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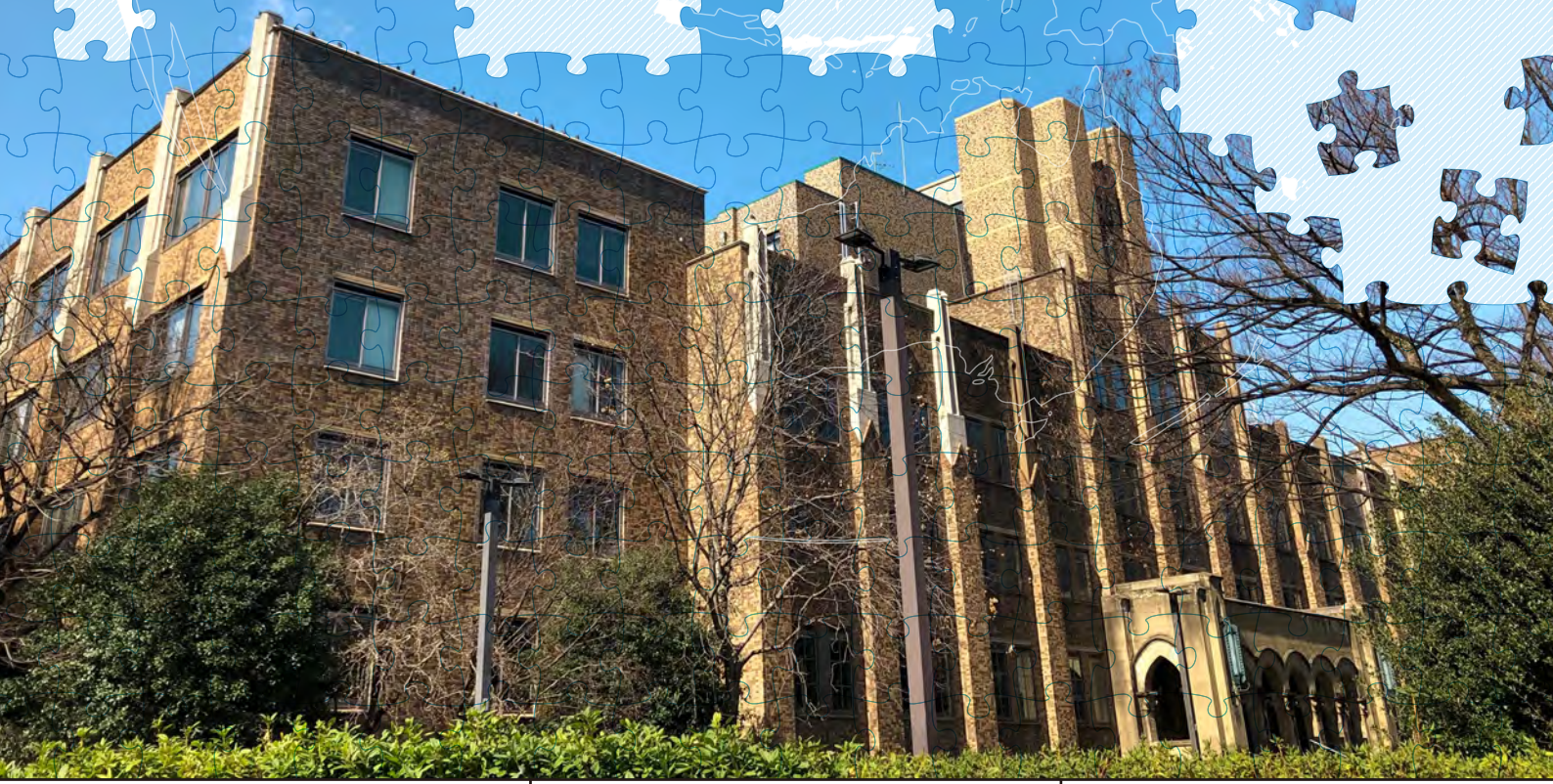
The Role of Portable Skill Aspirations in Explaining Gender Segregation in Fields of Study: Occupational Plans and Intended College Majors among Japanese High Schoolers



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The Role of Portable Skill Aspirations in Explaining Gender Segregation in Fields of Study:

Occupational Plans and Intended College Majors among Japanese High Schoolers

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August 2023

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Keywords: vocational education; gender segregation; skills; Japan

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Abstract (176 words)

Compared to men, women are underrepresented in science, technology, engineering, and math (STEM) fields, which contributes to persistent gender inequality in the labor market. In this study, we propose and evaluate a new hypothesis that students' orientation to accumulate portable skills through educational institutions can help explain gender segregation in fields of study. The results from the first wave of the Survey of High School Students and Mothers in Japan reveal three main findings. First, female students and parents of female students are more likely than male students and their parents to report that it is important to consider the portability of skills when these students choose their future occupations and expect to work in licensed occupations. Second, net of other factors, students with a stronger orientation to skill portability and licensed occupation are significantly more likely to indicate that they are interested in studying occupation-relevant fields (Medicine, Nursing, and Education) than STEM fields. Third, taking the orientation to skill portability and licensed occupation expectations into account significantly reduces the gender gap in intended college major.

Introduction

Women's enrollment in higher education has drastically increased over the past few decades in many wealthy countries (DiPrete and Buchmann 2013; OECD 2022). Despite the so-called gender gap reversal in higher education (van Bavel et al. 2018), gender segregation in fields of study has stalled in many countries (England and Li 2006; van de Werfhorst 2017).[1] Specifically, women are less likely to study and complete a science, technology, engineering, and math (STEM) education than men. Since this outcome is linked to occupational gender segregation (Zheng and Weeden 2023), studies suggest that gender segregation in fields of study in higher education, especially the underrepresentation of women in STEM subjects, contributes to gender inequality in the labor market (Barone 2011; Charles and Bradley 2009; England and Li 2006; Gerber and Cheung 2008).

Possible explanations for gender segregation in fields of study proposed by previous studies have primarily focused on gender differences in family-work orientation, academic achievement or self-assessed math ability, although the evidence supporting these hypotheses is limited. Several recent studies have argued that occupational plans play a more important role in explaining gender segregation in fields of study than other well-established hypotheses. Specifically, these studies have suggested that male students are more likely to plan to enter STEM or biomedical occupations, while female students tend to plan to enter health-related occupations (Legewie and DiPrete 2014; Mann and DiPrete 2013; Morgan et al. 2013; Weeden et al. 2020). Unlike STEM fields, these health-related occupations often require specific occupational licenses to practice the job. Some studies have suggested that these objectively certified skills, which send relatively clear signals about employability and productivity to

[1] We use the terms "fields of study" and "college majors" interchangeably in this paper.

employers (Blommaert et al. 2020), are preferred by those who expect to experience labor market discrimination or those who are likely to experience labor market interruption due to family events (Blair and Chung 2017; Redbird et al. 2020), including immigrants or women. The political economy literature also argues that those who anticipate family-related career interruptions are more likely to prefer skills that are portable across organizations (Estévez-Abe 2006, 2011, 2012; Kriesi and Imdorf 2019). For example, studies have documented that more women than men are enrolled in school-based vocational education (Charles and Bradley 2002; Estévez-Abe 2012; Haasler 2020; Jacob and Solga 2015; Rubery and Fagan 1993), where one can learn more portable skills than is possible in workplace-based vocational training. We suspect that women's preference for occupational licenses is especially the case in a labor market characterized by low-interfirm mobility and the concentration of on-the-job training as skill formation mechanisms because labor market entrants with publicly certified licenses may not need such on-the-job training at the beginning of their occupational career (Kogan and Unt 2008), thereby reducing employers' potential discrimination in hiring.

Based on these previous studies, we propose and evaluate a new hypothesis that students' orientation to accumulate portable skills can help explain gender segregation in fields of study. Specifically, we suspect that, potentially influenced by their peers or female family members who have experienced career interruption and penalties due to family events, women may be more likely to consider whether they can learn portable skills in school choice processes and may have aspirations for licensed occupation; we operationalize this variable as a measure of *school-based portable skill aspirations* (hereafter called portable skill aspirations). If there is a compositional difference in such orientations between men and women, and if these orientations are associated with interests in particular fields of study, then we can expect to see that these

compositional differences statistically account for a portion of the gender segregation in fields of study.

To answer this question, we specifically leverage the case of Japan, where the labor market has been characterized by a low level of interfirm mobility and an emphasis on within-firm on-the-job training (Dore and Sako 1998), both of which lead us to predict that individuals are likely to face severe employment disadvantages once they leave the labor market. The case of Japan also offers an interesting setting in which to examine the role of orientation to portable skills in gender segregation in fields of study since the composition of college majors in higher education has changed in such ways that the number of vocationally oriented programs have increased dramatically over the past decades. We can expect that in such a context, the potentially mitigating role of vocational education on gender inequality may be more salient than in other contexts (Estévez-Abe 2012; Kriesi and Imdorf 2019). Using a cross-sectional survey of high school students and their mothers, we test two operationalizations of skill portability. The first measure is the extent to which students and their parents consider the portability of skills when these students choose their future occupations. The second measure is occupational expectation, where we specifically focus on whether the expected occupation requires certified licenses. The multivariate analysis results find statistically significant gender differences in such portable skill aspirations. These orientations are also associated with a greater likelihood of students' interest in studying occupation-relevant fields (medicine, nursing, and education) than STEM fields. We also find that taking the orientation to skill portability and licensed occupation into account significantly reduces the gender gap in expected fields of study, especially nursing and education.

Our study provides several important theoretical insights into the mechanisms of gender segregation in both fields of study and occupation. Specifically, this study provides a novel perspective, namely, gender differences in portable skill aspirations, on gender segregation in higher education. Previous studies have argued that adolescents' future occupational plans play a critical role in shaping gendered educational trajectories (Legewie and DiPrete 2014; Mann and DiPrete 2013; Morgan et al. 2013; Weeden et al. 2020); however, these studies did not necessarily specify sources of the gender difference in occupational plans, providing only partial knowledge of the sources of segregation in fields of study. Our study adds to the literature empirical evidence that helps us to understand potential mechanisms through which gender-differentiated occupational plans shape gendered educational trajectories. Although this relationship has been suggested by the political economy and sociology of education literature (Estévez-Abe 2012; Kriesi and Imdorf 2019), this is the first study to provide empirical evidence consistent with the theoretical expectation.

