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Education as a Shield Against the Adverse Shock of Motherhood: Gender, Parenthood and Overeducation Among Highly and Mid-Educated British Workers

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Abstract

This research improves our understanding of overeducation by highlighting its risks among middle-educated workers, especially the specific risk that motherhood may pose for job mismatch among them, compared to highly educated women. It employs random-effects and Heckman selection models with Mundlak correctors on 14 waves of the United Kingdom Household Longitudinal Survey (UKHLS) to explore the relationship between overeducation, gender, and parenthood among middle- and highly educated employees. Overall, women are found to have a lower risk of overeducation compared to men. However, becoming a mother and having more children negatively impact the status of middle-educated women in comparison to both male workers and highly educated women. Characteristics of the labour market positions held by middle-educated workers (such as part-time employment), family circumstances like single motherhood, and their partners' education and gender egalitarian values do not explain the higher risk of job mismatch that motherhood poses for female workers. Nevertheless, additional evidence from the European Jobs and Skills Survey (2021) shows that jobs held by middle-educated individuals offer less job discretion than those held by highly educated workers. This lack of discretion may hinder the development of firm-specific or occupational skills that would enable women to maintain or enhance their job status after becoming mothers or having additional children.

JEL classification

J10, J12, J13, J16

Keywords

overeducation, gender, level of education, parenthood, gender inequality, United Kingdom

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1. Introduction

Overeducation happens when a worker's educational level exceeds the minimum needed to perform or qualify for their current role. It represents an inefficient use of human capital and a misallocation of both public and private resources that could be directed elsewhere, even within the education sector. The importance of educational mismatch has grown with the educational expansion, making it a key aspect to examine in labour market inequality. One potential factor contributing to such inequality is gender. Despite recent increases in female human capital investment in many OECD countries outpacing that of males, women may not receive the same occupational returns for comparable levels of human capital, partly because they might face greater trade-offs between parenthood and career advancement.

This work aims to contribute to the debate on the relationship between gender and overeducation by examining the impact of gender and parenthood on the risk of overeducation among British workers, and by considering the possibility that any gender or parenthood effect is not equally distributed across different levels of education. Much research on overeducation and gender to date has understandably focused on the highest possible level of education. However, the risk of overeducation also exists in those with middle-level education. While research comparing the probability of overeducation among middle- and highly-educated workers is relatively limited, studies with a specific focus on gender are even more scarce.

The following sections revise the theoretical arguments to expect a gender effect of overeducation. In section 2, we present reasons why these effects might vary across different levels of education. Section 3 provides the data used to test the hypotheses and describes the methods employed. Finally, the results of our analysis are discussed in Section 4.

2. The role of gender in explaining educational mismatch

The initial attempt to theoretically explain a potentially higher risk of overeducation among women was Frank's Theory of Differential Overqualification (TDO, hereafter) (Frank, 1978). According to TDO, couple formation plays a significant role in creating such a female disadvantage. Following "a pooled approach to decision making, with the household maximising a joint utility function" (Quinn and Rubb, 2011: 44), and considering gender wage differences in the labour market, women might accept the optimisation of their male partner's job match if the benefit is expected to be greater than their own. The female job search would thus become subsidiary to the male one. Women would become tied movers or tied stayers, limiting the geographical scope of their job search compared to their male partners. In families on the move in the US, women have indeed been found to be more likely to seek jobs after the move, rather than before; the opposite is true for male partners (Cooke 2008). There is also evidence that migration decreases overeducation for men more than for women (Quinn and Rubb, 2011).

Building on the TDO (Theory of Differential Overqualification), an unequal distribution of childcare responsibilities can limit not only the geographical areas where women seek employment but also the types of jobs they are willing to accept. This dynamic likely shapes how motherhood influences the risk of overeducation by gender. While fathers still have the option to change jobs to improve their job match, mothers are often prevented from doing so, making them less able than fathers to enhance their job fit (see Avram et al. (2024) for the UK; or Boll et al. (2016) for Germany).

Not by coincidence, the evidence supporting TDO theory often comes from labour markets where the male breadwinner model is still common. There is evidence of higher overeducation among female workers in Spain (García Serrano and Malo, 1996; 1997; Ramos and Sanromá, 2012), Korea (Lahsen et al., 2020), the Netherlands (Groot and Maassen van de Brink, 2000), and in many studies of the German labour market (Daly et al., 2000; Boll et al., 2016; Büchel and Battu, 2003). Another possible reason why women may be more vulnerable to overeducation in conservative welfare regimes is that they face longer breaks in their labour market careers related to motherhood. This leads to a greater devaluation of their credentials and a subsequent penalty in terms of educational mismatch when returning to work (Diener et al., 2013).

However, cross-national evidence does not systematically support a higher likelihood of overeducation among women (McGoldrick and Robst, 1996; Büchel and Pollmann-Schult, 2004; Groot and Maassen van de Brink, 2000; Groot, 1996; Sloane et al., 1999; Boll et al., 2009; Battu et al., 2000; Leuven and Oosterbeek, 2011). The studies that have not identified any gender difference in overeducation (or even higher overeducation among males) mainly focus on Anglo-Saxon countries, where the male breadwinner model is less common, and/or on tertiary or college graduates, rather than considering the entire spectrum of workers who are theoretically at risk of overeducation. This is linked to some theoretical arguments suggesting why Frank's TDO proposition may have become increasingly outdated. Firstly, this theory depends on the dominance of a male breadwinner model that has recently declined (Knight and Brinton 2017). Secondly, gender egalitarian values are more typical among highly educated women and couples, coinciding with a rise in female educational attainment.

With some exceptions (Boll et al., 2016; Delaney et al., 2020), research on overeducation and gender has largely overlooked potential differences between middle- and highly educated workers. Furthermore, studies examining gender differences in overeducation have often overlooked the possible moderating effect of children (Boto-García and Escalonilla, 2022). Our contribution lies in comparing gender differences in overeducation among mid- and high levels of educational attainment and considering the role of parenthood at each level. We present theoretical arguments (regarding family structure, the labour market position of middle-educated workers, and the characteristics of their partners) as to why mid-educated female workers may face a higher risk of overeducation compared to their highly educated counterparts.

