and family. For example, Adams-Prassl et al. (2022) show that white collar jobs are also more flexible in providing opportunities to work from home. In another recent paper, Harrington and Kahn (2023) show that the pandemic-induced ability to work from home reduced motherhood gaps in labor market outcomes considerably.

We build on prior research and offer an additional – skill-based – explanation for why education might increase the rates of family formation for women in particular. The past decades have seen a rapid increase in social skills and, if anything, a decrease in the importance of cognitive skills (Deming, 2017; Jokela et al., 2017; Edin et al., 2022). While schools are still working on ways to target social skills – parents have been recognized as a crucial input for the development of these types of higher order skills (Doepke and Zilibotti, 2017; Black et al., 2018). Moreover, recent research from Sweden suggests that parents are aware of these shifts in skill-demand (Hermo et al., 2022). And, although household activities have become more equal, women bear the brunt of childcare responsibilities – even in relatively gender equal countries like Finland (Kleven et al., 2023). Further, research from the United States shows that despite greater opportunity costs faced by highly educated mothers, women with high levels of education spend more time in childcare related activities even though they enjoy childcare related activities less than their less-educated peers (Kalil et al., 2023). Together, these findings highlight the increased importance of maternal education in shaping their children's life chances.

If educated women are perceived to be more capable parents, the increased demand for social skills could increase the demand for highly educated women in the marriage market even in the absence of increased labor market returns. In India, for example, Andrew and Adams-Prassl (2022) show that parents invest in girls' education because of the returns in the marriage – and not the labor – market. Given the strong correlation between education and latent parenting ability, education could signal better parenting ability even if education had no causal effect on parenting practices (Choo and Siow, 2006; Anderberg et al., 2022). In contexts like Finland, where women are over-represented at higher levels of education, women with low educational qualifications may be perceived as negatively selected in terms of parenting ability.

Our results also challenge the idea that increased educational attainment and earnings should increase the likelihood that men form families (Becker, 1981; Baudin et al., 2015; Autor et al., 2019). There is also some recent research questioning the empirical evidence in support of breadwinner norms, by which men should earn more than their spouses (Zinovyeva and Tverdostup, 2021; Binder and Lam, 2022). However, within the framework laid out by Becker (1981), one potential explanation

for this could be that higher incomes increase the value men experience by remaining single (Lerman, 1989). Earnings could increase the value of leisure time – making family life less attractive. Or, if the earnings premium resulting from higher education makes men more attractive on the marriage market, men may perceive a lower risk to remaining single and delay cohabitation – potentially until it is too late to find a suitable spouse.

5 Discussion

We study the effects of educational attainment on men's and women's family formation outcomes using regression discontinuity designs generated by centralized application systems to secondary and tertiary education in Finland. Our results suggest that while admission to further education increases family formation for women, but indicate no – or even a negative – effect for men. These results stand in contrast to prior research documenting that educated women may face a marriage penalty (Baudin et al., 2015). More recently authors have argued that gender norms (Esping-Andersen and Billari, 2015; Bertrand et al., 2021) or the increased compatibility between career and family can erase this penalty (Goldin, 2021; Doepke et al., 2023). Additionally, we suggest that in contexts with relatively equal gender norms and strong family policies, like contemporary Finland, highly educated women may face a premium on the marriage market if they are perceived as possessing better parenting abilities.

References

Aaronson, D., Lange, F., and Mazumder, B. (2014). Fertility transitions along the extensive and intensive margins. *American Economic Review*, 104(11):3701–3724.

Abadie, A., Athey, S., Imbens, G. W., and Wooldridge, J. M. (2023). When should you adjust standard errors for clustering? *The Quarterly Journal of Economics*, 138(1):1–35.

Abdulkadiroğlu, A., Angrist, J., and Pathak, P. (2014). The elite illusion: Achievement effects at boston and new york exam schools. *Econometrica*, 82(1):137–196.

Abdulkadiroglu, A., Angrist, J. D., Narita, Y., and Pathak, P. (2022). Breaking ties: Regression discontinuity design meets market design. *Econometrica*, 90(1):117–151.

Adams-Prassl, A., Boneva, T., Golin, M., and Rauh, C. (2022). Work that can be done from home: Evidence on variation within and across occupations and industries. *Labour Economics*, 74:102083.

Amin, V. and Behrman, J. R. (2014). Do more-schooled women have fewer children and delay childbearing? evidence from a sample of us twins. *Journal of Population Economics*, 27:1–31.

Anderberg, D., Bagger, J., Bhaskar, V., and Wilson, T. (2022). Marriage market equilibrium, qualifications, and ability.

Andrew, A. and Adams-Prassl, A. (2022). Revealed beliefs and the marriage market return to education. Technical report, Institute for Fiscal Studies.

Autor, D., Dorn, D., and Hanson, G. (2019). When work disappears: Manufacturing decline and the falling marriage market value of young men. *American Economic Review: Insights*, 1(2):161–178.

Bar, M., Hazan, M., Leukhina, O., Weiss, D., and Zoabi, H. (2018). Why did rich families increase their fertility? inequality and marketization of child care. *Journal of Economic Growth*, 23:427–463.

Baudin, T., De La Croix, D., and Gobbi, P. E. (2015). Fertility and childlessness in the united states. *American Economic Review*, 105(6):1852–1882.

Becker, G. S. (1965). A theory of the allocation of time. *The Economic Journal*, 75(299):493–517.

Becker, G. S. (1981). *A treatise on the family*. Harvard University Press.

Bertrand, M., Cortes, P., Olivetti, C., and Pan, J. (2021). Social norms, labour market opportunities, and the marriage gap between skilled and unskilled women. *The Review of Economic Studies*, 88(4):1936–1978.

Bertrand, M., Kamenica, E., and Pan, J. (2015). Gender identity and relative income within households. *The Quarterly Journal of Economics*, 130(2):571–614.

Binder, A. J. and Lam, D. (2022). Is there a male-breadwinner norm? the hazards of inferring preferences from marriage market outcomes. *Journal of Human Resources*, 57(6):1885–1914.

Black, S. E., Devereux, P. J., and Salvanes, K. G. (2008). Staying in the classroom and out of the maternity ward? the effect of compulsory schooling laws on teenage births. *The Economic Journal*, 118(530):1025–1054.

Black, S. E., Grönqvist, E., and Öckert, B. (2018). Born to lead? the effect of birth order on noncognitive abilities. *Review of Economics and Statistics*, 100(2):274–286.

Bongaarts, J. (1999). Fertility decline in the developed world: Where will it end? *American Economic Review*, 89(2):256–260.

Calonico, S., Cattaneo, M. D., and Titiunik, R. (2014). Robust nonparametric confidence intervals for regression-discontinuity designs. *Econometrica*, 82(6):2295–2326.

Chen, J. and Guo, J. (2022). The effect of female education on fertility: Evidence from china's compulsory schooling reform. *Economics of Education Review*, 88:102257.

Choo, E. and Siow, A. (2006). Who marries whom and why. *Journal of Political Economy*, 114(1):175–201.

Currie, J. and Moretti, E. (2003). Mother's education and the intergenerational transmission of human capital: Evidence from college openings. *The Quarterly Journal of Economics*, 118(4):1495–1532.

Cygan-Rehm, K. and Maeder, M. (2013). The effect of education on fertility: Evidence from a compulsory schooling reform. *Labour Economics*, 25:35–48.

Deming, D. J. (2017). The growing importance of social skills in the labor market. *The Quarterly Journal of Economics*, 132(4):1593–1640.

Doepke, M., Hannusch, A., Kindermann, F., and Tertilt, M. (2023). The economics of fertility: A new era. In *Handbook of the Economics of the Family*, volume 1, pages 151–254. Elsevier.

Doepke, M. and Zilibotti, F. (2017). Parenting with style: Altruism and paternalism in intergenerational preference transmission. *Econometrica*, 85(5):1331–1371.

Edin, P.-A., Fredriksson, P., Nybom, M., and Öckert, B. (2022). The rising return to noncognitive skill. *American Economic Journal: Applied Economics*, 14(2):78–100.

EIGE (2023). *Gender Equality Index 2023*. European Institute for Gender Equality.

Esping-Andersen, G. and Billari, F. C. (2015). Re-theorizing family demographics. *Population and development review*, 41(1):1–31.