Theoretical background

The link between educational and occupational gender segregation

Recent scholarship on gender segregation has explicitly examined the link between education and occupation. This examination has been motivated by previous studies focused on gender differences in academic achievement, self-assessed ability, or work-family attitudes. First, while results from international academic assessments constantly support men's advantages in mathematical achievements across countries, gender disparities in mathematical achievements are subtle (Aylon and Livneh 2013; Else-Quest et al. 2010; Gevrek et al. 2020; Mullis et al. 2020; OECD 2019; Penner 2008). In some countries, women outperform men

in mathematical achievement (Mullis et al. 2020; OECD 2019). Second, the literature on gender differences in self-assessed ability (e.g., Correll 2001) argues that female students' tendency to underestimate their mathematical abilities leads to women having a lower likelihood of pursuing STEM careers than men. Third, another line of research suggests that gender role socialization shapes personal values, motives, and career goals differently for men and women. Specifically, women are more likely to value intrinsic, altruistic, and social aspects of work, while men are more likely to value extrinsic rewards (Busch-Heizmann 2015; Eccles 2011; Frehill 1997; Marini et al. 1996). These gender differences, including women's lower math achievement, lower self-assessed ability, and weaker emphasis on extrinsic rewards, are expected to explain women's underrepresentation in STEM fields.

However, previous research has found that attitudes toward family-work orientation do not significantly differ by gender (Busch-Heizmann 2015; Marini et al. 1996) or that such attitudes have only a trivial effect on STEM major selection (Morgan et al. 2013; Weeden et al. 2020). Furthermore, only a small proportion of gender differences in STEM major selection or completion can be explained by self-assessed mathematical ability or academic performance (Mann and DiPrete 2013; Morgan et al. 2013; Weeden et al. 2020).

In this context, some recent studies have suggested that perceived educational relevance to future occupations seems to be a better explanation for gender differences in college major choice than the abovementioned well-established explanations (Kriesi and Imdorf 2019; Morgan et al. 2013; Weeden et al. 2020). Specifically, these studies have argued that male students are more likely to plan to enter STEM occupations, while female students tend to plan to enter health-related occupations (Weeden et al. 2020). An analysis based on US high schoolers

indicated that gender differences in occupational plans explain a significant portion of gender differences in entry into STEM subjects in college (Weeden et al. 2020).

There are several good theoretical reasons to expect that future occupational and career expectations play a prominent role in explaining gender-differentiated educational trajectories. First, the Wisconsin model of status attainment theory posits that children's educational and occupational aspirations influence their educational and occupational attainments (Sewell et al. 1970; Sewell et al. 1969). These children's aspirations are shaped not only by the observations resulting from their own academic ability but also from their parents, who form expectations for their children based on their socioeconomic positions and their children's academic ability. Although later studies have criticized that this model cannot explain the group-level differences in attainment (e.g., White and Black Americans) who tend to have similar educational aspirations—suggesting that the allocation of resources and opportunities to different groups is critical to shaping one's ability to realize one's aspirations (Kerckhoff 1976; Morgan 2005)—studies have provided empirical support showing that one's predictions of their future attainment play an important role in explaining why some groups are more likely to enter a specific educational trajectory than others (Morgan et al. 2013; Weeden et al. 2020).

Second, recent theoretical developments in cultural sociology suggest that an individual's imagined future, if it does not realize his or her intentions, shapes his or her recent behaviors (Frye 2012; Mische 2009; Suckert 2022). These studies have criticized that the model of rational individuals with clear plans for the future fails to understand social actions. Instead, the perception of future outcomes tends to be highly contingent on factors outside of an individual's control in uncertain situations (Johnson-Hanks 2005). In such contexts, maintaining options allows individuals to adapt to potentially unpredictable events. If perceived future uncertainty is

evaluated differently for men and women, such as the chance of career interruption after childbearing, we can expect that gender differences in future expectations are related to gendered educational trajectories.

School-based portable skill aspiration as a potentially new mechanism for gender segregation in fields of study

As discussed above, previous literature has already emphasized the role of occupational plans in contributing to gender segregation in fields of study (e.g., Weeden et al. 2020). These studies, however, did not necessarily pay enough attention to specific sources of gender-differentiated occupational plans. We believe that specifying potential mechanisms helps us to understand pathways through which gender differences in skill orientation and expectation formations turn into gender segregation in education via perceived education-occupation linkage. Based on this backdrop, we propose and evaluate a novel hypothesis to better understand the link between adolescents' occupational plans and educational trajectories, with a specific focus on the role of portable skill aspirations.

The comparative political economy literature on labor-market institutions and gender segregation proposes the gendered pattern of skill formation as an important source of occupational gender segregation. Specifically, these studies have suggested that women's inclination toward skills that are portable across organizations leads to gender differences in occupational attainments (Estévez-Abe 2005). According to Estévez-Abe (2012) and Estévez-Abe et al. (2001), for example, skills can be classified into three types: general skills trained through school-based education or off-the-job training, industry-specific skills attained via vocational schools or apprenticeships, and firm-specific skills provided through on-the-job

training. According to Busemeyer (2009: 381), this is because even if firm-specific skills that are acquired via on-the-job training can increase one's productivity in other firms, the lack of certification by public authority makes these skills seem less valuable to an employer outside of the specific firm (Busemeyer 2009; Estévez-Abe 2012; Estévez-Abe et al. 2001).[2] In contrast, general skills and industry skills are more portable because these skills often come with certification endorsed by public authority, including diplomas, degrees, or certification, thereby making the assessment of the value of the skills easier. If there is a systematic difference in the portability of skills, we can expect that, on average, firm-specific skills are less attractive for women who anticipate career interruptions for family events because more women than men are likely to be discriminated against by employers who want to minimize the loss of training costs. Instead, it is more reasonable for women to invest in portable skills through educational institutions where skills are attainable independently of employers' calculations (Estévez-Abe 2005).

These studies have also suggested that the potential role of skill portability in gender segregation may vary across labor market institutions. For example, according to Estévez-Abe (2005), gender segregation is more likely to be persistent in a labor market characterized by long-term mutual commitments between employers and workers, stronger employment protection, and a higher degree of specific skill investments, i.e., a so-called coordinated market economy (CME), than in a labor market characterized by highly fluid labor market relationships between workers and employers and a higher degree of general skill investments, i.e., a so-called liberal market economy (LME) (Estévez-Abe et al. 2001; Hall and Soskice 2001). This is

[2] Importantly, in the actual context, Japanese firms provide general skills that enhance one's productivity in other firms. However, unlike the vocational skills acquired through education, the lack of authorizing and certifying mechanism of firm-based skills makes these skills less portable across organizations (Busemeyer 2009).

because the cost of firm-specific skill investment via on-the-job training is much higher on average for employers in the CME than in the LME. Therefore, employers in the CME are more likely than those in the LME to have greater incentives to discriminate against women, who are statistically more likely to experience career interruption due to family events than men. We suspect that women's orientation toward portable skills is particularly salient in the CME, where employers are heavily involved in the process of skill formation.[3]

While these previous studies have aimed to explain occupational gender segregation, their theoretical perspective regarding gender differences in skill orientations can also provide a potential explanation for the mechanism of gender segregation in fields of study. Specifically, we can expect to see that if women project that they are less likely to receive on-the-job training due to career interruptions related to family events than men, then they are likely to be more attracted to acquiring skills that are portable across firms through educational institutions. Given women's orientation toward skill portability, it can be assumed that women are more likely to aspire to engage in occupations that require licenses endorsed by the government than men, including health-related occupations and teachers. This approach leads them to pursue health and education-related fields, thereby exacerbating gender segregation in fields of study.

Although some sociological studies have accounted for gender differences in occupational aspirations as a source of gender differences in fields of study (Morgan et al. 2013; Weeden et al. 2020), their focus was more on explaining women's lower likelihood of entry into STEM fields. In other words, despite the abundant literature in sociology regarding gender

[3] It should also be noted that variations among CMEs could lead to different degrees of women's orientation to skill portability. Busemeyer (2009) argues that there are three distinct CMEs, namely, segmentalist (firm-based) skill regimes such as Japan, differentiated (workplace-based) skill regimes such as Germany, and integrationist (school-based) skill regimes such as Sweden. It can be expected that women's stronger orientation to skill portability is especially likely in the segmentalist and the differentiated skill regimes than the integrationist skill regime because the former two regimes involve deeper employee involvement in skill formation than the latter regime (Estévez-Abe 2005).

differences in fields of study, previous studies have not adequately examined why women choose to study fields that lead them to acquire portable skills over STEM fields or other fields of study. Building upon the political economy literature, we propose that orientation to skill portability can serve as a new mechanism for gender segregation in fields of study. We make this argument by examining the Japanese case, which we discuss in detail in the next section.

Japanese labor market and education contexts

Japan is an ideal setting for sociologists to better understand the potential role of orientation to portable skill aspirations in shaping gendered educational trajectories. First, women's labor force participation has increased over time, but the rigidity of the Japanese labor market shapes men's and women's skill formation differently such that we can expect women to be more likely to prefer skills that are portable across firms than men. The traditional Japanese labor market is predicated on the assumption that men are expected to play the role of breadwinners committed to the company rather than the family, and women are expected to devote themselves to their children and home (Osawa 1993). However, this assumption is no longer true for most of the population, as career opportunities for women have significantly improved in recent years.

However, studies have suggested that the skill regime present in the Japanese labor market, which is characterized by the strong involvement of firms in the process of skill formation, is particularly disadvantageous to women (Estévez-Abe 2005). Specifically, this skill formation regime tends to incentivize employers to build strong levels of coordination between workers to prevent the poaching of skilled workers and thus contributes to the low interfirm mobility of workers and employers' and employees' expectations of lifetime employment

(Busemeyer 2009). This leads to a highly distinctive skill development regime that is skewed toward the concentration of firm-specific skills through intense on-the-job training and limited reliance on the public vocational education and training (VET) system. In such contexts, women who are likely to face discrimination from employers because of anticipated career interruptions due to family events may be more likely to prefer occupation-specific skills via vocational education. Indeed, women are less likely to receive on-the-job training than men in Japan (Brinton 1991).