We view motherhood as a potential career shock that could undermine the quality of job matching, and education as a shield helping women buffer this shock. The role of education as a shield against the adverse effects of parenthood on overeducation would be more important for women than for men. Compared to highly educated women, moderately educated women have weaker buffers, so the same motherhood shock poses a higher risk of job mismatch. Education acts as a buffer for women because it is linked to positive aspects in both the labour market and the marriage market, as well as increasing bargaining power within the couple (Sullivan & Gershuny, 2016). In the labour market, higher education can be associated with internal labour markets, greater discretion, more flexible scheduling (without formally shifting to part-time work), and fewer career interruptions (Smeaton, 2006; Schober & Scott, 2012). Beyond its advantages in the labour market, women's education also functions as marriage-market capital, influencing the timing and selection of unions towards more gender-egalitarian partners and higher-resource, more stable partnerships (Schwartz & Mare, 2005; Hirschl et al., 2024). Within partnerships, a woman's own education, through earnings and external options, enhances her bargaining power within the household (Lundberg & Pollack, 1996; Thomas, 1990).

From this perspective, Frank's TDO theory is fundamentally flawed because female education protects women against educational mismatch, granting them power derived both from their marriage and labour market positions. The more educated women are, the better protected they are from educational mismatch, especially from the shock that motherhood may bring to their job match.

In the following lines, we disentangle the elements of this differential shield against the risk of overeducation associated with motherhood, as brought about by education. One key reason for a stronger link between gender and overeducation at the mid-level of educational attainment is the prevalence of gender egalitarian values. Evidence from various countries (Inglehart & Norris, 2003) and studies in the UK (Breen & Cooke, 2005; Bolzendahl & Myers, 2004; Crompton & Lyonette, 2005) suggests that gender egalitarian values are more pronounced among highly educated women compared to those with lower levels of education. As a result, this difference may weaken the explanatory power of TDO theory among highly educated workers compared to those with middle levels of education.

> *Hypothesis 1: A stronger association between motherhood and overeducation among middle-educated females, relative to highly educated females, is mediated by gender egalitarian values.*

A second possible reason for a higher risk of overeducation among women with middle-level education is the prevalence of single motherhood, which is more common among them than among highly educated women (Berghammer et al., 2024; Härkönen, 2017). Having lower reservation wages than women in couples (Harkness, 2016), single mothers may be willing to accept jobs below their qualification level. This could explain a stronger link between motherhood and educational mismatch for women with middle-level education.

> *Hypothesis 2: A stronger association between motherhood and overeducation among middle-educated females, relative to highly educated females, is mediated by single motherhood.*

Third, the labour market segment occupied by middle-educated workers may possess certain traits that are particularly harmful to women, especially after they become mothers. One such trait is part-time work, which tends to be less secure and results in a lower accumulation of firm-specific or occupation-specific skills. This can threaten a worker's ability to retain suitable employment or progress to higher positions (Connnolly & Gregory, 2008). Part-time employment is more common among women and tends to increase with motherhood, mainly due to the challenges of balancing work and family life. Consequently, part-time work likely affects the relationship between overeducation and gender across different educational levels.

> *Hypothesis 2: A stronger association between motherhood and overeducation among middle-educated females, relative to highly educated females, is mediated by part-time employment.*

Fourth, workers with a middle level of education often experience more job disruptions, which negatively impact their employment status. The new roles they obtain may carry less prestige than their previous positions, increasing the likelihood of being overqualified. Both men and women face these disruptions, but women, particularly those who become mothers, may encounter a higher risk of overqualification due to limited job options, employer bias, or time pressures from unequal household responsibilities. Frequent interruptions in employment can especially harm middle-educated women, making it harder for them to resolve any mismatches

between their skills and jobs. Conversely, workers with higher education tend to experience fewer job disruptions, particularly involuntary job losses, which help protect their employment status compared to women with middle education.

> *Hypothesis 4: A stronger association between motherhood and overeducation among middle-educated women, compared to highly educated women, is mediated by previous non-employment.*

The TDO hypothesis relies implicitly on gender inequality within households, particularly in prioritising male participation in the labour market and job searching. As previously discussed, shifts in gender egalitarian values should have increasingly rendered this perspective untenable, especially among highly educated couples. Gender egalitarian values are more common at the higher end of the educational spectrum, including among men (Bolzendahl and Myers, 2004). Due to educational homogamy, gender egalitarianism might be weaker among the male partners of moderately educated women compared to those of highly educated women. In other words, mothers with mid-level education could be more exposed to less gender-egalitarian attitudes from their partners. This scenario would influence partnership and motherhood in line with the initial ideas of the TDO hypothesis, as proposed by Frank (see above).

> *Hypothesis 5a: A stronger association between motherhood and overeducation among middle-educated women, compared to highly educated women, is mediated by lower gender egalitarian values among their partners.*

> *Hypothesis 5b: The stronger association between motherhood and overeducation among middle-educated women, compared to highly educated women, is mediated by the partner's educational level.*

All previous arguments suggest that women with medium education might be more susceptible to overeducation than those with higher education, especially when they become mothers. Therefore, the following summary hypotheses:

> *Hypothesis 6: The relative risk of overeducation among women, compared to men, is higher among middle-educated than among highly-educated workers*

> *Hypothesis 7: Parenthood increases the relative risk of overeducation among middle-educated women more than among highly-educated women.*

3. Data and Methods

To test the hypotheses above, we use longitudinal data from the United Kingdom Household Panel Survey (UKHLS) from 2009 to 2022 (14 waves). In various cross-national studies, the United Kingdom is recognised as a country with a relatively high rate of overeducation (Capsada-Munsech, 2017; Verhaest and Van der Velden, 2013). Following McGuiness, Bergin, and Whelan (2018), we exclude self-employed individuals from the analysis, as the lack of formalised job entry requirements significantly reduces the reliability of educational attainment levels as a proxy for the human capital content of a specific job.