Fernández, R., Fogli, A., and Olivetti, C. (2004). Mothers and sons: Preference formation and female labor force dynamics. *The Quarterly Journal of Economics*, 119(4):1249–1299.

Finnish National Board of Education (2023a). Secondary application registry [toisen asteen yhteishakurekisteri]. Technical report, Helsinki: Statistics Finland. (accessed January 31 , 2024).

Finnish National Board of Education (2023b). University of applied sciences application registry [ammattikorkeakoulutukseen hakeneet]. Technical report, Helsinki: Statistics Finland. (accessed January 31 , 2024).

Fort, M., Schneeweis, N., and Winter-Ebmer, R. (2016). Is education always reducing fertility? evidence from compulsory schooling reforms. *The Economic Journal*, 126(595):1823–1855.

Geruso, M. and Royer, H. (2018). The impact of education on family formation: Quasi-experimental evidence from the uk. Technical report, National Bureau of Economic Research.

Goldin, C. (2021). *Career and family: Women's century-long journey toward equity*. Princeton University Press.

Goldin, C. and Katz, L. F. (2009). *The Race Between Education and Technology*. Harvard University Press.

Greenwood, J., Guner, N., Kocharkov, G., and Santos, C. (2016). Technology and the changing family: A unified model of marriage, divorce, educational attainment, and married female labor-force participation. *American Economic Journal: Macroeconomics*, 8(1):1–41.

Grönqvist, H. and Hall, C. (2013). Education policy and early fertility: Lessons from an expansion of upper secondary schooling. *Economics of Education Review*, 37:13–33.

Hahn, J., Todd, P., and Van der Klaauw, W. (2001). Identification and estimation of treatment effects with a regression-discontinuity design. *Econometrica*, 69(1):201–209.

Harper, S. (2014). Economic and social implications of aging societies. *Science*, 346(6209):587–591.

Harrington, E. and Kahn, M. (2023). Has the rise of work-from-home reduced the motherhood penalty in the labor market? Technical report.

Hazan, M., Weiss, D., and Zoabi, H. (2023). Highly educated women are no longer childless: The role of marketization. *Available at SSRN 4369085*.

Hermo, S., Päällysaho, M., Seim, D., and Shapiro, J. M. (2022). Labor market returns and the evolution of cognitive skills: Theory and evidence. *The Quarterly Journal of Economics*, 137(4):2309–2361.

Hoekstra, M. (2009). The effect of attending the flagship state university on earnings: A discontinuity-based approach. *The Review of Economics and Statistics*, 91(4):717–724.

Humlum, M. K., Kristoffersen, J. H., and Vejlin, R. (2017). College admissions decisions, educational outcomes, and family formation. *Labour Economics*, 48:215–230.

Huttunen, K., Pekkarinen, T., Uusitalo, R., and Virtanen, H. (2023). Lost boys? secondary education and crime. *Journal of Public Economics*, 218:104804.

Impicciatore, R. and Tomatis, F. (2020). The nexus between education and fertility in six european countries. *Genus*, 76(1):1–20.

Isen, A. and Stevenson, B. (2010). Women's education and family behavior: Trends in marriage, divorce and fertility. Technical report, National Bureau of Economic Research.

Jalovaara, M. and Andersson, L. (2023). A register-based account of period trends in union prevalence, entries, and exits by educational level for men and women in finland. *Demographic Research*, 48:373–386.

Jalovaara, M., Neyer, G., Andersson, G., Dahlberg, J., Dommermuth, L., Fallesen, P., and Lappegård, T. (2019). Education, gender, and cohort fertility in the nordic countries. *European Journal of Population*, 35:563–586.

Jokela, M., Pekkarinen, T., Sarvimäki, M., Terviö, M., and Uusitalo, R. (2017). Secular rise in economically valuable personality traits. *Proceedings of the National Academy of Sciences*, 114(25):6527–6532.

Kalil, A., Mayer, S., Delgado, W., and Gennetian, L. A. (2023). Education gradients in parental time investment and subjective well-being. Technical report, National Bureau of Economic Research.

Kleven, H. and Landais, C. (2017). Gender inequality and economic development: fertility, education and norms. *Economica*, 84(334):180–209.

Kleven, H., Landais, C., and Leite-Mariante, G. (2023). The child penalty atlas. Technical report, National Bureau of Economic Research.

Koebe, J. and Marcus, J. (2022). The length of schooling and the timing of family formation. *CESifo Economic Studies*, 68(1):1–45.

Korting, C., Lieberman, C., Matsudaira, J., Pei, Z., and Shen, Y. (2023). Visual inference and graphical representation in regression discontinuity designs. *The Quarterly Journal of Economics*, page qjad011.

Lavy, V. and Zablotsky, A. (2015). Women's schooling and fertility under low female labor force participation: Evidence from mobility restrictions in israel. *Journal of Public Economics*, 124:105–121.

Lee, D. S. and Lemieux, T. (2010). Regression discontinuity designs in economics. *Journal of economic literature*, 48(2):281–355.

Lefgren, L. and McIntyre, F. (2006). The relationship between women's education and marriage outcomes. *Journal of Labor Economics*, 24(4):787–830.

Lerman, R. I. (1989). Employment opportunities of young men and family formation. *The American Economic Review*, 79(2):62–66.

McCrary, J. and Royer, H. (2011). The effect of female education on fertility and infant health: evidence from school entry policies using exact date of birth. *American Economic Review*, 101(1):158–195.

Miettinen, A., Rotkirch, A., Szalma, I., Donno, A., and Tanturri, M.-L. (2015). Increasing childlessness in europe: Time trends and country differences. *Families and Societies. Working paper series*, 3.

Monstad, K., Propper, C., and Salvanes, K. G. (2008). Education and fertility: Evidence from a natural experiment. *The Scandinavian Journal of Economics*, 110(4):827–852.

Myrskylä, M., Kohler, H.-P., and Billari, F. C. (2009). Advances in development reverse fertility declines. *Nature*, 460(7256):741–743.

OECD (2021). Delivering quality education and health care to all.

OECD (2022). *Education at a glance: OECD indicators 2022*. OECD Paris.

Savelieva, K., Jokela, M., and Rotkirch, A. (2023). Reasons to postpone childbearing during fertility decline in finland. *Marriage & Family Review*, 59(3):253–276.

Silles, M. A. (2011). The effect of schooling on teenage childbearing: evidence using changes in compulsory education laws. *Journal of Population Economics*, 24:761–777.

Silliman, M. and Virtanen, H. (2022). Labor market returns to vocational secondary education. *American Economic Journal: Applied Economics*, 14(1):197–224.

Sleebos, J. (2003). Low fertility rates in oecd countries: facts and policy responses.

Statistics Finland (2023a). Degree registry [tutkintorekisteri]. Technical report, Statistics Finland, Helsinki: Statistics Finland Research Services. (accessed January 31 , 2024).

Statistics Finland (2023b). Folk basic data module [perustietomoduuli]. Technical report, Statistics Finland, Helsinki: Statistics Finland Research Services. (accessed January 31 , 2024).

Statistics Finland (2023c). Folk child-parent module [lapsi-vanhemmat]. Technical report, Statistics Finland, Helsinki: Statistics Finland Research Services. (accessed January 31 , 2024).

Statistics Finland (2023d). Folk cohabitation module [asuinliitot]. Technical report, Statistics Finland, Helsinki: Statistics Finland Research Services. (accessed January 31 , 2024).

Statistics Finland (2023e). Folk employment module [työssäkäyntimoduuli]. Technical report, Statistics Finland, Helsinki: Statistics Finland Research Services. (accessed January 31 , 2024).

Statistics Finland (2023f). Folk income module [tulotietomoduuli]. Technical report, Statistics Finland, Helsinki: Statistics Finland Research Services. (accessed January 31 , 2024).

Statistics Finland (2023g). Student registry [opiskelurekisteri]. Technical report, Statistics Finland, Helsinki: Statistics Finland Research Services. (accessed January 31 , 2024).

Tropf, F. C. and Mandemakers, J. J. (2017). Is the association between education and fertility postponement causal? the role of family background factors. *Demography*, 54(1):71–91.