To the extent that these skills are portable across different organizations, vocational education can improve women's attachment level to the labor market. We suspect that if more female high schoolers than their male counterparts anticipate such a possibility, then the orientation to such skill acquisition would be particularly stronger for women. Assuming that such an orientation is associated with a college major choice, gender differences in such anticipated future careers may explain gender segregation by fields of study.

Second, there are several institutional features that are likely to strengthen the link between occupational aspirations and choice of college major in Japan. As comparative social stratification research has compellingly demonstrated, institutional arrangements play a critical role in explaining the link between education and occupational attainment processes (DiPrete et al. 2017; Kerckhoff 2001; Scherer 2005; Andersen and Van de Werfhorst 2010). Studies have also argued that institutional arrangements have gendered consequences. Specifically, in highly differentiated educational systems characterized by tight school-to-work linkage, gender-specific aspirations and expectations contribute more to gender segregation in education and occupation (Charles et al. 2001). While Japan has been characterized by a skill formation system that is mainly provided through firms (Busemeyer 2014; Estévez-Abe et al. 2001) rather than through

secondary and postsecondary education (Dore and Sako 1998), higher education expansion in Japan has been accompanied by institutional diversification in terms of curricular programs, as seen in many other countries (Charles and Bradley 2009). Specifically, the government has relaxed regulations regarding the establishment of new occupation-relevant departments such as nursing, social work, and pharmacy in response to the rapid aging of the population. This trend is evidenced in Figure 1, which presents the composition of selected major occupation-relevant programs over the last two decades. In the early 2000s, such programs accounted for 7.5% of the total capacity of four-year institutions, while recent years have seen an increase in such programs, contributing to 12% of the total capacity. This increase has been driven by specific programs, including nursing, pharmacy, and therapist programs. Although official statistics are not available, to the best of our knowledge, occupation-relevant programs have expanded in other fields, including social worker or childcare worker programs.

[Figure 1 about here]

Importantly, most students make decisions about their area of study before starting college, as the entrance examination is typically specific to each university department (Roth 2019). Therefore, a student's college major is usually determined upon their entry into college, and transfers between departments are relatively rare (Itō and Hoshi 2020). Since studies have provided evidence that women tend to have more clear occupational plans than men (Feliciano and Rumbaut 2005; Sikora and Pokropek 2011), including in Japan (Fujihara 2020), female students may be more likely to consider fields of study over other criteria (e.g., selectivity) under

the department-specific admission system, especially when female students have clear plans for future occupation and training for these occupations is offered by school.

Research questions and hypotheses

Building upon two lines of sociological literature, namely, that occupational plans play a critical role in influencing college major choice (Morgan et al. 2013; Weeden et al. 2020) and that women are likely than men to prefer portable skills in the segmented labor market (Busemeyer 2009; Estévez-Abe 2005), we examine whether male and female high schoolers have different portable skill aspirations and whether these aspirations are associated with their intended college major. By doing so, this study contributes to a better understanding of explanations for gender segregation in fields of study and occupations. We explain our hypotheses with reference to the conceptual framework presented in Figure 2.

First, we test whether aspirations for portable skill acquisition are higher for female students than for male students (direction from gender to portable skill aspirations). Employing the Wisconsin model of social stratification processes (Sewell et al. 1970；Sewell et al. 1969), we also consider parents' expectations, which are likely to influence children's educational aspirations. This approach is compelling, especially in the Japanese context, where public spending on higher education is considerably limited (Brinton 1993; Nakazawa 2016). The lack of public spending results in children's heavy reliance on parents' financial support to attend a higher education institution. Parents' role is further emphasized because parents' investment in shadow education is critical for success in meritocratic selection through college admissions (Stevenson and Baker 1992; Yamamoto and Brinton 2010). Specifically, we test the following hypotheses:

Hypothesis 1a: Female children have higher portable skill aspirations than male children.
Hypothesis 1b: Mothers of female children have higher portable skill aspirations for their children than mothers of male children.

The second part of the analysis focuses on high school children's intended college major (direction from portable skill aspirations to intended college major). We expect that higher portable skill aspirations are associated with planning to study occupation-relevant fields of study. If there is a gender gap in portable skill aspirations, and these aspirations are related to choosing occupation-relevant fields, we can also expect that the compositional differences in portable skill aspirations between men and women statistically account for the gender gap in educational choice regarding fields of study. Thus, we test the following hypotheses:

Hypothesis 2a: Children with higher portable skill aspirations are likely to aspire to occupation-relevant fields.
Hypothesis 2b: Children whose mothers have higher portable skill aspirations are likely to aspire to occupation-relevant fields.
Hypothesis 3: Compositional differences in portable skill aspirations for female and male students partially account for the gender gap in occupation-relevant fields of education.

[Figure 2 about here]

Data and variables

This study uses the first wave of the Survey among High School Students and their Mothers. This is a longitudinal survey targeting pairs of 11th-grade children (aged 16-17) and their mothers, with detailed information about attitudes toward education. A monitor list of 11th-grade students who are registered with the survey company was selected and then stratified by regional blocs, city size, and gender. The survey forms were sent to 1,560 pairs of mothers and students, and answers were received from 1,070 pairs (68.6%). Since this study is interested in the intended college majors of those who aim to attend college, the sample is limited to the pairs where the children aim to attend college, which reduces the sample size to 670 pairs.

Our main dependent variable is high school children's intended college major. We constructed categorical variables based on verbatim responses to questions on the intended college major. If students did not declare their intended college major, we relied on responses to questions about specific subjects or disciplines they planned to study in college to create the intended college major. We categorized these intended college majors into (1) STEM, (2) social sciences, (3) humanities, (4) medicine, dentistry and pharmacy, (5) nursing and health, (6) education, social work, and home economics and (7) others,[4] which includes both no specific intended college major and multiple college majors.

We treated medicine, nursing, and education as occupation-relevant fields because these fields offer occupational licenses such as those provided to physicians, dentists, pharmacists, nurses, social workers, and teachers. We first distinguished the field of education, social work, and home economics from other occupation-relevant fields based on the strength of the linkage between these fields and specific occupations. While this group of college majors is linked to specific occupational licenses, including school teachers for education, social workers for social

[4] Other fields include *art*, *beauty*, *tourism*, *sports*, and those that are undeclared.

work, or nutritionists for home economics, these majors do not exclusively provide vocational education. For example, students can specialize in the sociology of education in education departments. In addition, one can obtain an occupational license while specializing in other fields of study. For example, students who wish to pursue becoming a science teacher can be enrolled in a STEM major instead of education, while becoming a doctor or another health-related occupation requires students to specialize in the corresponding majors. We therefore distinguished the last group of fields from the other two groups. We then separated medicine, dentistry, and pharmacy from nursing and health because the required skill levels for the former majors are higher than those for the latter majors, as they require six years of education with a few exceptions.

The main independent variables are orientation to skill portability and aspirations for licensed occupation as an indicator of school-based portable skill aspirations. The first measure is derived from a survey question where respondents noted from among a series of aspects the ones that they have considered for their children's future occupations. The variable of interest is a response to a specific question about how much they consider "*te ni shoku*" (which literally means "skills in your hand"). This variable can be interpreted as respondents' emphasis on accumulating transferable and marketable skills.

We also used occupational expectations as another proxy measure of portable skill aspirations, with a specific focus on aspirations for licensed occupations. Admittedly, there is widespread acceptance that such licensed occupation is an outcome of specific vocational training, which is likely to provide fewer portable skills across organizations (e.g., Korber and Oesch 2019); however, this understanding is based on the few cases in which the skill regime is characterized by an apprenticeship system, such as Germany or Switzerland. In contrast to

vocational skills obtained via such workplace-based training, there are good reasons to believe that the vocational skills obtained in Japan are more portable. Specifically, although it is true that some vocational skills training opportunities are offered via on-the-job training, most notably in automobile industries that have their own training schools (Dore and Sako 1998), other training opportunities are offered via vocational high schools, professional technical colleges, or increasingly higher education institutions, which are likely to provide more a standardized vocational education than that offered by firms. Importantly, these skills are publicly endorsed by the government as occupational licenses. These institutional mechanisms make vocational skills in Japan more portable across organizations than the apprenticeship system utilized in Germany or Switzerland. Therefore, in this study, we treat one's expectation for licensed occupation as a proxy of school-based vocational education, which is more portable than workplace vocational education.

However, there is one potential drawback of using this variable, which is that one's aspired occupation may be related to characteristics other than portable skill aspirations, such as the share of women in the occupation. To avoid such a possibility, we also considered the share of female workers in the planned occupation. This variable was constructed by linking occupation codes in the survey to census occupation. For some occupations that we could not match (2 occupations), we assigned the female proportion averaged over all occupations. It is also likely that children's occupational aspiration is too tightly linked to their intended college major (e.g., children whose expected occupation is nurse aim to pursue a nursing major). To address this perfect prediction problem, we used only parents' expected occupation for their children. We also distinguished those without any expected occupation from those with at least one expected occupation.

Although this study is interested in the consequences of gender-differentiated portable skill aspirations for gender segregation in higher education, rather than the source of such aspirations, we considered several potential confounders that could explain the relationship between portable skill aspirations and intended college major. Specifically, we created mothers' educational attainment and employment status. For the former, we constructed a categorical variable, including high school, professional training college (PTC), junior college, and BA degree or more (BA+). Mother's current employment status is a categorical variable that distinguishes between mothers who are unemployed, those employed in licensed occupation, and those employed in nonlicensed occupation. We also considered the logged household income, children's school grade at age 15 (parents' report), and the number of children in the family.

Method

To identify the association between portable skill aspirations and intended college majors, we used multinomial logistic regression models. Specifically, we examined whether respondents' higher portable skill aspiration is associated with children's intention to study occupation-relevant college majors. First, we examined the baseline model, to which we added a female dummy to predict children's intended college major:

$$\ln\left[\frac{p_{ij}}{1-p_{ij}}\right] = \beta_{0j} + \beta_{1j}Female_i + \varepsilon_{ij} \ldots \text{(Model 1)}$$

where j is a dependent variable that includes *STEM* (j=1, reference category), *social sciences* (j=2), *humanities* (j=3), medicine, dentistry, and pharmacy (j=4), nursing and health (j=5), education, social work, and home economics (j=6), and other fields (j=7). Thus, the dependent

variable $\ln\left[\frac{p_{ij}}{1-p_{ij}}\right]$ is the log of the ratio of the probability of selecting an educational field ($j \neq 1$) to the probability of selecting a STEM field. β_{0j} represents the intercept for outcome j. We chose STEM as the reference category because this college major is substantially male-dominated, which allows a more straightforward interpretation when we compare models predicting different college majors.

