The influence of gender beliefs and early exposure to math, science and technology in female degree choices

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Abstract

This research consists of three sections testing the hypothesis that gender roles and gender-stereotyping of certain fields of study could be associated with women choosing traditionally female degree options characterized by lower wages. The analysis is framed within the identity economics framework. In the first chapter, data from the 1970 British Cohort Study supports the hypothesis that teenage girls are more likely to accept gender-equal beliefs when their mother shares these beliefs or she works; and that having gender equal beliefs and developing early mathematical and technological skills either encourage girls to study for high-paying degrees or discourage them from entering female-dominated degrees.

The second chapter analyses the responses from an online questionnaire applied to female academics at the University of York. Such survey collected testimonies about their experiences regarding the construction of gender, encouragement and discouragement in mathematics, science and technology at school and the household environments; and their degree choice. Results provide some evidence in favour of the initial hypothesis, but they also show a disassociation between how women perceive the sex-typing of subject fields and their own confidence in their capabilities and tastes. It also suggests that bad experiences with certain subjects are more relevant in keeping women away from high-earnings degrees than the lack of positive experiences.

Finally, the third chapter estimates earnings functions and provides a gender wage decomposition using data from the 1970 British Cohort Study at ages 29 and 34. Results do not support the hypothesis that having a high-earnings degree is associated with higher wages for women. Although there is an initial premium, it disappears by age 34. In contrast, working in a high-earnings occupation is positively associated with higher wages, while remaining in female-dominated occupations is negatively associated with wages for women.

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Author's declaration

I hereby declare that the work presented in this dissertation is my own and belongs to the research carried out as a student at the University of York from October, 2010 to the present day.

The influence of gender beliefs and early exposure to math, science and technology in female degree choices

"One might ask: if an education geared to the growth of the human mind weakens femininity, will an education geared to femininity weaken the growth of the mind? What is femininity, if it can be destroyed by an education which makes the mind grow, or induced by not letting the mind grow?" (Friedan, 1963, p. 136)

1. Introduction

On average, working women earn about three quarters of the male wage (United Nations Statistics Division, 2010). This gender wage gap constitutes a persistent disadvantage for working women, who cannot access the same wages as their male counterparts. Occupational segregation[1] stands out as the most significant barrier in closing the gender wage gap (Becker, 1971 and Oaxaca, 1973). Although the wage differential between women and men narrowed during the 1990s, its persistence proves difficult to explain from standard economic theory: in the short-run, because human capital is fixed, an excess demand for one type of workers would push their wages up but, in time, this higher wage would create an incentive for the workers in the other sector to invest enough in their human capital in order to mobilize to the other, more dynamic one. Eventually, this would increase the labour supply in the first sector and reduce it in the second one, so that the market wages would tend to converge again. However, this has not happened: women do not enter the occupations that offer higher economic possibilities at the pace needed to keep narrowing –and eventually close- the income gap. Most of the literature that has looked into this problem focuses on entry barriers or discrimination on part of the firms or the male workers. Instead, this research focuses on female behaviour. In particular, it looks at different social factors that might influence the degree choice of graduate women in the United Kingdom.

[1] Occupational segregation is understood in this thesis as the phenomenon according to which women and men are concentrated in different types of occupations.

Traditionally, women enter degrees that are considered feminine, such as nursing, teaching or the social disciplines, characterized by lower demand and wages. This dissertation tries to test the hypothesis that women might tend to choose traditionally female degrees due to a gender bias that signals this type of careers as appropriate for their gender. Particularly, it looks at a possible existence of differentiated stimuli in encouraging girls and boys to develop math, technology and science skills during childhood. Although there is no particular proof that the construction of gender identity can determine the degree choice of women, at least there seems to be a trend between female occupations and lower wages. The following data from the United States and the United Kingdom illustrates this relationship (although subsequent chapters will only deal with data from the United Kingdom).