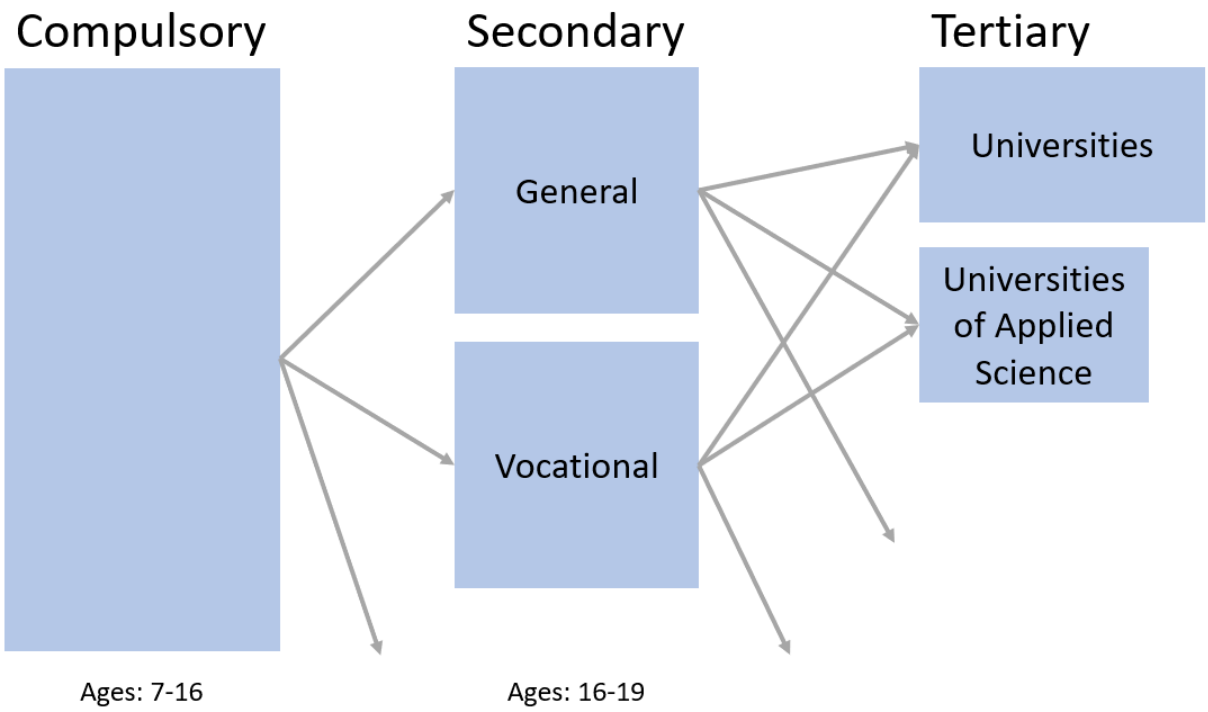
Zimmerman, S. D. (2014). The returns to college admission for academically marginal students. *Journal of Labor Economics*, 32(4):711–754.

Zinovyeva, N. and Tverdostup, M. (2021). Gender identity, coworking spouses, and relative income within households. *American Economic Journal: Applied Economics*, 13(4):258–284.

A Appendix

A.1 Finnish education system

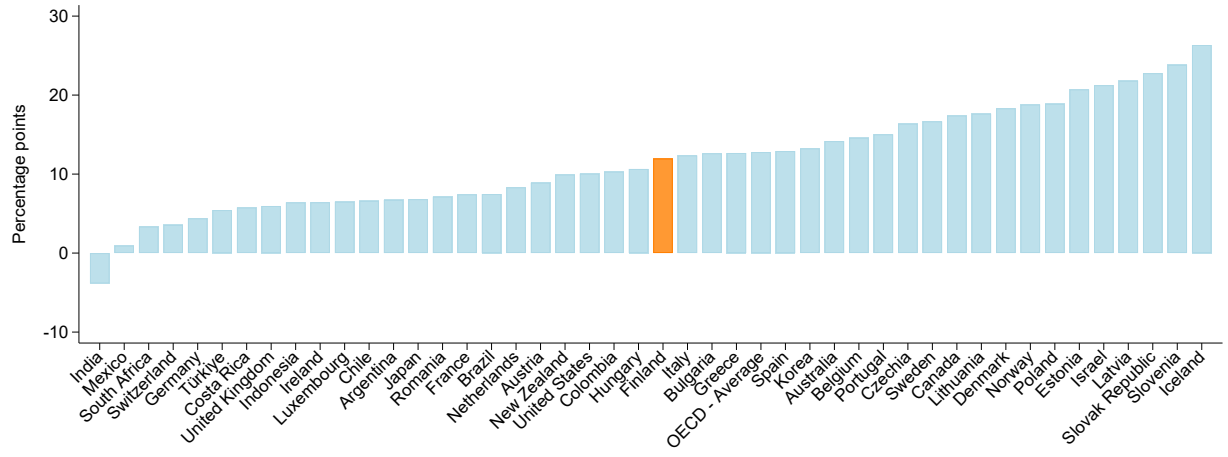
Figure A.1: Educational pathways in Finland



Notes: This figure depicts possible pathways through the Finnish education system. As the figure suggests, not all students in compulsory education complete an upper secondary degree. Even fewer complete a tertiary degree.

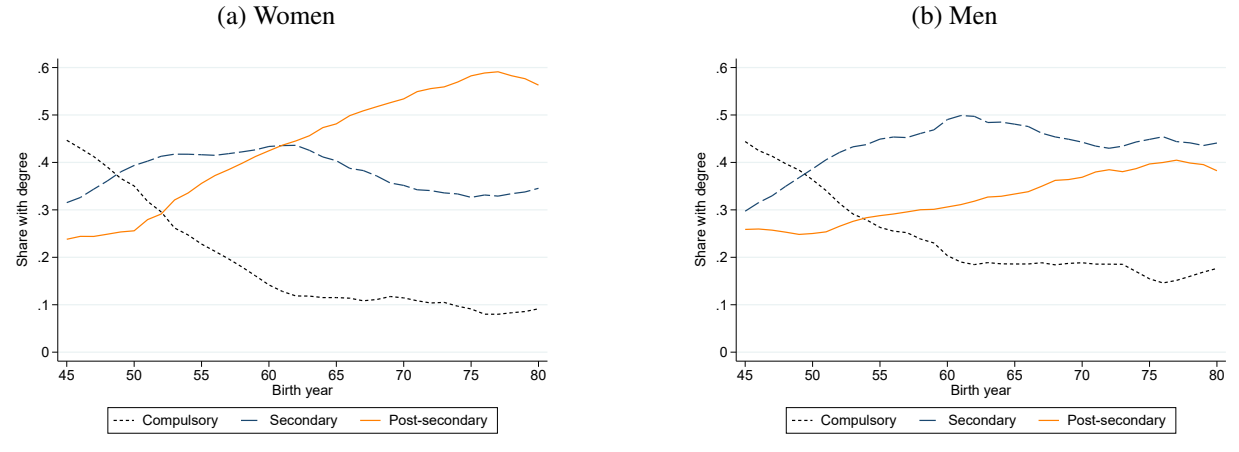
A.2 Cohort trends in education and fertility by gender

Figure A.2: Female-male difference in higher education



Notes: This figure plots the difference in higher educational attainment between men and women across OECD countries, for people aged 25-34. Data: OECD (2022).

Figure A.3: Cohort trends in educational attainment (by age 42) and gender

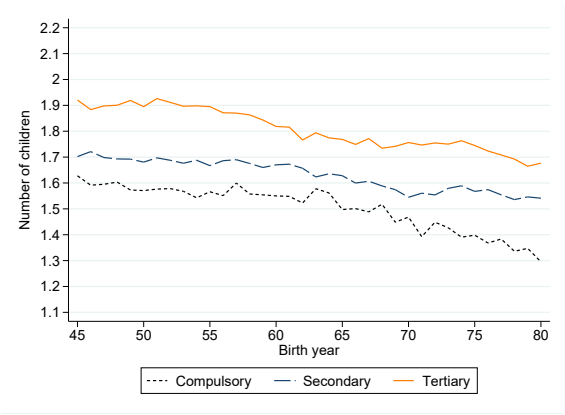


Notes: These figures show the shares of birth cohorts with various levels of educational attainment by gender.