To test Hypotheses 2a and 2b, we added orientation to skill portability *(Portability)* (Model 2) and mother's licensed occupation expectation *(License)* (Model 3):

$$\ln\left[\frac{p_{ij}}{1-p_{ij}}\right] = \beta_{0j} + \beta_{1j}Female_i + \beta_{2j}\,Portability_i + \varepsilon_{ij} \ldots \text{(Model 2)}$$

$$\ln\left[\frac{p_{ij}}{1-p_{ij}}\right] = \beta_{0j} + \beta_{1j}Female_i + \beta_{2j}\,Portability_i + \beta_{3j}\,License_i + \varepsilon_{ij} \ldots \text{(Model 3)}$$

Furthermore, we added several potential cofounders to see if the observed relationship between children's intended college major and orientation to skill portability and mother's licensed occupation expectation was robust:

$$\ln\left[\frac{p_{ij}}{1-p_{ij}}\right] = \beta_{0j} + \beta_{1j}Female_i + \beta_{2j}\,Portability_i + \beta_{3j}\,License_i + \sum_{k=1}^{K}\beta_{kj}X_{ki} + \varepsilon_{ij} \ldots \text{(Model 4)}$$

Finally, to test Hypothesis 3, we used the Karlson-Holm-Breen (KHB) decomposition method (Breen et al. 2021) to determine to what extent the association between gender and intended college major is explained (in a statistical accounting sense) by considering portable

skill aspirations measured by orientation to skill portability and mother's licensed occupation expectation.

Results

Descriptive results

Table 1 presents descriptive statistics for all variables, shown separately by sex of the child. Regarding children's intended college major, we can see that male students' intended college majors are heavily concentrated in STEM fields (40%), while those of female students are more diverse, with very few of them intending to study a STEM field (8%). Compared to male students, female students are more likely to express their interest in studying occupation-relevant fields. Specifically, 14% of female students intend to study a nursing or health major many of which offer a vocational education relevant to a specific occupation (e.g., nurse or therapist); however, only 3% of male students plan to study in this field. Additionally, 22% of female students are interested in studying an education, social work, or home economics major, many of which also offer a vocational education relevant to a specific occupation (e.g., teacher or social worker); however, only 10% of male students intend to study in such a field. The intention to study within another occupation-relevant field, namely, medicine, dentistry, and pharmacy, is not different between male and female students (5% vs. 6%, respectively).

In terms of portable skill aspirations, we can see that orientation to skill portability, which is measured by both children's and parents' responses, is larger for female children than for male children (3.23 vs. 3.07 for children's responses and 3.42 vs. 3.21 for mothers' responses).[5] We can also see that mothers' licensed occupation expectations for their children are gendered.

[5] The gender difference in children's responses was statistically significant at the 1% level, while that in the parents' response was significant at 0.1% level.

Specifically, approximately 44% of the mothers of female children reported that they want their child to have a licensed occupation, while only 21% of the mothers of male children did so. These compositional differences in mothers' expectations could potentially explain the gender difference in portable skill aspirations, which is consistent with Hypotheses 1a and 1b.

[Table 1 about here]

Figure 3 presents the distribution of children and mothers' orientation to skill portability and mothers' licensed occupation expectation for their child across children's intended college major; this information is once again presented separately for male and female students. We can see that orientation to skill portability tends to be higher for those who intend to study three occupation-relevant fields, i.e., nursing and health; medicine, dentistry, and pharmacy; and education, social work, and home economics. It appears that the orientation is stronger for female children and the mothers of female children, particularly for those who intend to study in an education, social work, or home economics field. Looking at mothers' occupational expectations, there is no consistent gender pattern present in intended college major regarding mothers' occupational expectations for their child; however, we can see that the mothers of female students are more likely to expect their child to have a licensed occupation when children intend to study one of the three occupation-relevant fields than are mothers of male children.

[Figure 3 about here]

Regression results predicting students' intended college major

Table 2 presents the multinomial logistic regression results predicting students' intended college major. Looking at Model 1, we can see that the female dummy is negative across intended majors, which reflects the descriptive results shown earlier that very few female students are interested in studying STEM (reference category). In Model 2, we added children's and mothers' orientation to skill portability. The results show that both children's and mothers' higher orientation to skill portability (for their child) is positively associated with children's intention to study in the fields of medicine, dentistry, and pharmacy or nursing and health compared to STEM, which is consistent with Hypothesis 2a; we also see that such orientation is not strongly associated with studying in the fields of education, social work, and home economics.

In Model 3, we further added the mother's occupational expectations for their child. On the one hand, we can see that the lack of occupational expectations is negatively associated with children's intention to study in the fields of nursing and health. On the other hand, mothers' licensed occupation expectations for their children are positively associated with children's intention to study in the field of medicine, dentistry, and pharmacy (2.61), that of nursing and health (3.15), and that of education, social work, and home economics (1.36), all of which are statistically significant at the 1% level. These results are consistent with Hypothesis 2b.

Next, Model 4 shows the results of evaluating whether gender differences are still visible even after considering a wider range of potential confounders. We are particularly interested in the possibility that the positive correlation between the mother's licensed occupation expectation and children's intention to study occupation-relevant fields may be driven by the fact that these expected occupations are female-dominated rather than licensed. To control for the potential influence of gender occupational segregation, Model 4 added the share of women in the

occupations that mothers expect their children to pursue. We can see that this variable is positively associated with children's intention to study occupation-relevant fields; however, comparing Models 3 and 4 shows that while the substantive results regarding the positive association between licensed occupation and intention to study occupation-relevant college majors are robust to adding this variable, the coefficients are slightly reduced. We also added other potential covariates, including parental socioeconomic status or other demographic characteristics, which did not change the substantive results shown in Models 2 and 3.

[Table 2 about here]

KHB decomposition results

Comparing Model 1 and Model 2 (and Model 3), it seems that the female dummy coefficients decreased when we included orientation to skill portability, as well as the mother's licensed occupation expectation for the child. To precisely account for the percent contribution of these portable skill aspirations to gender differences in intended college major, we applied the KHB method to see how the coefficients of the female dummy are accounted for by considering these variables. Table 3 presents the results, which demonstrate that the difference in coefficients for the female dummy is significantly reduced for all three occupation-relevant fields (medicine, dentistry, and pharmacy; nursing and health; and education, social work, and home economics). For example, the positive coefficient of the female dummy for medicine, dentistry, and pharmacy (compared with STEM) decreased from 1.75 to 1.44 between Model 1 and Model 2 and from 1.77 to 0.92 between Model 1 and Model 3. The other two occupation-relevant majors present similar results, while we can also see that the magnitude of the difference in the female

coefficient between Model 1 and Model 3 is much larger (from 3.24 to 2.32 for nursing and health and from 2.51 to 2.21 for education, social work, and home economics).

Figure 4 summarizes the relative contribution of these portable skill aspiration variables to explaining the gender gap in occupation-relevant college major choices. For the field of medicine, dentistry, and pharmacy, approximately 17.6% of the gender gap is accounted for by considering orientation to portable skills. The relative contribution increases to 48.3% when we also consider mothers' licensed occupation expectations. Similarly, orientation to skill portability explains 9.7% of the gender gap in indenting to study in the field of nursing and health, while all three portable skill aspiration predictors in total explain 28.6% of the gender gaps in that field of study. For the field of education, social work, and home economics, we do not see a contribution of orientation to skill portability in explaining the gender gap, while 11.8% of the gender gap is accounted for by considering mothers' licensed occupation expectations. These results are generally consistent with Hypothesis 3.

[Table 3 about here]

[Figure 4 about here]

Supplementary analyses

We conducted several supplementary analyses to ensure that our results are robust to different model specifications. First, the main analysis did not include children's occupational plans because such plans may be too closely related to the child's intended college major. However, more female students (42%) than male students (21%) have licensed occupation plans in our analytical sample, which leads us to speculate that compositional differences in licensed occupation plans for men and women may explain the gender gap in intended college majors.

Therefore, we conducted several supplementary analyses to examine whether our results are robust even when we include children's occupational plans. Appendix Table 1 presents multinomial regression results limiting the outcome to the three occupation-relevant fields with reference to STEM. In Model 2, we included both child's occupational plans (in cases where they have a plan, and the planned occupation is licensed) and orientation to skill portability. We can see that across the three fields, a child's licensed occupation plan is positively associated with the intention to study within those fields in college. This is still the case even when we included the mother's occupational expectation in Model 3 or other potential covariates in Model 4; however, the coefficients are reduced.

Next, Appendix Figure 1 presents the percent contribution of these portable skill aspirations to explaining gender differences in intention to study the three occupation-relevant college majors. We can generally see results similar to those presented in Figure 4. Specifically, the child's and mother's orientation to skill portability and the child's occupational plan account for more than half (54.1%) of the gender gap in intention to study in the field of medicine, dentistry, and pharmacy, 27.8% of the gender gap in intending to study in the field of nursing and health, and 16.1% of the gender gap in intending to study in the field of education, social work, and home economics. Comparing the dark blue bar shown in Appendix Figure 1 to the one shown in Figure 4, we can see that additionally considering the child's occupational plans further increases the contribution of portable skill aspiration to explaining the gender gap in studying occupation-relevant fields (from 48.2% to 66.6% for medicine, dentistry, and pharmacy, from 28.6% to 34.6% for nursing and health, and 11.8% to 19% for education, social work, and home economics).