Dependent variable

We rely on an objective measure of overeducation called the 'realised matches approach' (RM), initially based on the distribution of years or levels of education among workers in different

occupational categories. A worker is considered overeducated if their years of education exceed the average in their occupation by more than one standard deviation (Verdugo and Verdugo, 1989). However, years of education may not always be recorded precisely, and interviewees might better remember their level of education than the exact length of their formal training. When classifying workers into educational categories, using the mode (the most common level of education) within a specific occupational category is more suitable for identifying overeducated workers than relying on the mean. Consequently, following recent research (McGuinness et al., 2018; Delaney et al., 2020), we define workers as overeducated if their level of education surpasses the educational mode for their respective occupations.

For the construction of our RM indicator of overeducation, we take a raw educational variable constituted by the following (broadly hierarchical) categories: "Degree" (which includes 'higher degree' and '1st. degree or equivalent'); "Other degree" (constituted by 'diploma in higher education', 'teaching qualification no PGCE', 'nursing or other medical qualification' and 'other higher degree'); "A-level" or similar (constituted by A-level, 'Welsh baccalaureate', 'international baccalaureate' and 'highers' (Scottish system); "GSCE" or similar (constituted by the following categories: GSCE/O level, or 'standard/o/lower'); "Other qualification" (which could be CSE or 'other school certificate'); and, finally, "No qualification". These six categories have been reduced to four: "Higher education" (resulting from merging "Degree" and "Other degree"); "A-level"; "GCSE or similar" (resulting from merging the above "GCSE" and "Other qualification"), and "No qualification".

Regarding occupation, we use ISCO 2-digit occupational categories. A 3-digit classification could offer narrower but more homogeneous occupational groups in terms of the educational credentials needed for optimal productivity; however, some of these narrower categories would have very low frequencies. This would make their educational mode less reliable and stable across waves. Choosing two-digit occupations provides a reasonable compromise between accuracy and homogeneity in the skills and credentials required for an occupational category, while also maintaining a sufficient sample size that ensures stability in educational modes over different waves (see McGuinness et al, 2018).

Independent variables and mediators

Aside from gender, the other key independent variables in our analysis are parenthood and two broad levels of education: highly educated, consisting of those with a university degree ("Higher degree" or "first degree"), and middle-educated, comprising those whose educational attainment ranges from a 'Diploma in HE' to GCSE (with the latter excluded). The categories from GCSE to 'No qualification' are excluded from the analysis because workers in these occupations are unlikely to be overeducated. Regarding parenthood, the variable includes 'No child', 'One child', 'Two children' or 'Three children or more'.

Concerning potential mediators of a potentially diverse relationship between gender and parenthood, on one side, and overeducation, on the other, the first is gender egalitarianism. Gender egalitarian values are incorporated into the analysis as an index ranging from 0 to 5. The index has been derived from the interviewee's agreement to two statements: "Family suffers if the mother works full-time" and "Husband should earn, the wife should stay at home."

Another potential mediator is single motherhood. Using a simple dummy variable for single mothers might exclude women without children from the analysis. Therefore, instead of directly focusing on single motherhood, we used a variable that differentiates between 'not being in a

couple' and being married or cohabiting. The aim is to evaluate how this variable influences the effect of motherhood on overeducation.

Part-time employment is indicated by a binary variable (full-time/part-time). Concerning interruptions in the labour market path, we use a variable that shows whether the worker's job is new, and thus, whether workers might be experiencing the scarring effect of previous unemployment or inactivity. Lastly, we assess if there has been at least one period of employer-provided training since the last interview.

Finally, we consider two potential partner-related mediators: firstly, the same index of gender egalitarianism used among women (see above) and the male partner's educational attainment. To avoid excluding women (and men) who are single when this mediator is introduced into the analysis, we have defined it as a three-category variable that includes being single, having a male partner with higher education, and having a male partner with less than higher education.

Controls

In our analyses, we control for age, migrant origin, career preferences, and unemployment rate. Age acts as a proxy for labour market experience, which is known to reduce educational mismatch. Immigrants are more likely to be overeducated than natives due to discrimination, unobserved language differences, or the limited transferability of human capital credentials across borders (Dahlstedt 2011; Nielsen, 2011; Fernandez and Ortega, 2008; Battu and Sloane 2002). At the same time, immigrants tend to be over-represented among middle-educated workers compared to those who are highly educated.

Although not explicitly linked to gender, work-related values have already been identified as one reason why some individuals are more inclined to start their careers in overeducation (Blazquez and Budria, 2012). This is important because the preference for a good match versus other job aspects, such as proximity to home or flexibility, may not be equally distributed by gender (Tarvid, 2013). Information on job preferences was collected from a question where the interviewee states the "main attraction of the current job". We kept three options from this variable (a job "near home" or that involves "less travel"; the "time dimensions" associated with the job; and the "suitability of the respondent's training") and combined the rest into one category ("Other options"). We aim to identify preferences that could influence the perceived value of jobs for which the individual is overeducated. Preferring to work near home or having a more flexible schedule are work preferences that may explain potential gender differences in overeducation.

Finally, we include a control for the economic cycle because economic downturns increase the likelihood of overeducation (Summerfield and Theodossiou, 2016). The variable covers four economic periods within our data timeframe: 2009-2011 (unemployment rises); 2011-2019 (unemployment falls); 2020 (unemployment rises due to the COVID-19 economic downturn); and 2021-2023 (unemployment falls).