Figure A.4: Cohort trends in fertility by education and gender

(a) Number of children (age 42), women

(b) Number of children (age 42), men

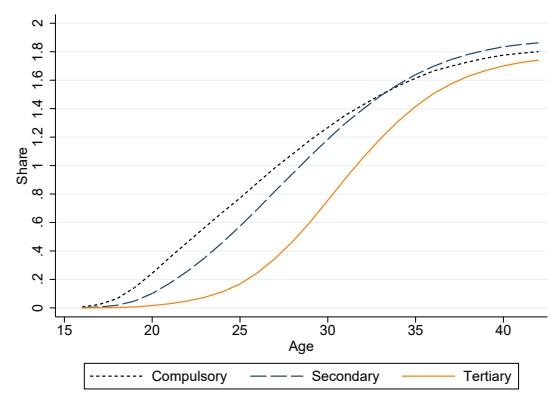


Notes: These figures show the portion of each birth cohort who have a child by the age of 42, by gender.

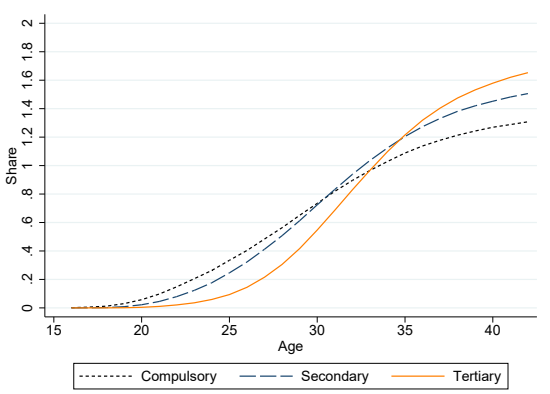
A.3 Family formation through age 42 by education and gender

Figure A.5: Alternative measures of family formation through age 42

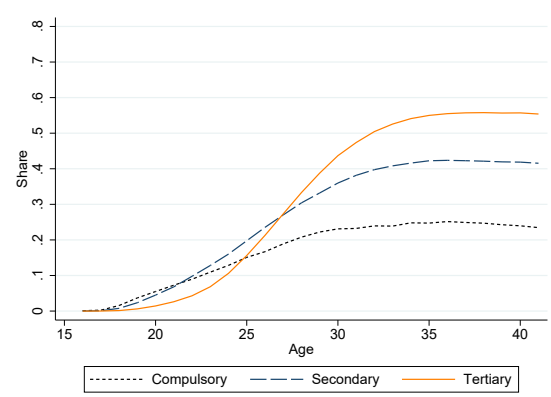
(a) Number of children, women



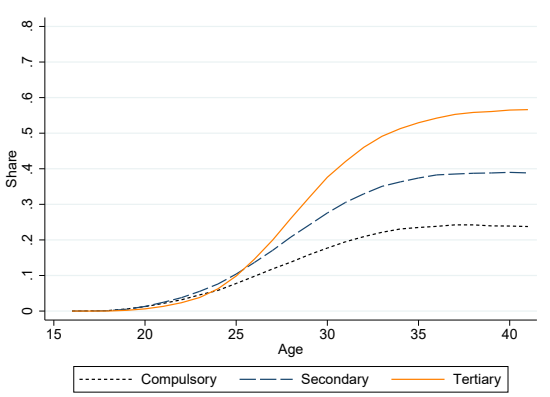
(b) Number of children, men



(c) Married, women



(d) Married, men

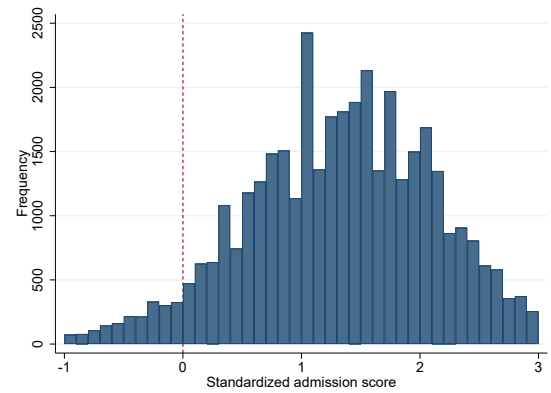


Notes: These figures plot our two alternative measures of family formation from ages 16 to 42 by each person's highest level of education and gender. Figures (a) and (b) plot the mean number of children each person has at each age – where having no children is coded as a zero. Figures (c) and (d) plot the portion of each cohort which is married at each age. So that we can follow this sample through age 42, these figures are based on cohorts born between 1979 and 1980.

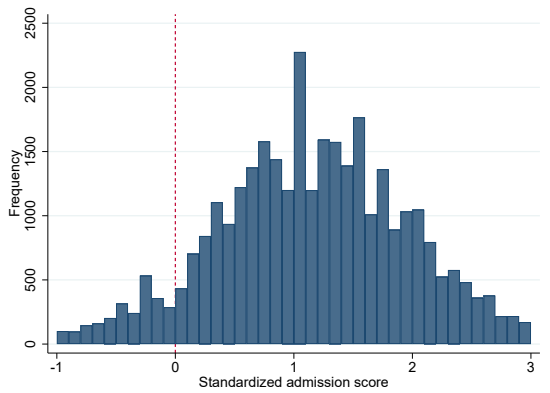
A.4 Frequency of observations across the cutoff

Figure A.6: Density of observations across the cutoff

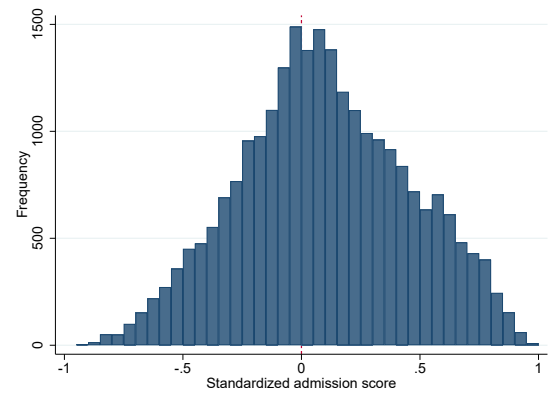
(a) Women, secondary margin



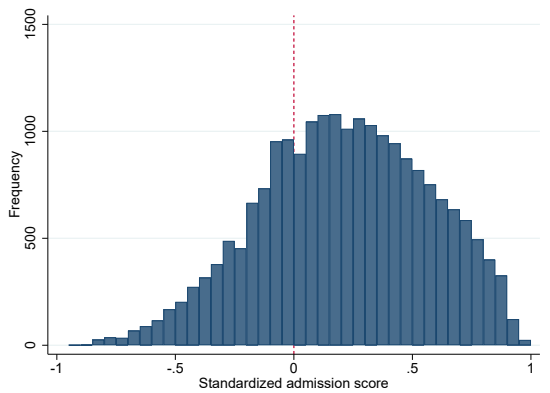
(b) Men, secondary margin



(c) Women, tertiary margin



(d) Men, tertiary margin

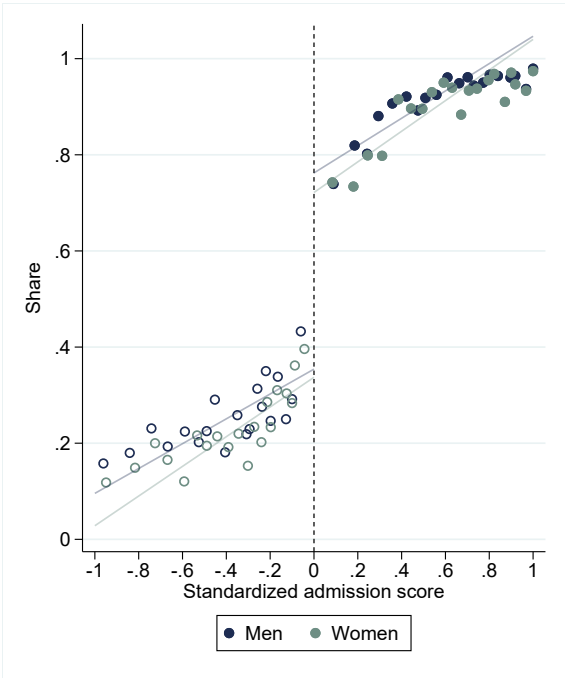


Notes: These figures plot the distribution of male and female applicants to secondary and tertiary education by their admissions scores in our two estimation samples. Panels (a) and (b) focus on admissions to secondary education. Panels (c) and (d) focus on admissions to tertiary education.