Second, we also considered gender-differentiated expectations about future labor market outcomes as an alternative explanation for the link between portable skill aspirations and intended college majors. Studies have suggested that these attitudinal differences play an important role in explaining gender differences in college major choices in higher education (Altonji et al., 2012; Altonji et al., 2015). Specifically, more women than men tend to choose their jobs based on nonpecuniary or altruistic reasons, including social meaning and intrinsic rewards, than financial rewards (Busch-Heizmann 2015; Eccles 2011; Frehill 1997; Marini et al. 1996), which accounts for a sizable fraction of college major choices for men (50%) and for women (75%) (Zafar 2012). These attitudinal gender differences may predict portable skill aspirations. This is because women's tendency to prefer portable skills is driven by their occupational expectations, which emphasize social meaning or intrinsic rewards; this is because most occupations with highly portable skills, typically licensed occupations such as teachers, nurses, or pharmacists, are characterized by jobs that allow individuals to realize these social or intrinsic values.[6]

To consider this possibility, we examined a series of models that included children's expectations about future labor market outcomes. Specifically, we included two attitudinal questions that measure children's emphasis on intrinsic rewards (interaction with people and contribution to society). After standardizing these attitudinal variables, we summarized them and standardized them again. Looking at the average value by gender, female students are more likely to have an intrinsic value (0.19) than male students (-0.19), while this attitude is weakly correlated with students' orientation to skill portability (0.19). The results of multinomial logistic

[6] Another possibility is that those who respond more to monetary rewards tend to choose careers that do not require portable skills; this is because cumulative returns to firm-specific skills are likely higher than returns to portable skills in the Japanese labor market, where the dominant form of wage growth (typically those who are in stable employment and a large firm) depends more on age seniority than productivity.

regressions indicate that respondents' intrinsic value is positively associated with choosing medicine, dentistry, and pharmacy; nursing and health, and education, social work, and home economics. These results suggest that gender differences in intrinsic values may play a partial role in explaining the gender gap in intended college majors. Comparing Model 3 in Appendix Table 2 and Model 3 in Table 2 (main results), the coefficient for orientation to skill portability is reduced for all intended majors. Although the association between orientation to skill portability and nursing and health was statistically significant in the main results, this variable is not significant when we consider intrinsic values, as shown in Appendix Table 2. Nevertheless, occupational expectations, specifically expectations for licensed occupations, seem statistically significant, and the effect sizes do not change even if we consider gender differences in intrinsic values. Since one's intrinsic values are weakly associated with one's portable skill aspirations, the KHB results shown in Appendix Figure 2 indicate that this attitudinal variable has an additive influence on gender differences in intended college majors.

Discussion and conclusion

In this study, we investigated whether the gender differences in orientation to skill portability and expectations for licensed occupations, both of which are measured as a proxy of portable skill aspirations, can explain gender segregation in fields of study. We focused on the Japanese context, which is characterized by a gender-unequal labor market structure because of its high degree of interfirm skill investment and low interfirm mobility, as well as related expanded and diversified higher education contexts that increasingly offer occupation-relevant programs.

The first part of the analysis examined gender differences in portable skill aspirations. As we expected in Hypotheses 1a and 1b, portable skill aspirations measured by orientation to skill portability and licensed occupation expectations are significantly higher for female students or mothers of female children. We also examined how gendered portable skill aspirations are associated with intended college majors. Consistent with Hypotheses 2a and 2b, children with a more positive orientation to skill portability and mothers with licensed occupation expectations for their child were found to be positively associated with children's intention to study in three occupation-relevant fields, namely, medicine, dentistry, and pharmacy; nursing and health; and education, social work, and home economics. Last, the KHB decomposition results suggested that a sizable part of gender differences in intended college major, specifically between STEM fields and the abovementioned three occupation-relevant fields, is accounted for by considering compositional differences in orientation to skill portability and licensed occupation expectations. Supplemental analysis also suggested that a child's occupational plan plays an independent role in explaining the gender gap.

While the general conclusions support our hypotheses, we also found a significant difference across the three occupation-relevant fields. Specifically, we found that the contribution of the compositional difference in portable skill aspirations for male students and female students to explaining the gender gap in intending to study occupation-relevant fields differ by specific majors. While the contribution was larger for medicine, dentistry, and pharmacy, it only explained a relatively small proportion of the gender gap in education, social work, and home economics. One interpretation is that this result may be driven by the relatively weaker linkage to teaching professions, since some education college major programs provide

not only teaching profession training but also other academic courses (e.g., sociology of education).

While this study has proposed a potential new mechanism for gender segregation by field of study, which is an important pathway of occupational segregation (Zheng and Weeden 2023), there are some limitations. First and most importantly, we did not examine sources of gender-differentiated vocational aspirations. Studies of early socialization theory, including the Wisconsin model of attainment processes, have suggested that adolescents' aspirations are shaped by families and schools. Psychological studies have also suggested that vocational interests shaped during young adolescence (ages 12-13) tend to be stable until one's college years (ages 18-19) (Low et al. 2005). We considered parents' aspirations together with children's aspirations; however, these aspirations are also shaped by family backgrounds, as well as school contexts. For example, it could be the case that mothers with vocational education experience may be more likely to evaluate the value of vocational education for women. If that is the case, then mothers' vocational education experience, which is correlated with their aspirations for children's education, could directly influence their child's portable skill aspirations by transmitting their skills and knowledge and forming expectations. Thus, we controlled for mothers' socioeconomic status, including educational attainment and current occupation, including vocational education and licensed occupation, as a potential confounder. The results suggested that the compositional differences in mothers' expectations between female and male children do not explain the gendered portable skill aspirations of children; however, future studies need to examine detailed processes through which these origin characteristics shape children's destinations by influencing their aspirations.

Second, although we used licensed occupation expectations as a proxy of portable skill aspirations, we did not extensively examine the extent to which they reflect portable skill aspirations. Since many licensed occupations are of a female-dominant nature (e.g., nurses, teachers, social workers), it is difficult to distinguish whether female students prefer such occupations because of their license attainment or female affinity. Although we added the share of women in the planned occupation to the model, female affinity can be represented in other forms (e.g., societal perception regarding femininity of occupation). Careful analysis is thus required in future empirical studies. Third and last, although we examined whether our results are robust to the inclusion of variables that measure social meaning and intrinsic rewards in supplementary analysis, our dataset does not allow us to carefully investigate how attitudes toward skill portability are related to or differ from other job values or family-work orientations. In light of the literature regarding job values, we could expect that an orientation to accumulate portable skills may be associated with a student's family-work orientation. Another possibility is that orientation to portable skills comes from students' desire to maintain job security. Comparison with other work-related values would allow us to strengthen our results.

Despite these limitations, the current study makes both an empirical and a theoretical contribution. The former shows that a gender-specific orientation to portable skills plays an important role in explaining, although only partially, gender differences in intended college majors. The latter contributes to at least two streams of the literature on gender inequality in higher education. First, this study provides important insights into the mechanisms through which men and women with different orientations regarding their future occupations are sorted into different educational trajectories. Previous studies have investigated what role gender plays in the context of college major choice (Combet 2023; Kriesi and Imdorf 2019; Ochsenfeld 2016;

Quadlin 2020; Simon et al. 2017). These studies have revealed that occupational preferences or values associated with women, including altruistic and communitarian values (Diekman et al. 2010) or preferences for abstract reasoning skills (Combet 2023), partially explain women's underrepresentation in STEM careers. Meanwhile, other previous studies have suggested that women are more likely to prefer skills that are portable across organizations based on the finding that the length of on-the-job training tends to be much shorter for women than men (Grönlund 2012). Other studies have provided evidence that occupational plans projected by adolescents are associated with gendered educational trajectories; however, they do not adequately document specific sources of gender differences in occupational plans that are linked to gendered college major choice. To our knowledge, this is the first study to suggest that gender differences in the orientation to accumulate portable skills among high school students may be an important mechanism in explaining gender segregation in fields of study, as well as later occupational careers.

Second, our study also contributes to the literature by providing a novel measure of skill orientation. While the literature refers to the educational system, such as the share of students enrolled in vocational tracks or educational systems focused on vocational training as a measure of vocational specificity (Blommaert et al. 2020), these approaches have been criticized for overemphasizing the macrolevel structure (DiPrete et al. 2017) and not adequately accounting for individual preferences. Our measure of skill orientation, which is measured by students' aspirations for skill portability, contributes to the literature by explaining how individuals make decisions under specific institutional settings.

Third, although our study is focused on a single aspect of such orientations, we suspect that there are broader implications in better understanding the mechanisms of gender segregation

in higher education. Specifically, previous studies have suggested that expansion in higher education accompanies the diversification of curricular programs (Charles and Bradley 2009), which may maintain or even exacerbate gender segregation. For example, Charles and Bradley (2009: 927) argued that expansion and diversification in higher education contribute to creating "gender-specific curricular niches," by which they mean that highly diversified tertiary educational programs tend to promote students' gender-differentiated expressive interests. By encouraging such gender-differentiated educational and career aspirations, the authors argued that curriculum diversification can maintain gender segregation in higher education in terms of fields of study. They also pointed out that an increase in vocationally oriented programs, which characterizes higher education expansion in many countries, including Japan (shown in Figure 1) and the United States (Roksa et al. 2007), has contributed to the increase in female-affinity fields (e.g., physical education, human development, teacher education, and law), thereby accommodating women's enrollment in female-dominant fields (Charles and Bradley 2009: 932). Considering that such macrolevel changes have occurred in higher education across many countries, our study provides important insights into how these structural changes in higher education shape gender inequality in higher education via the expansion of vocational education.