Main methodological approach

Since one of our key independent variables (gender) is time-constant, using fixed effects to control for individual-level unobserved heterogeneity that might affect our results becomes difficult. This prompts us to consider a random-effects model, but such models assume that the individual-specific effects (αi) are uncorrelated with the explanatory variables (Xit). If this assumption is violated (which often occurs), the estimates can become biased. Mundlak's

correction, which incorporates the individual means of the time-varying covariates across waves in the analysis, accounts for the potential correlation between the error term and the explanatory variables. This causes the random-effect models to approximate a fixed effects specification, thus providing reliable estimates and enabling us to retain time-invariant controls. This strategy has already been used in previous studies of overeducation (Boll et al. 2016; McGuinness et al. 2018). More formally, our model can be expressed as follows.

$$y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 \bar{X}_i + \alpha_i + \varepsilon_{it} \qquad (1)$$

Where y_{it} is the overeducation status of individual i at time t, β_0 is a constant term, X_{ijt} represents a set of j independent variables with β_j the associated coefficients, α_i is the unobserved time-invariant country effect and ε_{it} the error term. The Mundlak correction is implemented through the inclusion of $\bar{X}_{,i}$, which denotes the time-averaged means of the independent variables in the models.

Although we introduce gender egalitarian values and work preferences into the analysis and control for any time-constant unobserved heterogeneity through a modified random effects model, residual selection effects may still be a concern. Overeducation is only observed among workers, but men and women select themselves into employment based on unobserved characteristics that may also influence their likelihood of overeducation (Hamjediers and Schmelzer, 2022). Moreover, selection due to gender may not be equal across highly educated and middle-educated workers.

For all these reasons, we supplement the random-effects models with Mundlak corrections for the whole sample (mentioned earlier) with separate Heckman selection models for men and women. In these models, the dependent variable in the outcome equation is the same indicator of overeducation, and the dependent variable in the selection equation is employment status (whether being employed or not). Essentially, we enhance equation 1 with an inverse Mill's ratio control (λ) that accounts for selection into employment (equation 2). The same key independent variables, controls and Mundlak correctors are included in both the selection and outcome equations. Following Rubb (2014), the instrument in the selection equation[1] is the regional unemployment rate in the UK[2].

$$y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 \bar{X}_i + \lambda_i + \alpha_i + \varepsilon_{it} \qquad (2)$$

We also utilise data from the second wave of the European Skills and Jobs Survey (collected in 2021) to examine the relationship between occupational attainment and measures of job discretion. The European Skills and Jobs Survey (ESJS) is a periodic survey gathering information on job skill requirements, digitalisation, skill mismatches, and workplace learning among representative samples of European adult workers. We are interested in how the probabilities of job discretion vary between occupations predominantly staffed with highly and middle-educated females. As part of our analysis, we estimate equation 3, where D is a binary measure of job discretion, X is a vector of job and personal characteristics, and the Occ dummy variable distinguishes between occupations concentrated with highly and middle-educated females.

[1] We consider this a better instrument than others used in the past for the study of overeducation. Büchel and Van Ham (2003) used 'age' as an instrument in the selection equation in similar models. However, age is likely related to labour market experience and tenure, two natural correctors of educational mismatch

[2] Yearly unemployment rates for the period of study were drawn from the UK Office of National Statistics and merged with our UKHLS data. Unfortunately, no date for Northern Ireland was available.

$$D_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 Oc_{it} + \varepsilon_{it} \quad (3)$$

4. Results

Table 1 shows the cross-wave average overeducation rates for females and males across different education levels and parenthood statuses. The rates are notably similar to those reported for the UK using a comparable mode-based RM approach on EU Labour Force Survey data: between 15.8% in 2011 and 17.8% in 2018 (Baran, 2024). These figures closely match our estimates for highly educated workers.

Unlike what TDO theory predicts, male overeducation rates are noticeably and systematically higher than female ones. Our results align with Boll et al.'s findings for Germany (2016). A higher likelihood of overeducation among males was also identified by Castagnetti et al. (2018) for Italy and by McGuinness and Sloane (2011) in their study of European college graduates with REFLEX data. One possible explanation for higher male overeducation is that routine-biased technological change and hollowing out the occupational structure are negatively affecting traditionally male-dominated sectors. This may make male workers at certain educational levels more susceptible to downward occupational mobility than female workers of the same educational level.

Table 1 also shows that this female advantage (a lower overeducation rate) is initially greater among middle-educated workers (an 8.2 percentage point difference in favour of women) than among highly educated workers (a 4.7 percentage point difference). However, this advantage diminishes with parenthood and the number of children (although the trend reverses for parents of three or more children), and it declines more for middle-educated women than for highly educated women. Importantly, Table 1 indicates that the rate of overeducation among middle-educated women is nearly three times higher than among highly educated women, with the largest difference (24.5 percentage points) observed among women with three or more children. The descriptive evidence thus supports the hypothesis that having children worsens the overeducation disadvantage of mid-educated women compared to their highly educated counterparts.

--Table 1--

Table 2 presents the results of the random-effects logistic regression with Mundlak corrections. As expected, age is a significant factor in overeducation, and migrant origin is positively associated with it. Surprisingly, work and gender variables do not show a statistically significant link to overeducation, and the relationship between different periods and overeducation does not fully support the idea that the likelihood of overeducation rises during economic downturns. Finally, as expected, overeducation is associated with a preference for working close to home or with a greater concern for time flexibility.

The relationship between gender, parenthood, and education level, on one side, and overeducation, on the other, is illustrated by the three-way interaction shown in the shaded area of the table. To better interpret this interaction, the predicted probabilities for the involved terms are graphically displayed in Figure 1. Motherhood does not create any gender disadvantage among highly educated women, but it does among those with lower education levels, compared to highly educated mothers. The gap in the likelihood of overeducation between moderately educated women and highly educated women widens with parenthood.

Conversely, the corresponding gap between moderately educated and highly educated men eventually disappears.

--Table 2 & Figure 1 --

To eliminate any bias from the possibility that highly and middle-educated women are differently selected into employment based on unobserved factors beyond those considered as controls in the random effects model, we run two Heckman two-stage models with random effects (for men and women, respectively), where employment status served as the dependent variable in the selection equation. The results (Table 3) show that the correlation between time-varying unobserved factors influencing employment and overeducation at the same time (Rho) is negative for women but not statistically significant. This indicates that short-term, idiosyncratic shocks affecting female employment do not systematically overlap with those influencing female overeducation. Selection bias due to unobserved, time-varying factors is therefore minimal. However, the correlation between the random effects of the outcome and selection equations is negative and statistically significant, both for men (-0.13**) and women (-0.15**). This suggests that, as expected, persistent, unobserved individual characteristics that increase the likelihood of employment tend to reduce the probability of overeducation, consistent with the hypothesis of positive selection into employment.