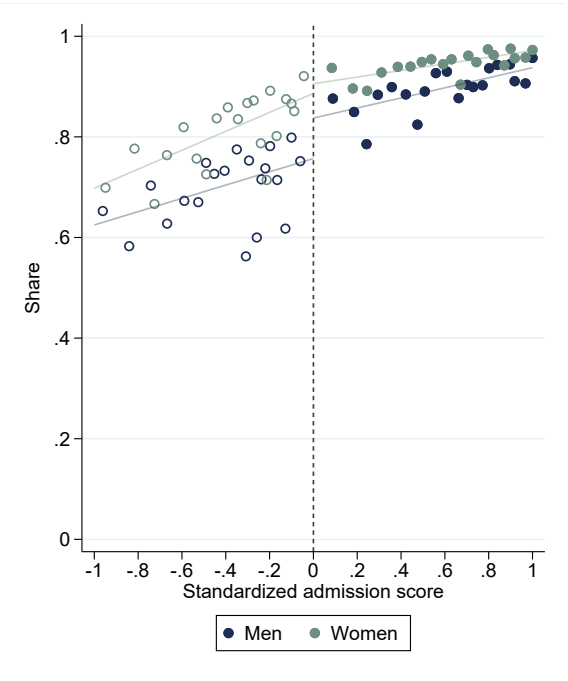
A.5 Educational outcomes across the cutoff

Figure A.7: Secondary education margin: enrollment and graduation

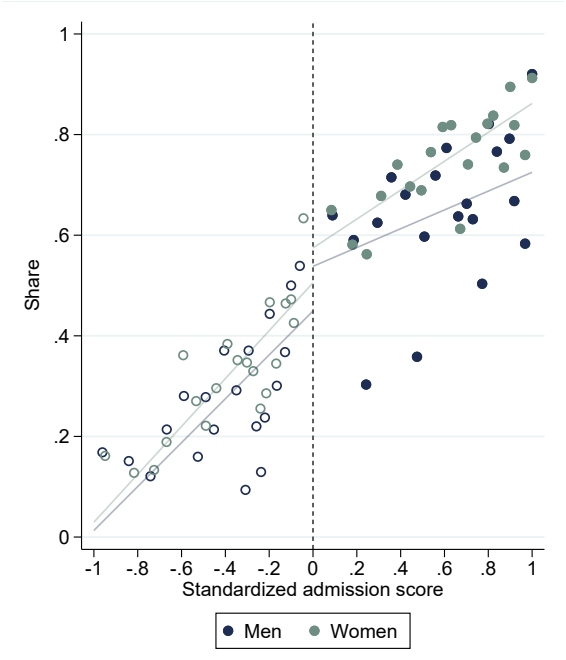
(a) Enrollment to secondary education



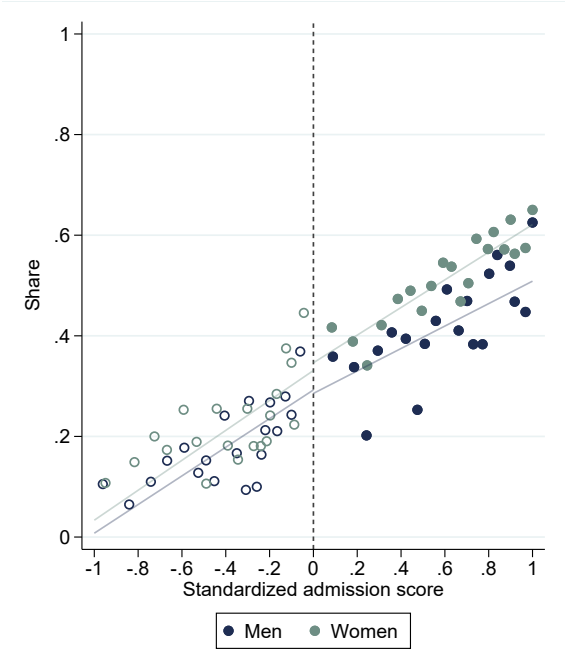
(b) Secondary degree, age 36



(c) General secondary degree, age 36



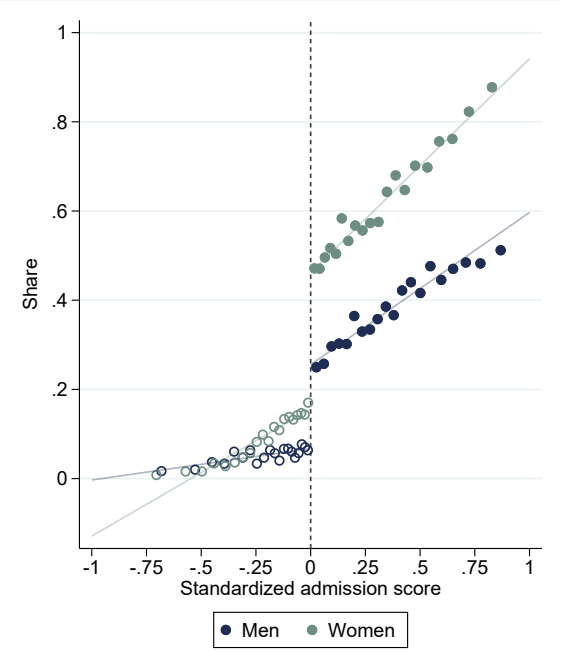
(d) Tertiary degree, 36



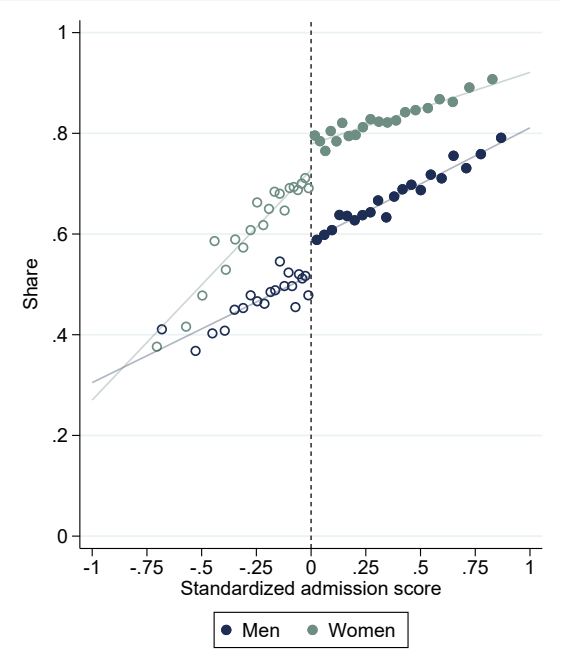
Notes: These figures plot the share of applicants enrolled in secondary education (a) and completing degree in secondary or tertiary education (b)-(d) based on their admissions scores. We set the number of bins based on admissions scores to 40 equally sized groups, and show these plots with linear fit-lines based on triangular weights.