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Table 1 Descriptive statistics

	Male		Female	
	Mean	SD	Mean	SD
Intended college major				
STEM	0.40	0.49	0.08	0.27
Social sciences	0.24	0.43	0.20	0.40
Humanities	0.07	0.25	0.19	0.39
Medicine, dentistry, and pharmacy	0.05	0.23	0.06	0.23
Nursing and health	0.03	0.18	0.14	0.35
Education, social work, and home economics	0.10	0.30	0.22	0.42
Others	0.11	0.31	0.11	0.32
Child's orientation to skill portability	3.07	0.77	3.23	0.7
Mother's orientation to skill portability for her child	3.21	0.68	3.42	0.63
Mother's any occupational expectation for her child	0.72	0.45	0.74	0.44
Mother's licensed occupation expectation for her child	0.21	0.41	0.44	0.50
% female for mother's expected occupation for her child	0.28	0.27	0.47	0.34
Mother's educational attainment				
High school				
Professional training college (PTC)	0.16	0.37	0.15	0.36
Junior college (JC)	0.36	0.48	0.33	0.47
BA+	0.20	0.40	0.18	0.38
Mother's employment status				
Not employed	0.21	0.41	0.21	0.40
Employed (not licensed occupation)	0.63	0.48	0.65	0.48
Employed (licensed occupation)	0.16	0.37	0.14	0.35
Logged household income	15.02	3.33	14.87	3.65
Income missing	0.05	0.21	0.06	0.23
Children's school grade at age 15 (parents report)	2.83	1.04	2.97	0.93
Number of children	2.32	0.73	2.26	0.69
Observations	348		322	

Table 2 Multinomial logit regression results

	Model 1		Model 2		Model 3		Model 4	
Social Sciences								
Female	1.42***	(0.27)	1.52***	(0.28)	1.50***	(0.28)	1.32***	(0.29)
Child's orientation to skill portability			-0.17	(0.16)	-0.16	(0.16)	-0.12	(0.17)
Mother's orientation to skill portability			-0.38**	(0.18)	-0.36**	(0.18)	-0.27	(0.19)
Mother's any occupational expectation					-0.21	(0.27)	-1.24***	(0.39)
Mother's licensed occupation expectation					-0.04	(0.33)	-0.06	(0.35)
% female for mother's expected occupation							2.64***	(0.66)
Professional training college							0.12	(0.39)
Junior college							0.35	(0.31)
BA+							0.42	(0.36)
Not employed							-0.02	(0.30)
Employed (licensed)							-0.24	(0.36)
Logged household income							0.41	(0.29)
Income missing							5.71	(4.61)
Child's school grade							-0.08	(0.13)
Number of children							0.07	(0.18)
Constant	-0.53***	(0.14)	1.17*	(0.68)	1.23*	(0.71)	-5.72	(4.63)
Humanities								
Female	2.66***	(0.32)	2.81***	(0.33)	2.75***	(0.34)	2.70***	(0.36)
Child's orientation to skill portability			-0.52***	(0.20)	-0.50**	(0.20)	-0.43**	(0.21)
Mother's orientation to skill portability			-0.26	(0.22)	-0.27	(0.23)	-0.22	(0.24)
Mother's any occupational expectation					-0.47	(0.34)	-1.54***	(0.55)
Mother's licensed occupation expectation					0.31	(0.39)	0.31	(0.42)
% female for mother's expected occupation							2.82***	(0.88)
Professional training college							0.68	(0.50)
Junior college							1.11***	(0.41)
BA+							1.46***	(0.45)
Not employed							-0.30	(0.39)
Employed (licensed)							-0.87*	(0.50)
Logged household income							-0.21	(0.35)
Income missing							-4.08	(5.61)
Child's school grade							-0.38**	(0.16)
Number of children							0.15	(0.22)
Constant	-1.81***	(0.22)	0.51	(0.84)	0.78	(0.88)	3.71	(5.60)
Medicine, Dentistry, and Pharmacy								
Female	1.63***	(0.39)	1.44***	(0.40)	0.92**	(0.43)	0.75	(0.48)
Child's orientation to skill portability			1.25***	(0.35)	1.18***	(0.37)	1.34***	(0.40)
Mother's orientation to skill portability			0.53	(0.33)	0.22	(0.35)	0.26	(0.36)
Mother's any occupational expectation					0.28	(0.86)	-0.73	(0.98)
Mother's licensed occupation expectation					2.61***	(0.55)	2.51***	(0.56)
% female for mother's expected occupation							2.90***	(1.04)
Professional training college							0.21	(0.69)
Junior college							0.65	(0.52)
BA+							0.12	(0.66)
Not employed							-0.22	(0.50)
Employed (licensed)							-1.54*	(0.84)
Logged household income							0.59	(0.56)
Income missing							9.95	(8.94)
Child's school grade							0.24	(0.26)
Number of children							-0.00	(0.29)
Constant	-2.00***	(0.24)	-8.06***	(1.60)	-8.13***	(1.80)	-19.00**	(9.09)

Table 2 Multinomial logit regression results (cont.)

	Model 1		Model 2		Model 3		Model 4	
Nursing and Health								
Female	3.01***	(0.39)	2.81***	(0.39)	2.32***	(0.41)	1.62***	(0.47)
Child's orientation to skill portability			0.59**	(0.27)	0.46*	(0.28)	0.52*	(0.30)
Mother's orientation to skill portability			1.01***	(0.32)	0.68**	(0.33)	0.73**	(0.36)
Mother's any occupational expectation					-1.47**	(0.71)	-4.68***	(0.94)
Mother's licensed occupation expectation					3.15***	(0.65)	2.80***	(0.68)
% female for mother's expected occupation							6.63***	(1.07)
Professional training college							0.34	(0.56)
Junior college							0.07	(0.48)
BA+							-0.32	(0.65)
Not employed							-0.71	(0.56)
Employed (licensed)							-0.13	(0.53)
Logged household income							0.84*	(0.49)
Income missing							13.13*	(7.77)
Child's school grade							0.04	(0.21)
Number of children							0.37	(0.26)
Constant	-2.46***	(0.30)	-7.91***	(1.38)	-6.53***	(1.45)	-20.56***	(7.84)
Education, Social Work and Home Economics								
Female	2.43***	(0.30)	2.42***	(0.30)	2.21***	(0.31)	1.76***	(0.34)
Child's orientation to skill portability			-0.18	(0.19)	-0.25	(0.19)	-0.14	(0.20)
Mother's orientation to skill portability			0.24	(0.21)	0.08	(0.22)	0.17	(0.24)
Mother's any occupational expectation					0.10	(0.37)	-2.45***	(0.57)
Mother's licensed occupation expectation					1.36***	(0.34)	1.21***	(0.37)
% female for mother's expected occupation							5.35***	(0.83)
Professional training college							-0.09	(0.46)
Junior college							0.35	(0.36)
BA+							0.48	(0.43)
Not employed							-0.10	(0.37)
Employed (licensed)							-0.24	(0.42)
Logged household income							-0.13	(0.34)
Income missing							-3.49	(5.39)
Child's school grade							-0.05	(0.16)
Number of children							0.26	(0.20)
Constant	-1.42***	(0.19)	-1.67**	(0.83)	-1.34	(0.89)	-0.20	(5.34)
Other								
Female	1.66***	(0.31)	1.69***	(0.32)	1.69***	(0.32)	1.62***	(0.35)
Child's orientation to skill portability			-0.16	(0.20)	-0.13	(0.20)	-0.13	(0.21)
Mother's orientation to skill portability			-0.01	(0.22)	0.03	(0.23)	0.20	(0.25)
Mother's any occupational expectation					-0.69**	(0.32)	-2.01***	(0.54)
Mother's licensed occupation expectation					-0.40	(0.45)	-0.59	(0.49)
% female for mother's expected occupation							3.41***	(0.91)
Professional training college							-0.34	(0.48)
Junior college							0.58	(0.37)
BA+							-0.41	(0.52)
Not employed							0.43	(0.38)
Employed (licensed)							0.67	(0.41)
Logged household income							-0.65*	(0.34)
Income missing							-10.24*	(5.32)
Child's school grade							-0.70***	(0.16)
Number of children							-0.09	(0.23)
Constant	-1.30***	(0.18)	-0.76	(0.85)	-0.50	(0.89)	10.82**	(5.33)
Observations	670							
Log Likelihood	-1165.45		-1123.30		-1061.04		-973.82	

Standard errors in parentheses. * p<0.10 ** p<0.05 *** p<0.01

Table 3 KHB decomposition results

Model 1 vs. Model 2	Social Sciences	Humanities	Medicine	Nursing	Education	Others
Reduced (Model 1)	1.41***	2.67***	1.75***	3.11***	2.44***	1.66***
	0.27	0.33	0.40	0.40	0.30	0.32
Full (Model 2)	1.52***	2.81***	1.44***	2.81***	2.42***	1.69***
	0.28	0.33	0.40	0.39	0.30	0.32
Diff	-0.10*	-0.14*	0.31**	0.30**	0.02	-0.03
	0.05	0.06	0.12	0.10	0.05	0.05
Model 1 vs. Model 3						
Reduced (Model 1)	1.39***	2.68***	1.77***	3.24***	2.51***	1.58***
	0.27	0.33	0.43	0.43	0.31	0.32
Full (Model 3)	1.51***	2.75***	0.92*	2.32***	2.21***	1.70***
	0.28	0.34	0.43	0.41	0.31	0.32
Diff	-0.11	-0.07	0.85***	0.93***	0.30**	-0.12
	0.09	0.10	0.20	0.20	0.10	0.12

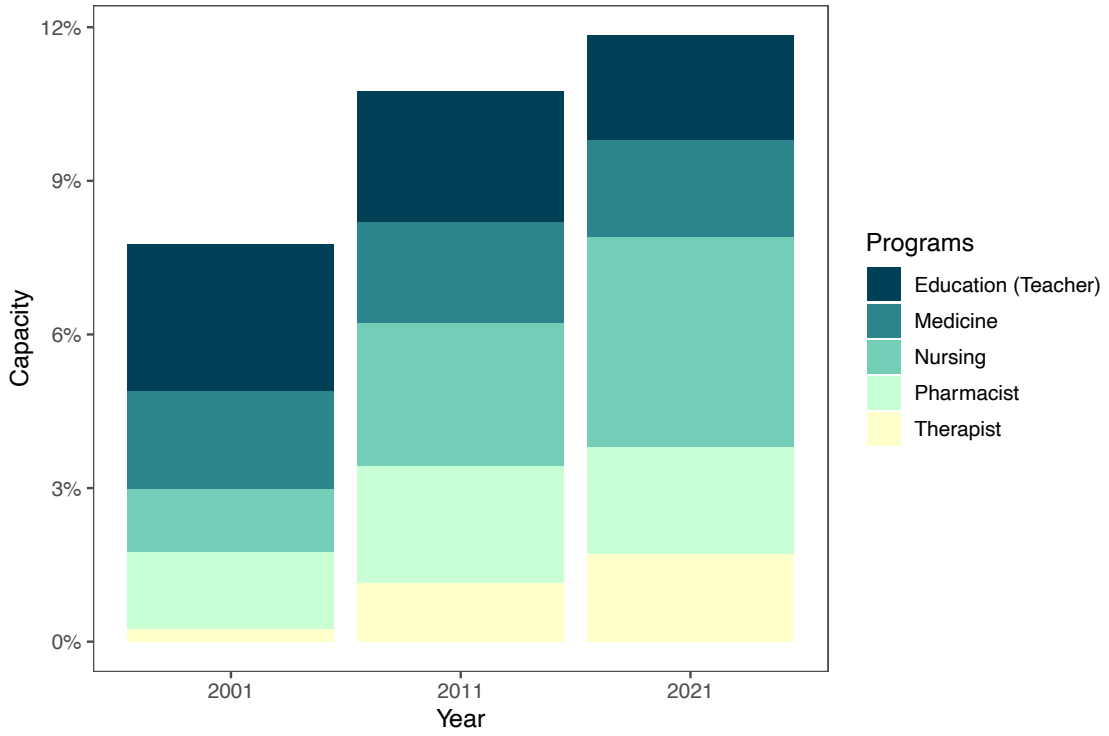


Figure 1 Changes in the composition of occupation-relevant programs in four-year institutions