--Table 3 --

In the selection equation, motherhood stands out as something that reduces women's probability of employment more than it does for men. The instrumental variable (regional unemployment rate) has an unexpectedly positive sign for men and women. The added-worker effect, according to which a female labour market activity increases as a result of household income reduction due to male unemployment in times of crisis, would have inclined us to expect the opposite sign of 'county unemployment' for men and women.

Moving on to the outcome equation, the interaction between motherhood and the number of children, on one hand, and the level of education (middle/high), on the other, remains consistent after accounting for selection into employment. It does so for women, as expected, while the corresponding interaction is not statistically significant for men. In other words, whatever reduces the chances of securing or maintaining a suitable job match for middle-educated mothers more than for highly-educated ones is not explained by selection into employment.

Figures 2 and 3 display the predicted probabilities derived from Table 3. Overeducation consistently remains higher among middle-educated workers than among highly educated ones. This aligns with findings for Germany in one of the few comparisons of overeducation between workers with middle and higher levels of education (Boll et al., 2014). However, while entering parenthood or having an additional child does not influence this difference for men (Fig. 2), it adversely affects the occupational status of middle-educated female workers, resulting in an increased probability of overeducation from 0.24 (for those without children) to 0.30 (for mothers of three or more children) (Fig.3).

-- Figures 2 & 3 --

Hypotheses 6 and 7 are confirmed. Firstly, female workers with a middle level of education seem more susceptible to over-education than those who are highly educated, compared to their male counterparts. Secondly, the relationship between motherhood and over-education differs

between women with middle and higher education. Motherhood is linked to increased over-education among the former, but not among the latter. This may enhance women's motivation to acquire human capital: by doing so, they reduce the risk of losing occupational prestige associated with motherhood.

The other hypotheses sought to explain a possible increase in the risk of overeducation linked to motherhood among women with middle-level education. Due to space limitations, the full analysis for each mediator is only presented in the Appendix (Tables A1-A5, in the Supplementary Online Appendix). Table 4 provides a summary of the net effects of various mediators on the relationship between motherhood and overeducation across different education levels. Each coefficient in the table represents one of these mediators. It is obtained from a series of Heckman two-stage models with random effects, conducted solely for women, where employment status again functions as the dependent variable in the selection equation, and each mediator was added to the main equation. Most potential mediators' associations with overeducation behave as expected. However, they do not fully explain the heterogeneous effect of parenthood for women with middle and higher education.

--Table 4 --

Part-time female workers are more likely to be overeducated than full-time workers. However, a higher incidence of part-time work among middle-educated mothers cannot explain the increase in their risk of overeducation compared to highly-educated mothers (Table A2). A more uncertain labour market trajectory (proxied by previous non-employment spells) is also linked to a greater risk of overeducation. Still, the results in Table A3 indicate that a possibly more precarious trajectory for middle-educated women does not account for why they are more prone to overeducation when they become mothers, compared to highly educated women.

Contrary to what the TDO theory suggests, living in a couple *reduces* the risk of overeducation. This finding aligns with research by Hamjediers and Schmelzer, which indicates that married German women have a lower risk of overeducation than their unmarried counterparts (Hamjediers and Schmelzer, 2022: 73; similar results for the Netherlands are reported in Groot and Van de Brink, 2009). This outcome supports a 'social support perspective,' according to which sharing resources such as money, knowledge, and emotional encouragement between spouses enhances labour market outcomes. Yet, this variable does not eliminate the interaction effect between motherhood and women's education level in the outcome equation (Table A6). In other words, the higher likelihood of single motherhood does not account for why mothers with a middle level of education are at a higher risk of overeducation compared to highly educated mothers.

Surprisingly, gender egalitarianism is positively (not negatively) linked to overeducation. In any case, it does not mediate the relationship between motherhood and level of education, on the one hand, and overeducation, on the other (see Table A1). The suggestion that middle-educated mothers are more likely to be overeducated because they hold weaker gender egalitarian values than highly educated mothers is not supported by our findings.

Finally, we investigate whether the characteristics of male partners of middle- and highly educated female workers account for the rise in overeducation related to motherhood among the latter. Contrary to our initial expectations, a partner's gender egalitarianism neither decreases the likelihood of overeducation among British women nor alleviates the negative impact of motherhood among middle-educated women (Table A4). However, when we consider the partner's level of education instead, the results differ. Comparing the coefficients for a

partner with 'Less than higher education' and one with 'Higher education' in Table 4 shows that having a highly educated partner is linked to a lower likelihood of overeducation. This supports the 'social support perspective' mentioned earlier, possibly strengthened when the partner's education is higher. Nonetheless, it does not remove the statistical significance of the interaction between motherhood and level of education (see Table A5).

So far, we have explored potential mediators related to family structure, labour market positions typically held by middle-educated workers, or characteristics assumed in partners of middle-educated women. In each case, we have rejected the associated hypothesis in our theoretical discussion (hypotheses 1 to 5). An additional distinction between middle- and highly-educated mothers concerns the nature of the jobs usually occupied by these groups, not just their relative position in the labour market. Jobs held by middle-educated workers may not enable as much accumulation of firm- or sector-specific human capital as those usually held by highly-educated workers. This could result in greater job security and opportunities for advancement among the latter, and such career progression might be crucial for maintaining or improving their occupational status. Consequently, this may reduce their risk of overeducation when they become mothers or have more children, compared to middle-educated mothers.