Figure A.8: Tertiary education margin: enrollment and graduation

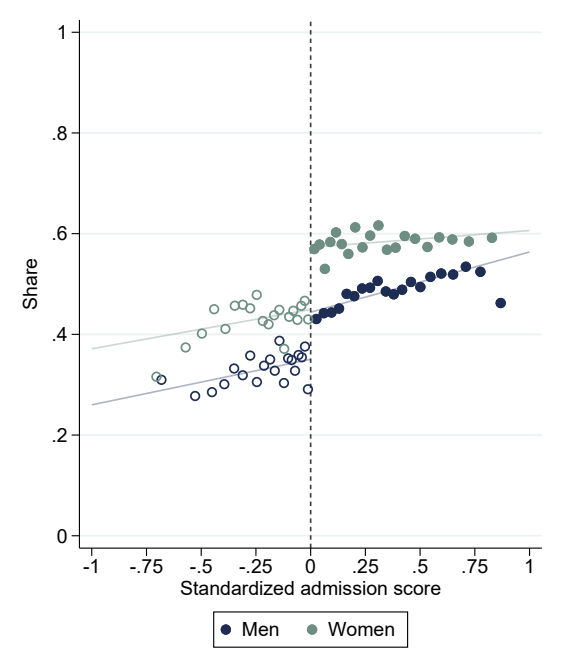
(a) UAS enrollment



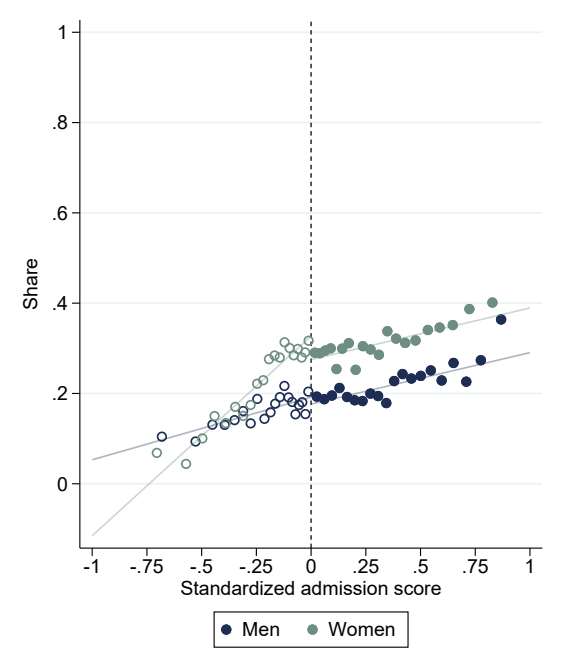
(b) Tertiary degree, age 36



(c) UAS degree, age 36



(d) University degree, age 36



Notes: These figures plot the share of applicants enrolled in university of applied sciences (a) and completing degree in tertiary education (b)-(d) based on their admissions scores. We set the number of bins based on admissions scores to 40 equally sized groups, and show these plots with linear fit-lines based on triangular weights.

Table A.1: Main results: secondary margin

	Has children	Number of children	Married	Has partner
		Women		
Effect of admission	0.08	0.15	0.17**	0.08
	(0.07)	(0.18)	(0.07)	(0.07)
Mean below	0.71	1.48	0.38	0.66
Observations	4,704	4,704	4,704	4,704
		Men		
Effect of admission	0.02	0.04	-0.07	-0.07
	(0.07)	(0.16)	(0.07)	(0.07)
Mean below	0.54	1.03	0.33	0.61
Observations	5,468	5,468	5,468	5,468
		Women-Men difference		
Effect of admission	0.06	0.11	0.24**	0.16
	(0.10)	(0.24)	(0.10)	(0.10)
Total observations	10,172	10,172	10,172	10,172

Notes: This table reports regression discontinuity estimates of the effects of admission to secondary education on measures of family formation for men and women separately. The third panel in the table reports the differences in the effects for men and women (p-values: * < 0.10, **< 0.05, and *** < 0.01).

Table A.2: Main results: tertiary margin

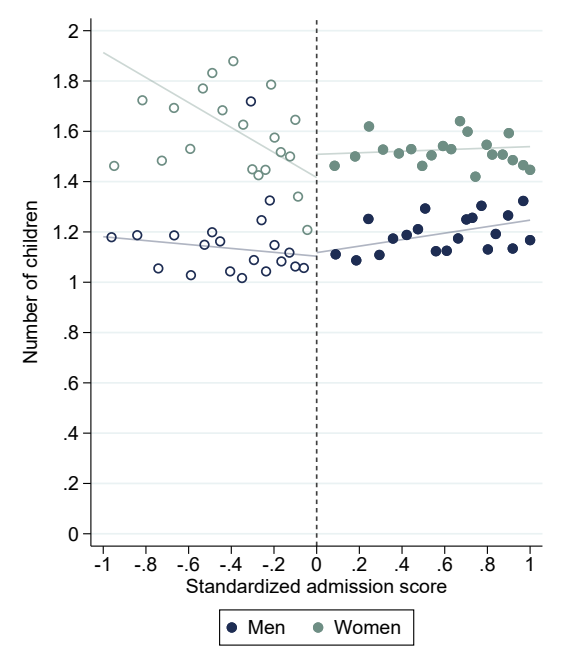
	Has children	Number of children	Married	Has partner
		Women		
Effect of admission	0.06**	0.02	0.02	0.02
	(0.03)	(0.07)	(0.02)	(0.02)
Mean below	0.73	1.56	0.27	0.40
Observations	19,703	19,703	19,703	19,703
		Men		
Effect of admission	-0.02	-0.14	-0.08**	-0.04
	(0.05)	(0.13)	(0.04)	(0.03)
Mean below	0.63	1.26	0.24	0.37
Observations	15,417	15,417	15,417	15,417
		Women-Men difference		
Effect of admission	0.08	0.16	0.10**	0.05
	(0.06)	(0.15)	(0.04)	(0.04)
Total observations	35,120	35,120	35,120	35,120

Notes: This table reports regression discontinuity estimates of the effects of admission to tertiary education on measures of family formation for men and women separately. The third panel in the table reports the differences in the effects for men and women (p-values: * < 0.10, **< 0.05, and *** < 0.01).

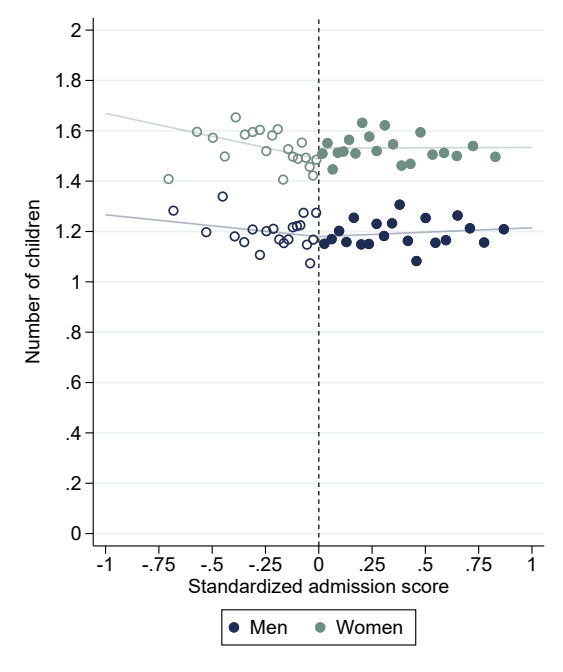
A.6 Alternative measures of family formation outcomes

Figure A.9: Effects of admission to further education on the number of children

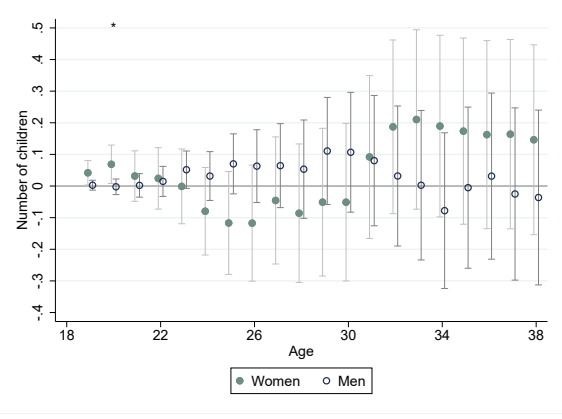
(a) Number of children age 38, admission to secondary



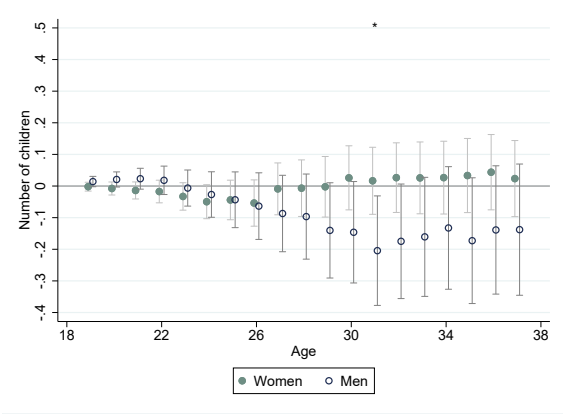
(b) Number of children age 37, admission to tertiary