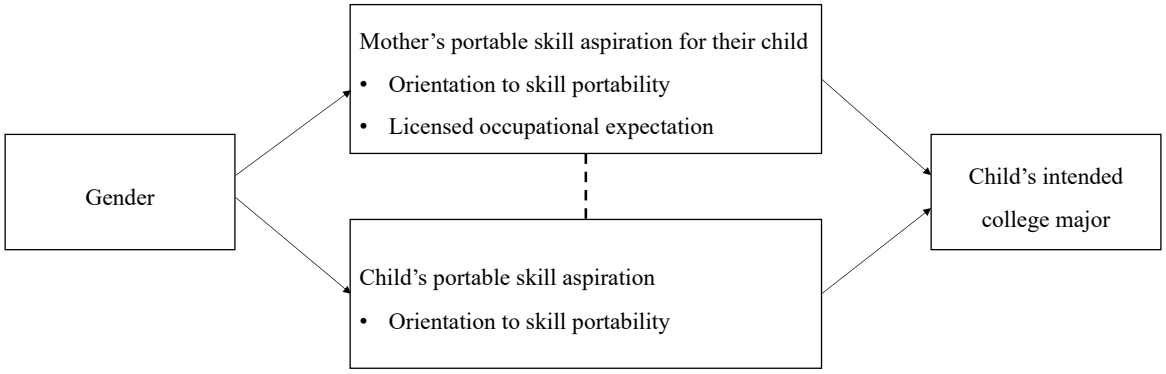


Figure 2 Conceptual model

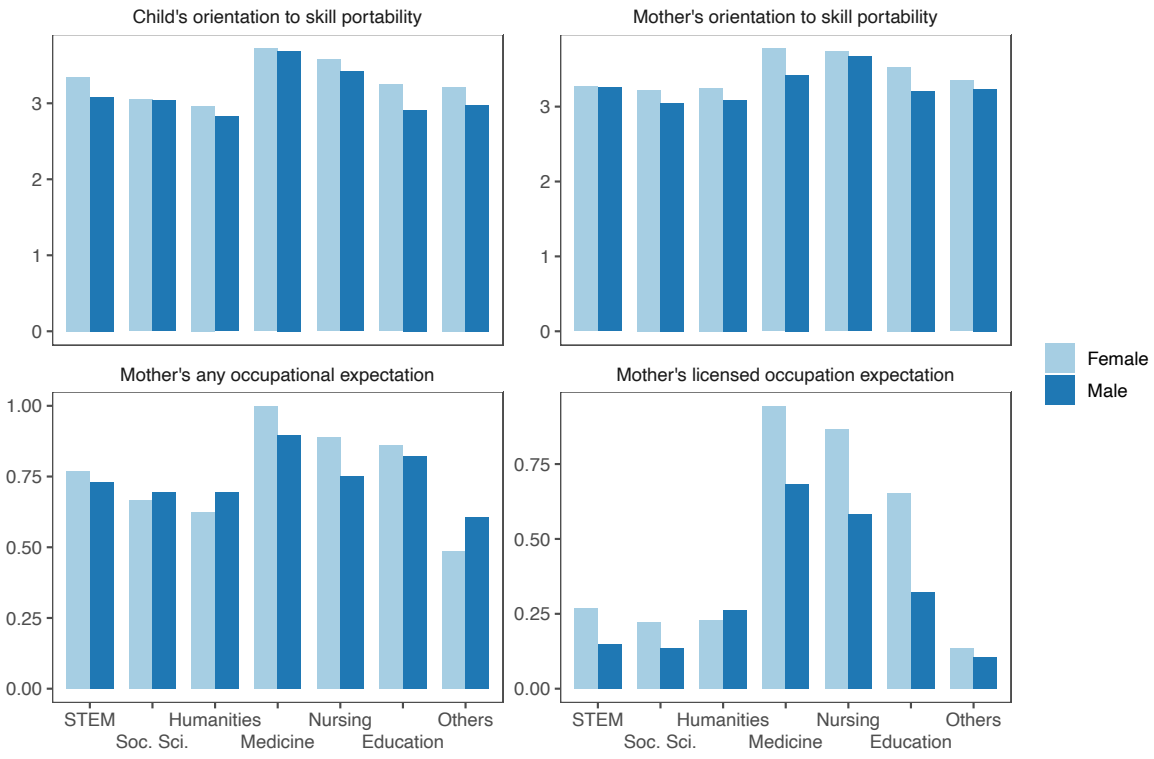


Figure 3 Distributional differences in portable skill aspirations across intended college majors

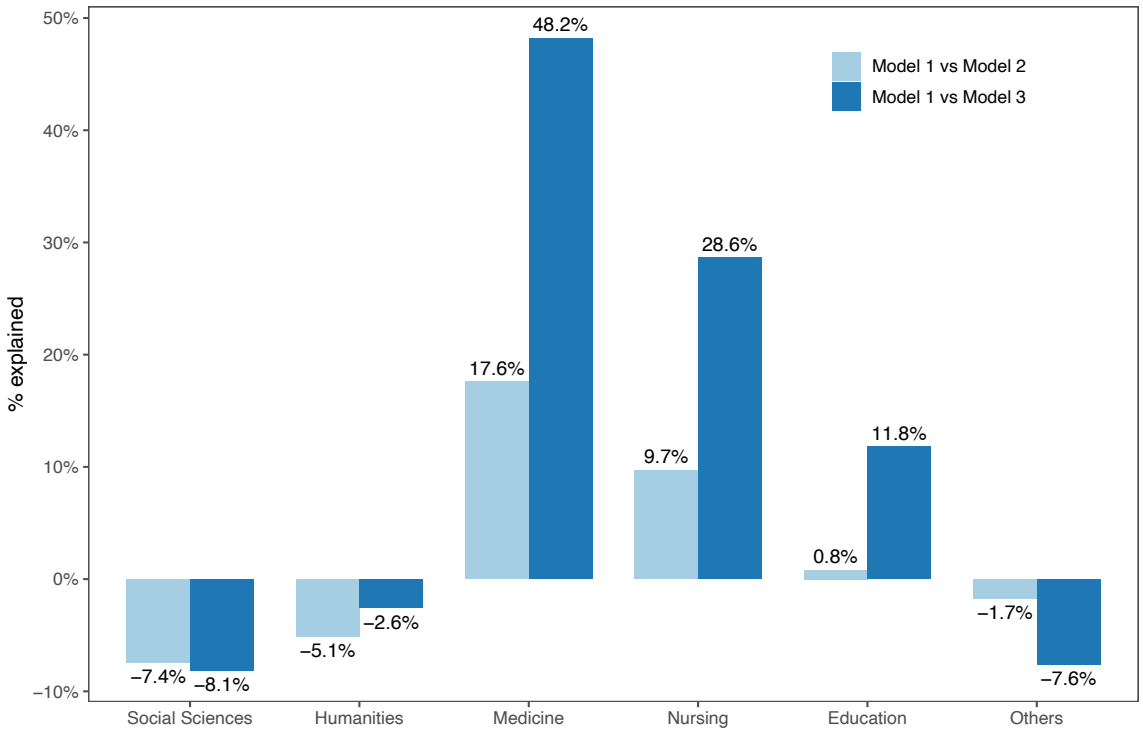
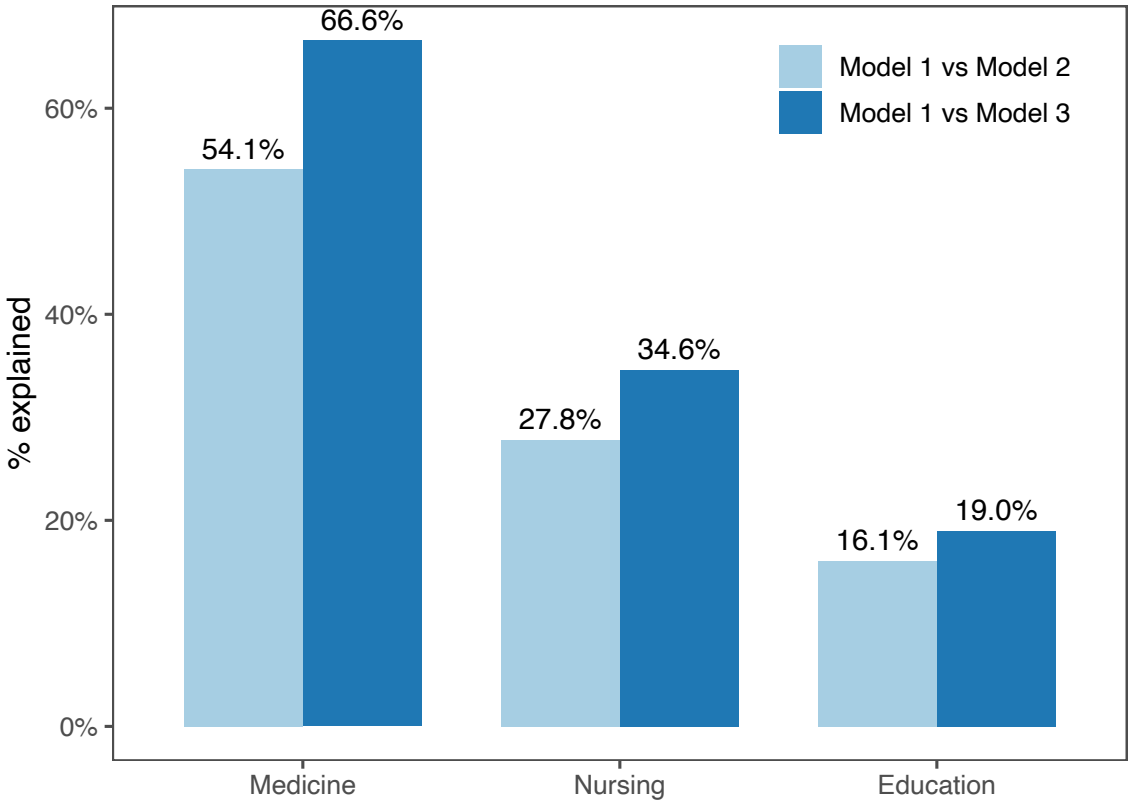