Unfortunately, information on job characteristics is not as precisely recorded in the UKHLS (Understanding Society) as in other sources. From the European Skills and Jobs Survey 2021, we obtained data on job traits for the ISCO 3-digit categories that account for over 80% of employment among highly and middle-educated workers as defined for our analysis with UKHLS. We then analysed job traits not available in UKHLS. Robustness checks were performed using 2-digit categories, consistent with those used in our analysis.

The results (Table 5) show that, although middle- and highly-educated British workers have similar views on job satisfaction and fear of losing their jobs, the jobs common among middle-educated women tend to offer less job discretion. These jobs are less likely to "involve learning new things" or provide the same level of training as those held by highly educated women. They also often involve more repetitive tasks. These features do not support increased work productivity and make middle-educated female workers less likely to sustain or improve their occupational status after childbirth, leading to higher levels of overeducation. Motherhood does not necessarily disrupt the ongoing progress towards a better job match for highly educated women, but it can hinder such progress for the middle-educated.

--Table 5 --

As a further test of this suspicion, we derive a measure of high job discretion based on female workers who report that (i) their job does not often require performing short, repetitive tasks, (ii) they can often choose their methods of work, and (iii) they can frequently plan their work activities. The average incidence of high job discretion was 10.85% across the entire female sample, and 10.5% and 7.4% among females in occupations mainly held by highly educated and middle-educated individuals, respectively. This again suggests lower levels of job discretion in occupations mainly occupied by middle-educated females. In Table 6, we estimate a basic probit model for job discretion, using a forward step approach to account for potential collinearity. The results indicate that being in an occupation common among mid-educated females reduces the likelihood of having high job discretion by between 5 and 6 percentage points, depending on the specification. The results are consistent when including firm size, tenure, and number of working hours as possible determinants of job discretion.

--Table 6 --

5. Conclusions

In this study, we examined how the risk of overeducation varies by gender, education level, and parenthood, considering that motherhood may lead to higher overeducation among female workers. Using random-effects models with Mundlak corrections on data from fourteen waves of the United Kingdom Household Longitudinal Survey, we found that, after controlling for immigrant status, work preferences, gender egalitarian values, and the economic cycle, the risk of overeducation is higher among males than females. However, the impact of gender on overeducation depends on education and motherhood. Women with intermediate education face a greater risk of overqualification compared to those with higher education, and this risk increases with the onset of motherhood. Importantly, this disadvantage does not apply to women with higher education. Our research shows that, unlike what was predicted by the Theory of Differential Overqualification (Frank, 1978), the level of education actually works as a shield against overeducation, and especially for women when entering parenthood. Therefore, this finding encourages women to pursue higher education, as it may help them avoid the increased risk of educational mismatch associated with motherhood if they do not have a university degree.

Many assessments of the impact of gender on the likelihood of overeducation overlook potential bias in estimates if selection into employment is not taken into account. This becomes especially important when analysing the effects of parenthood. Therefore, we improved the previous analysis by applying separate Heckman selection models for men and women, using employment as the dependent variable in the selection equation and the regional unemployment rate as the instrument. Our results confirmed that motherhood increases the risk of overeducation for middle-educated women compared to highly educated women.

Finally, we examined various mechanisms that might explain the different effects of motherhood across education levels. We identified several factors related to the labour market niche of middle-educated workers, such as part-time employment and previous experiences of unemployment, as well as family circumstances like single motherhood and the education and gender egalitarian values of their partners. Most of these factors showed the expected correlation with overeducation but did not mediate the impact of motherhood on middle-educated female workers. Circumstantial evidence from Britain's second wave of the 2021 European Skills and Jobs Survey indicated that jobs held by middle-educated British workers generally offer significantly less job discretion. This finding tentatively suggests that the lower job discretion associated with middle-educated positions may hinder the accumulation of firm-specific or occupation-specific human capital, making middle-educated women more vulnerable to educational mismatches following motherhood or the birth of another child, and may also reduce their chances of securing or maintaining a job that matches their education. This explanation remains preliminary and highlights the need for further research, as direct information on job discretion was not available in the UK Household Longitudinal Study (UKHLS).

Two key factors contributing to overeducation are also absent from our data. Firstly, the field of study is known to be linked to educational mismatch, and women may be over-represented in fields that are more prone to overeducation. Unfortunately, we lack this information in the UK Household Longitudinal Study (UKHLS), possibly because the field of study does not significantly influence education stratification in the UK as it does in other countries. Secondly, we do not have data on cognitive abilities similar to those available in the Programme for the International Assessment of Adult Competencies (PIAAC) database. Finally, the UKHLS data do not allow us to

compare results using both objective and subjective measures of overeducation, since there is no assessment from interviewees regarding how well their education matches their current job.

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Table 1. OVEREDUCATION INDICATOR BASED ON **ISCO-2 DIGITS**
Mean percentage across waves for each combination of gender, education and parenthood

	No child		One child		Two children		Three children +	
	Middle	High	Middle	High	Middle	High	Middle	High
Male	37.9%	16.0%	38.9%	15.4%	35.1%	13.3%	43.1%	19.1%
Female	29.7%	11.3%	32.8%	11.5%	33.7%	10.5%	38.2%	13.7%
Diff male-female	8.2%	4.7%	6.1%	3.9%	1.4%	2.8%	4.9%	5.4%

Table 2. Random-effects logistic regression with Mundlak corrections

NOTE: Coefficients corresponding to Mundlak correctors omitted from the results.