(c) Number of children, admission to secondary



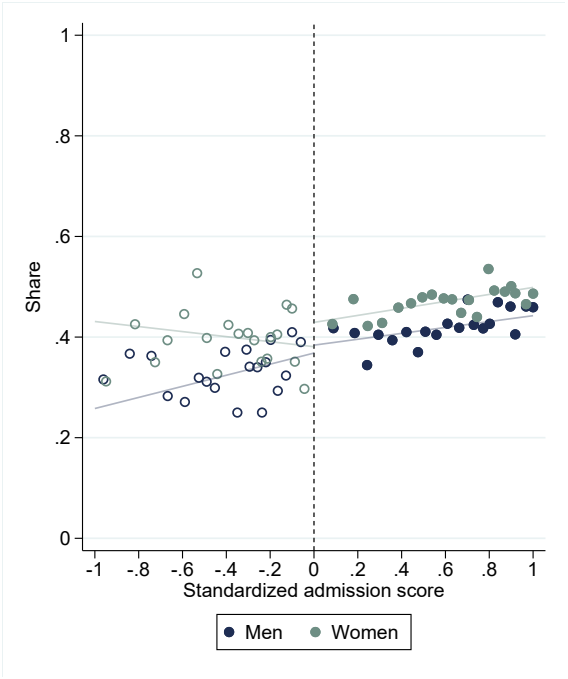
(d) Number of children, admission to tertiary



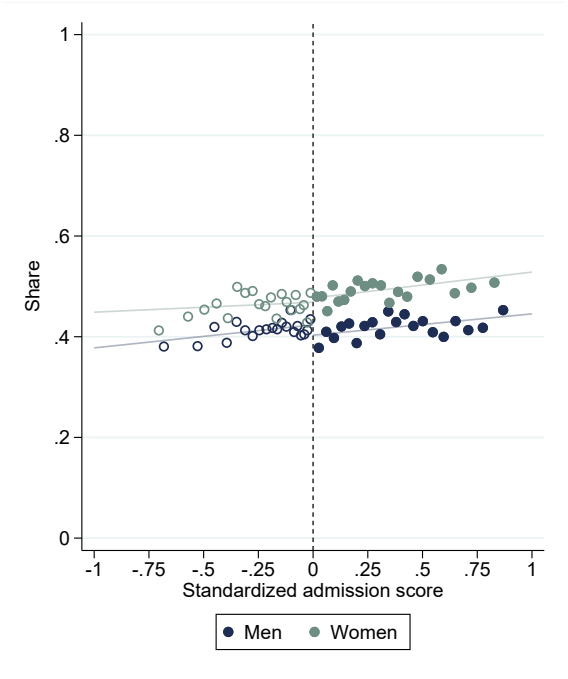
Notes: Figures (a) and (b) plot the number of children men and women have by standardized admissions score. Figures (c) and (d) show the RDD estimates of the effects of admission to further education on the number of children over the life-cycle, as well as their 90-percent confidence intervals. Figures (a) and (c) focus on students at the margin of admission to secondary education, while Figures (b) and (d) focus on students on the margin of admission to tertiary education. Results are reported separately for men and women. Significance stars are used to denote whether we are able to detect statistically significant differences in the effects for men and women (p-values: * < 0.10, **< 0.05, and *** < 0.01).

Figure A.10: Effects of admission to further education on marriage

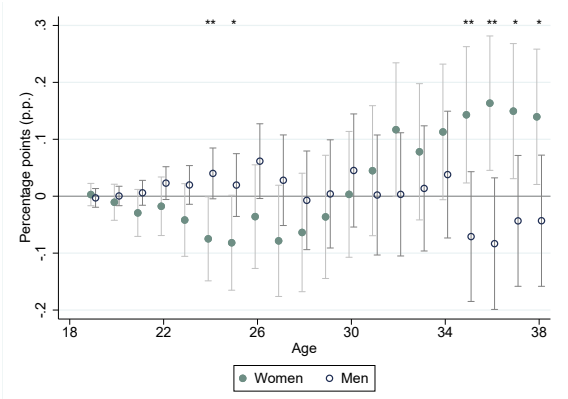
(a) Married at age 38, admission to secondary



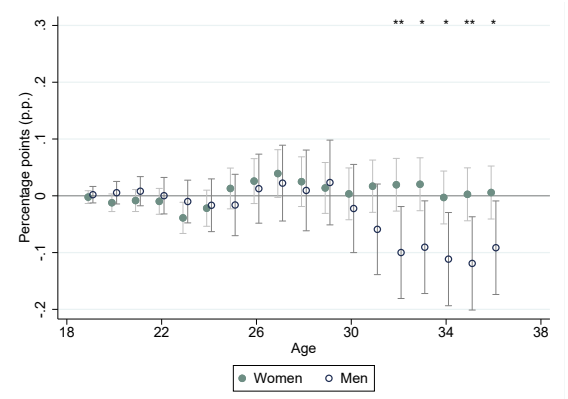
(b) Married at age 37, admission to tertiary



(c) Married, admission to secondary



(d) Married, admission to tertiary

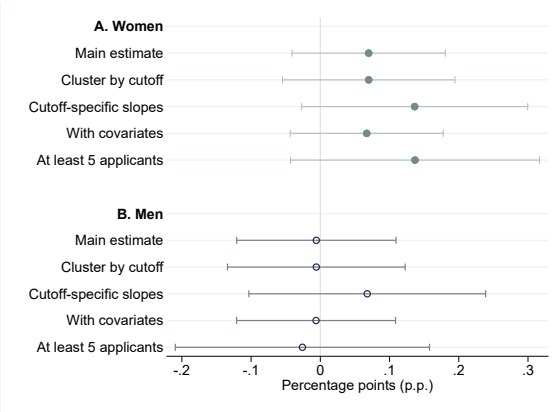


Notes: Figures (a) and (b) plot the share of men and women who are married by standardized admissions score. Figures (c) and (d) show the RDD estimates of the effects of admission to further education on marriage over the life-cycle, as well as their 90-percent confidence intervals. Figures (a) and (c) focus on students at the margin of admission to secondary education, while Figures (b) and (d) focus on students on the margin of admission to tertiary education. Results are reported separately for men and women. Significance stars are used to denote whether we are able to detect statistically significant differences in the effects for men and women (p-values: * < 0.10, **< 0.05, and *** < 0.01).

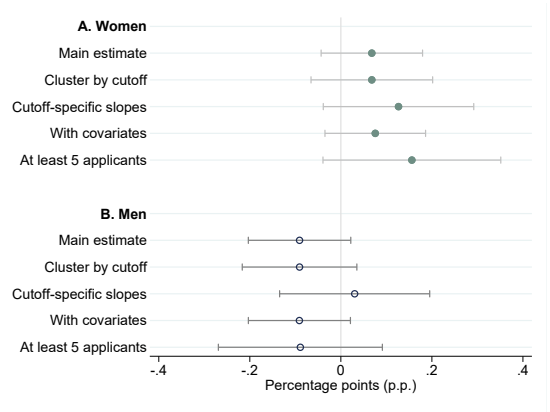
A.7 Robustness

Figure A.11: Robustness to choice of specification

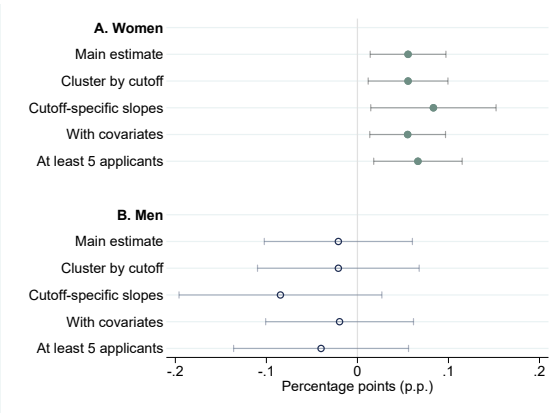
(a) Has child by age 38, admission to secondary



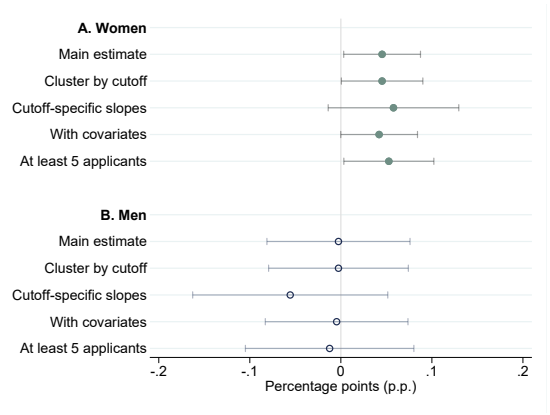
(b) Cohabitation at age 38, admission to secondary