Figure 4 KHB decomposition results (% explained)

Appendix Table 1 Multinomial regression results adding children's occupational plans

	Model 1		Model 2		Model 3		Model 4	
Medicine, Dentistry, and Pharmacy								
Female	1.63***	(0.39)	0.95**	(0.44)	0.62	(0.46)	0.51	(0.52)
Orientation to skill portability			1.20***	(0.38)	1.15***	(0.39)	1.41***	(0.42)
Mother's orientation to skill portability			0.45	(0.35)	0.33	(0.37)	0.33	(0.39)
Child's any occupational expectation for themselves			-1.57*	(0.89)	-1.70*	(0.91)	-2.88**	(1.16)
Child's licensed occupation expectation for themselves			3.87***	(0.77)	3.28***	(0.80)	3.24***	(0.82)
Mother's any occupational expectation for her child					0.56	(0.89)	-0.25	(1.13)
Mother's licensed occupation expectation for her child					1.63***	(0.60)	1.64**	(0.64)
% female for child's expected occupation							3.71**	(1.53)
% female for mother's expected occupation							1.79	(1.41)
Other covariates							Yes	
Constant	-2.00***	(0.24)	-8.21***	(1.80)	-8.36***	(1.96)	-15.63	(9.73)
Nursing and Health								
Female	3.01***	(0.39)	2.37***	(0.42)	2.07***	(0.43)	1.15**	(0.51)
Orientation to skill portability			0.51*	(0.29)	0.40	(0.30)	0.42	(0.33)
Mother's orientation to skill portability			0.85**	(0.33)	0.71**	(0.34)	0.84**	(0.38)
Child's any occupational expectation for themselves			-0.85	(0.65)	-0.64	(0.67)	-4.33***	(1.03)
Child's licensed occupation expectation for themselves			3.02***	(0.54)	2.34***	(0.57)	2.06***	(0.63)
Mother's any occupational expectation for her child					-1.29*	(0.73)	-2.89***	(1.02)
Mother's licensed occupation expectation for her child					2.29***	(0.68)	2.18***	(0.73)
% female for child's expected occupation							8.05***	(1.44)
% female for mother's expected occupation							2.98**	(1.34)
Other covariates							Yes	
Constant	-2.46***	(0.30)	-7.59***	(1.51)	-6.60***	(1.54)	-14.93*	(8.17)
Education, Social Work, and Home Economics								
Female	2.43***	(0.30)	2.13***	(0.32)	2.05***	(0.32)	1.44***	(0.36)
Orientation to skill portability			-0.32	(0.20)	-0.34*	(0.20)	-0.25	(0.22)
Mother's orientation to skill portability			0.16	(0.22)	0.09	(0.22)	0.20	(0.25)
Child's any occupational expectation for themselves			0.17	(0.40)	0.16	(0.41)	-2.63***	(0.66)
Child's licensed occupation expectation for themselves			1.91***	(0.34)	1.63***	(0.37)	1.60***	(0.42)
Mother's any occupational expectation for her child					0.13	(0.39)	-1.51**	(0.62)
Mother's licensed occupation expectation for her child					0.72*	(0.37)	0.71*	(0.42)
% female for child's expected occupation							6.36***	(1.02)
% female for mother's expected occupation							2.95***	(0.93)
Other covariates							Yes	
Constant	-1.42***	(0.19)	-1.65*	(0.91)	-1.53	(0.95)	3.96	(5.80)
Observations	670							
Log Likelihood	-1165.45		-1034.31		-1013.82		-902.27	

Standard errors in parentheses. * p<0.10 ** p<0.05 *** p<0.01

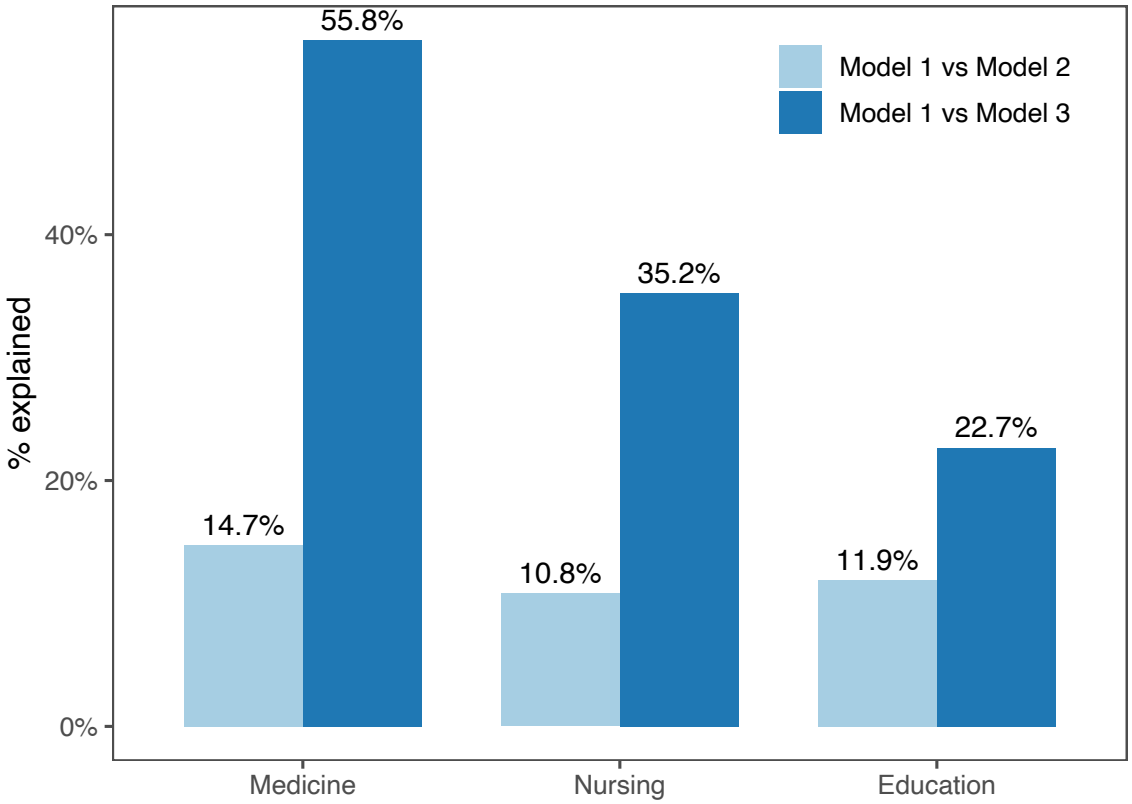


Appendix Figure 1 KHB decomposition results (% explained) adding child's occupational plans

Appendix Table 2 Multinomial regression results adding child's intrinsic rewards

	Model 1		Model 2		Model 3		Model 4	
Medicine, Dentistry and Pharmacy								
Female	1.63***	(0.39)	1.50***	(0.40)	0.84*	(0.43)	0.68	(0.48)
Standardized intrinsic value			0.67***	(0.20)	0.56***	(0.21)	0.42*	(0.22)
Orientation to skill portability					1.05***	(0.37)	1.26***	(0.40)
Mother's vocational orientation to skill portability					0.24	(0.36)	0.25	(0.37)
Mother's any occupational expectation for her child					0.35	(0.86)	-0.64	(1.00)
Mother's licensed occupation expectation for her child					2.62***	(0.55)	2.52***	(0.57)
% female for mother's expected occupation							2.87***	(1.07)
Other covariates							Yes	
Constant	-2.00***	(0.24)	-1.89***	(0.25)	-7.69***	(1.83)	-18.52**	(9.04)
Nursing and Health								
Female	3.01***	(0.39)	2.84***	(0.39)	2.22***	(0.42)	1.53***	(0.48)
Standardized intrinsic value			0.88***	(0.18)	0.80***	(0.19)	0.80***	(0.21)
Orientation to skill portability					0.27	(0.29)	0.35	(0.31)
Mother's vocational orientation to skill portability					0.65*	(0.34)	0.68*	(0.36)
Mother's any occupational expectation for her child					-1.40*	(0.72)	-4.55***	(0.95)
Mother's licensed occupation expectation for her child					3.16***	(0.66)	2.79***	(0.69)
% female for mother's expected occupation							6.56***	(1.10)
% female for child's expected occupation							8.05***	(1.44)
% female for mother's expected occupation							2.98**	(1.34)
Other covariates							Yes	
Constant	-2.46***	(0.30)	-2.40***	(0.31)	-5.77***	(1.47)	-19.23**	(7.97)
Education, Social Work, and Home Economics								
Female	2.43***	(0.30)	2.28***	(0.30)	2.07***	(0.32)	1.63***	(0.35)
Standardized intrinsic value			0.79***	(0.15)	0.85***	(0.15)	0.84***	(0.16)
Orientation to skill portability					-0.46**	(0.20)	-0.34	(0.21)
Mother's vocational orientation to skill portability					0.08	(0.23)	0.14	(0.24)
Mother's any occupational expectation for her child					0.15	(0.38)	-2.38***	(0.59)
Mother's licensed occupation expectation for her child					1.41***	(0.35)	1.27***	(0.38)
% female for mother's expected occupation							5.29***	(0.85)
Other covariates							Yes	
Constant	-1.42***	(0.19)	-1.34***	(0.20)	-0.67	(0.93)	0.93	(5.46)
Observations	666							
Log Likelihood	-1165.45		-1135.39		-1034.82		-950.58	

Standard errors in parentheses. * p<0.10 ** p<0.05 *** p<0.01"



Appendix Figure 2 KHB decomposition results (% explained) adding child's intrinsic rewards