	Coefficient	Std error
Non-native (*ref: native)*	1.31***	0.10
Age	-0.51***	0.00
Work values	0.01	0.03
Female	-0.71***	0.10
Highly educ. *(ref: middle educated)*	-1.25***	0.15
Female* Education		
Female * highly educated	-0.16**	0.15
Children (*ref: no child)*		
One child	-0.18**	0.09
Two children	-0.46**	0.11
Three or more	-0.30	0.21
Female * parenthood		
Female * One child	0.55***	0.12
Female * Two children	1.13***	0.14
Female *Three or more	0.95***	0.30
Education * parenthood		
High * One child	0.13	0.15
High * Two children	0.33*	0.17
High * Three or more	0.48	0.30
Female * education * parenthood		
Female * High * One child	-0.61**	0.20
Female * High * Two children	-0.91***	0.23
Female * High * Three or more	-0.75*	0.39
Work dimensions (*ref: other dimensions)*		
Nearer home/less travel	0.50***	0.14
Time dimensions	0.72***	0.11
Suit respondent's training	-0.12	0.15
Economic cycle (*ref: unemp.increase 2009-2011)*		
Unemployment decrease (2011-2019)	-0.20***	0.04
Unemployment increase (2020)	0.57***	0.09
Unemployment decrease (2021-2023)	1.44***	0.09
Constant	10.76***	0.42
N observations	131750	
N individuals	19067	
/lnsig2u	3.00	
sigma_u	4.49	
Rho	0.85	

Statistical significance levels: ****p < 0.01. **p < 0.05. p* < 0.1*

Figure 1

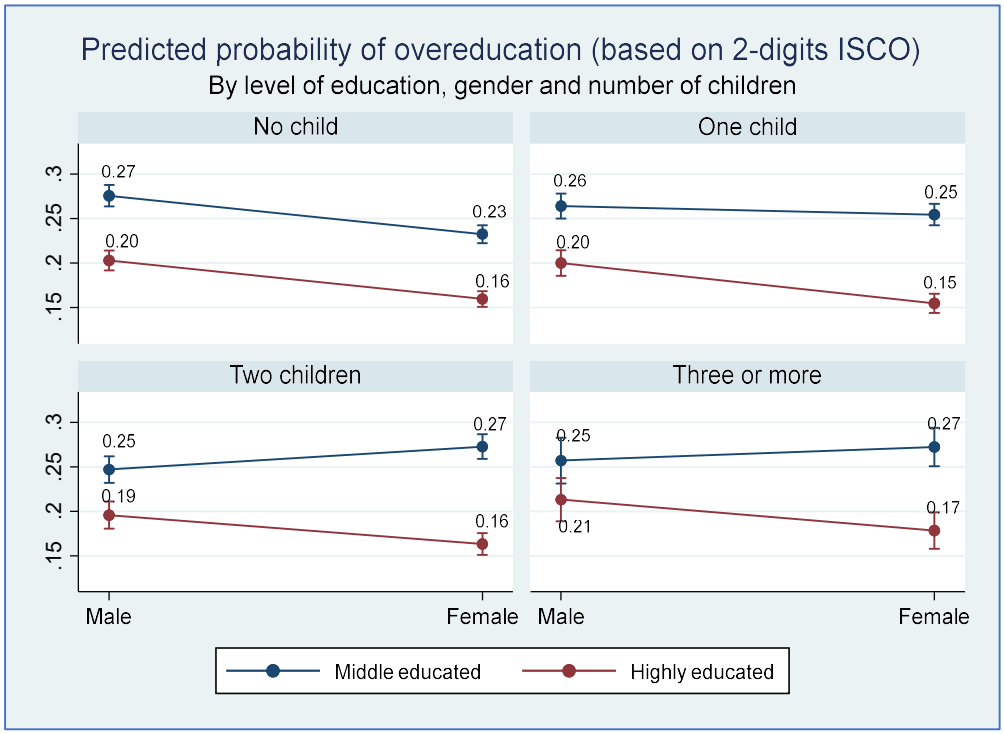
Predicted probability of overeducation (based on 2-digits ISCO)
By level of education, gender and number of children
No child
One child
Two children
Three or more
.15
.2
.25
.3
0.27
0.23
0.20
0.16
0.26
0.25
0.20
0.15
0.25
0.27
0.19
0.16
0.25
0.27
0.21
0.17
Male
Female
Male
Female
Middle educated
Highly educated

Table 3. Random-effects linear regression (linear probability model) with endogenous sample selection and Mundlak corrections in the outcome and selection equations

NOTE: Coefficients corresponding to Mundlak correctors omitted from the results of outcome and selection equations. Controls for non-native origin, age, work values (preferences) and economic are considered both in the main equation and selection equation. They are omitted from the table for reasons of space

	WOMEN	MEN
Overeducation		
Highly educ. *(ref: middle education)*	-0.13***	-0.13***
Children (*ref: no child)*		
One child	0.03***	0.00
Two children	0.06***	-0.01
Three or more	0.05***	-0.00
High education * children		
Highly educated * One child	-0.04***	-0.01
Highly educated * Two children	-0.04***	0.01
Highly educated * Three children+	-0.05**	-0.01
Constant	0.96***	0.88***
Employment		
Regional unemployment rate	0.08***	0.04***
Highly educated. *(ref: middle educated)*	-0.14*	-0.16
Children (*ref: no child)*		
One child	-0.49***	-0.06
Two children	-0.68***	-0.05
Three or more	-1.10***	-0.38***
Constant	0.32***	0.17
Rho	-0.06	0.03
Correlation of random effects	-0.07***	-0.14***
N individuals	10590	8849
N observations	78220	58581