(c) Has child by age 37, admission to tertiary



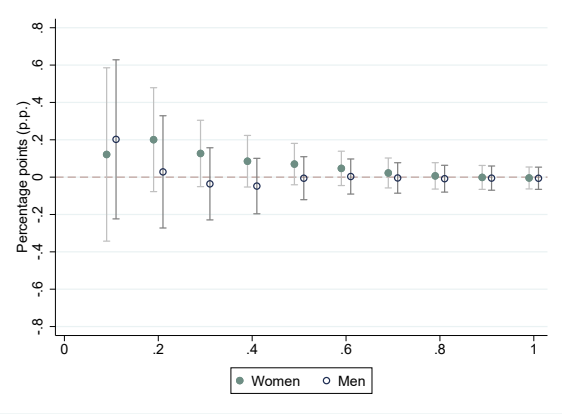
(d) Cohabitation at age 36, admission to tertiary



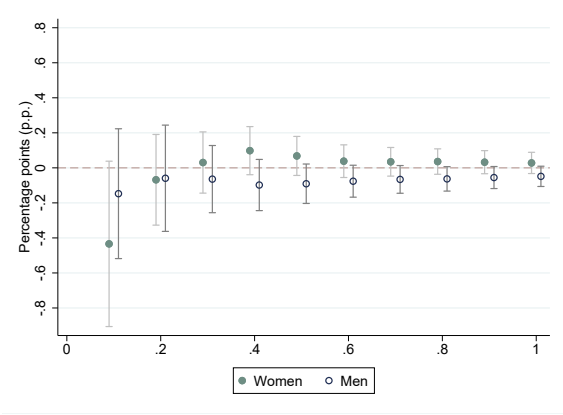
Notes: This figure compares results from our main specification to those from modified versions of the regression equation. First, we cluster our standard errors at the cutoff rather than individual level. Second, we allow there to be different slopes – not just on either side of the cutoff and by gender, but by gender and program-specific cutoff. Third, we add covariates to our baseline specification. Fourth, we restrict the set of cutoffs we include in our estimates to those with at least five applicants on either side of the admissions threshold (p-values: * < 0.10, **< 0.05, and *** < 0.01).

Figure A.12: Sensitivity to bandwidth

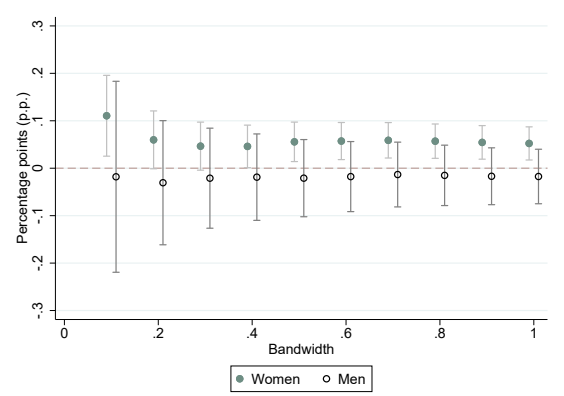
(a) Has child, secondary margin



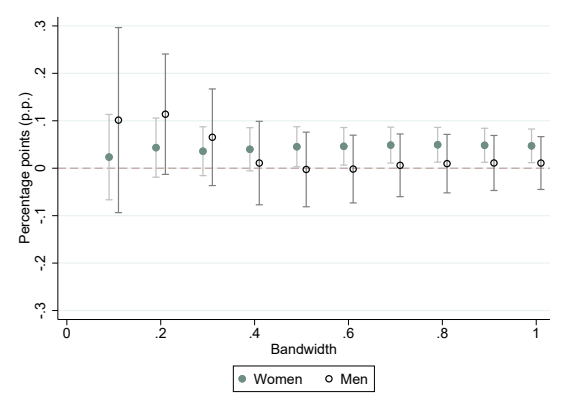
(b) Cohabitation, secondary margin



(c) Has child, tertiary margin



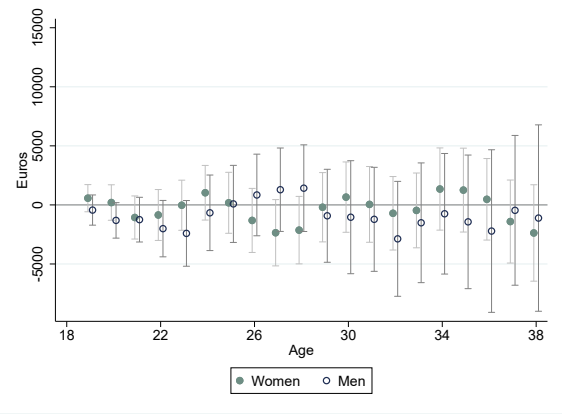
(d) Cohabitation, tertiary margin



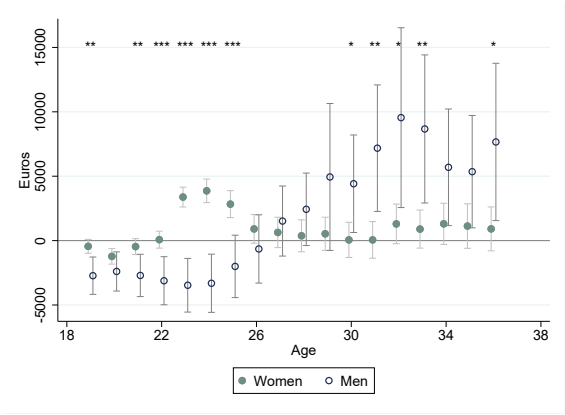
Notes: This figure tests for the sensitivity of our main results to the choice of bandwidth for the range of fixed bandwidths from 0.1 to 1 (p-values: * < 0.10, **< 0.05, and *** < 0.01). In our main estimates we fix our bandwidth to 0.5 in both the secondary and tertiary education samples.

Figure A.13: Effects of admission to further education on income

(a) Income, admission to secondary education

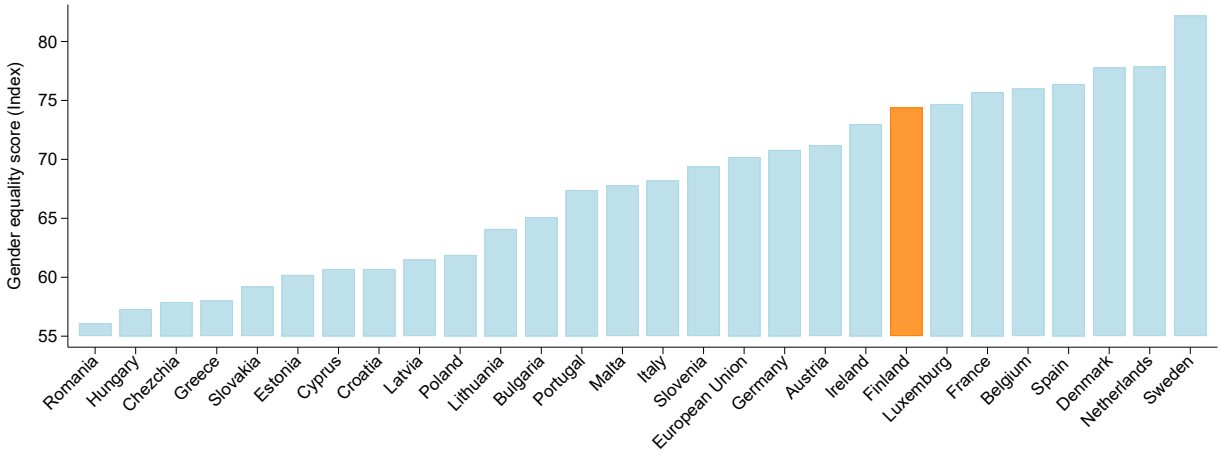


(b) Income, admission to tertiary education



Notes: Figures (a) and (b) show the RDD estimates of the effects of admission to further education on income over the life-cycle, as well as their 90-percent confidence intervals. Results are reported separately for men and women. Significance stars are used to denote whether we are able to detect statistically different effects for men and women (p-values: * < 0.10, **< 0.05, and *** < 0.01).

Figure A.14: Gender equality in Finland and other EU countries



Notes: This figure plots national scores on gender equality, as measured by the European Institute for Gender Equality. Data: EIGE (2023).