Statistical significance levels: ****p < 0.01. **p < 0.05. p* < 0.1*

Figure 2

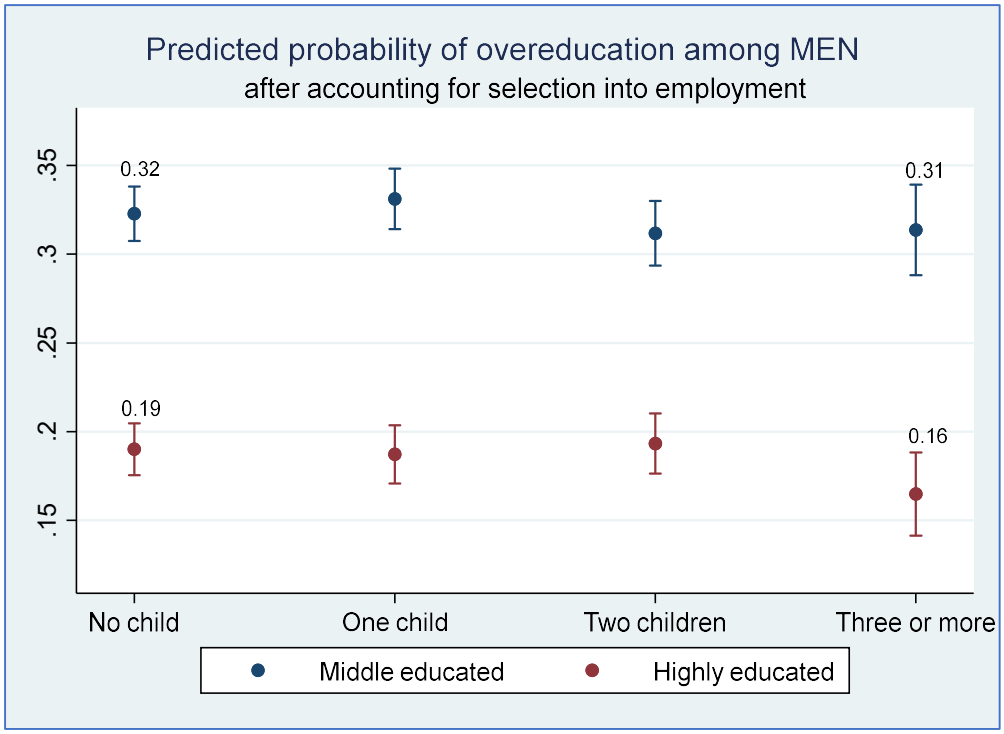

Figure 3

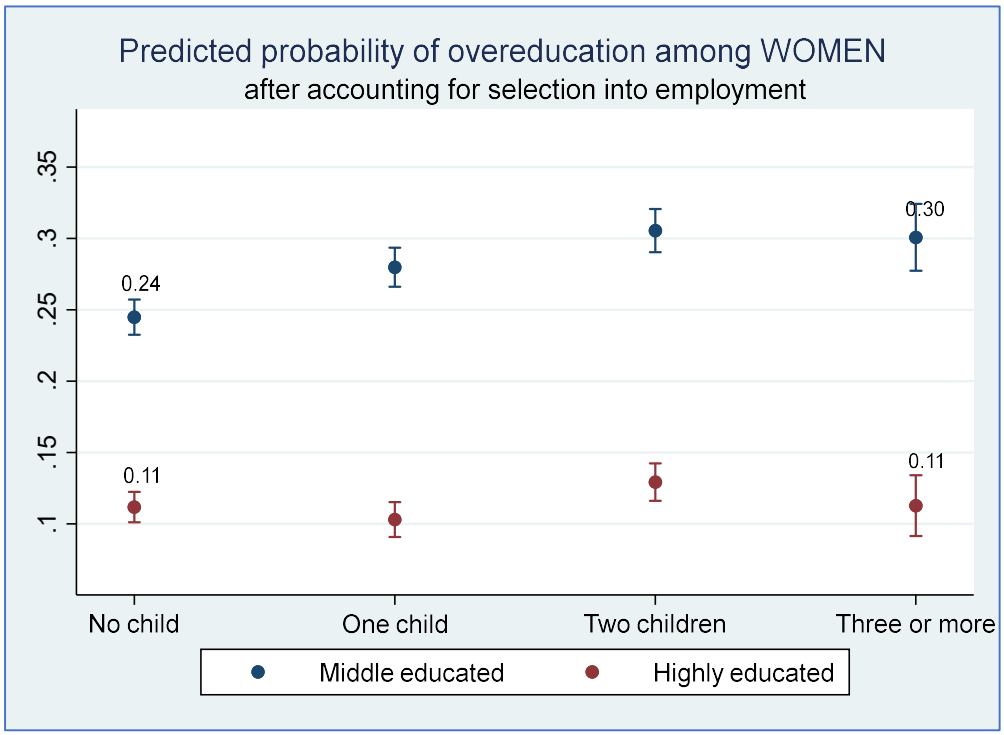

Table 4. Coefficients corresponding to possible mediators of a heterogeneous association between parenthood and overeducation for middle and highly educated female workers

Random-effects linear regression (linear probability model) with endogenous sample selection and Mundlak corrections in outcome and selection equation

NOTE: Each line corresponds to a model equivalent to the one presented in Table 3 to which a mediator has been added (see full results for men and women in Tables A1-A5)

Gender egalitarianism	0.04*
Part-time *(ref: full-time)*	0.06***
Non-employment in the previous wave *(ref: employed in previous wave)*	0.08***
Employer-provided training *(ref: no training provided by the employer since the last interview)*	-0.01***
Living in couple *(ref: single)*	-0.04***
Partner's egalitarian gender values	0.006*
Partner's less than higher education *(ref: no partner)*	-0.01**
Partner's higher education	-0.02***

Statistical significance levels: ****p < 0.01. **p < 0.05. p* < 0.1*

Table 5. Scores of middle and highly educated British workers in job discretion indicators (European Skills and Jobs Survey, 2021)

	Middle educated	Highly educated
Job often involves doing short, repetitive tasks	32.5	27.6
Can often choose methods for doing work	25.1	28.1
Can often plan own work activities	36	42.8
Job often involves learning new things	19.6	24.7
Received training in the previous 12 months	54.4	63.7
Satisfied with career/promotion prospects	9.7	9.6
Satisfied with work-life balance	16.1	15.5

Satisfied with working conditions	16.9	16
Fear of job loss	8.7	7.4

Table 6: Job Discretion among Females:
2021 European Skills and Jobs Survey (Probit: Marginal effects)

	Specification 1	Specification 2
Middle educated	-0.06***	-0.05***
	(0.005)	(0.006)
Highly educated	0.03***	0.02***
	(0.006)	(0.006)
Tenure		0.00**
		(0.000)
Firm size		0.01***
		(0.002)
Week hours		0.00***
		(0.000)
Pseudo R2	0.01***	0.01***
Observations	23,178	22,326

The models control for country-level and sector fixed effects
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p