TABLE 1:

Science and Engineering graduate students in the USA, by field of study and sex

Year: 2008

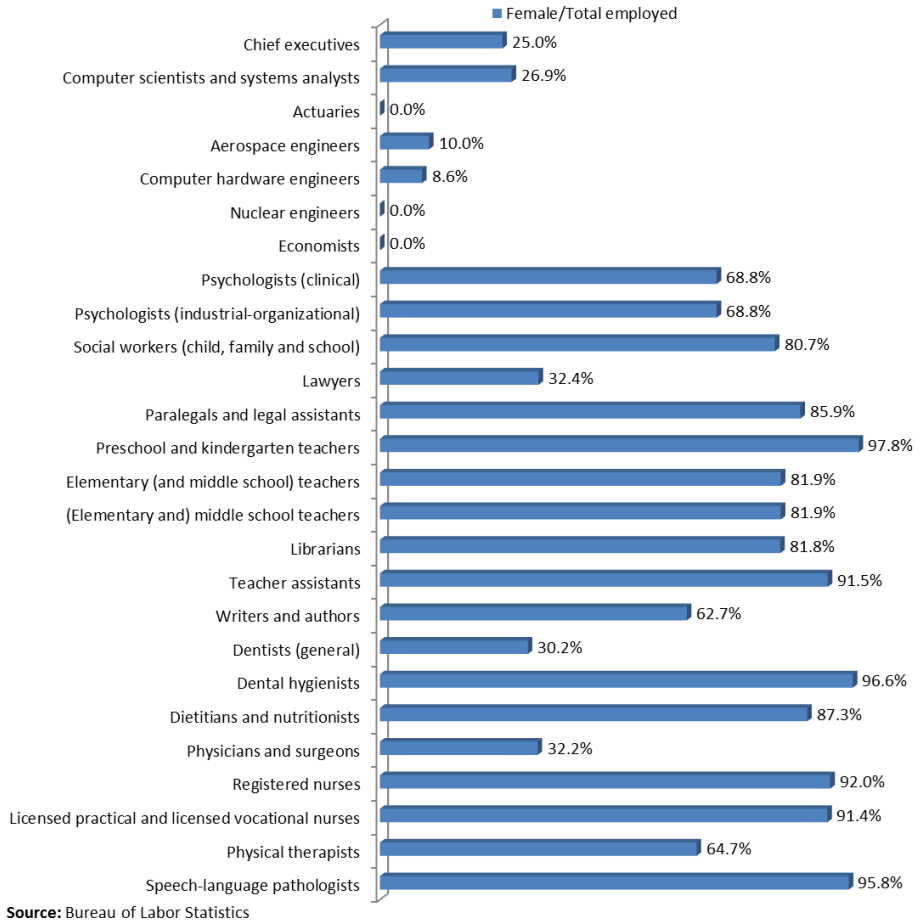
	Total	Female	Male	Female/Total
Total	529 275	231 997	297 278	43.83%
Science minus social and behavioral sciences and multidisciplinary studies	347 336	119 012	228 324	34.26%
Science	391 419	200 460	190 959	51.21%
Natural science	138 527	67 179	71 348	48.50%
Mathematics	21 400	7 751	13 649	36.22%
Computer sciences	49 553	12 545	37 008	25.32%
Social and behavioral sciences	176 380	109 751	66 629	62.22%
Multidisciplinary/interdisciplinary studies	5 559	3 234	2 325	58.18%
Engineering	137 856	31 537	106 319	22.88%

Source: National Science Foundation.

In the United States, for instance, most of the science graduates are women, but this figure drops significantly –to just about a third- when social and behavioural sciences are excluded from the group (National Science Foundation, 2011). In particular, computer science and engineering show the lowest participation of women, as shown in Table 1. On the other hand, natural sciences show a female participation rate close to gender parity due mainly to women going into medicine, which is counterintuitive to the basic hypothesis, since medicine is one of the most profitable career options, but it is also a career choice that, in theory, calls

for humanitarian service, a traditionally assumed female trait. This first example, drawn from the United States, illustrates how degree choices are gender segregated, resulting in an underrepresentation of women in technological subjects, such as computer sciences.

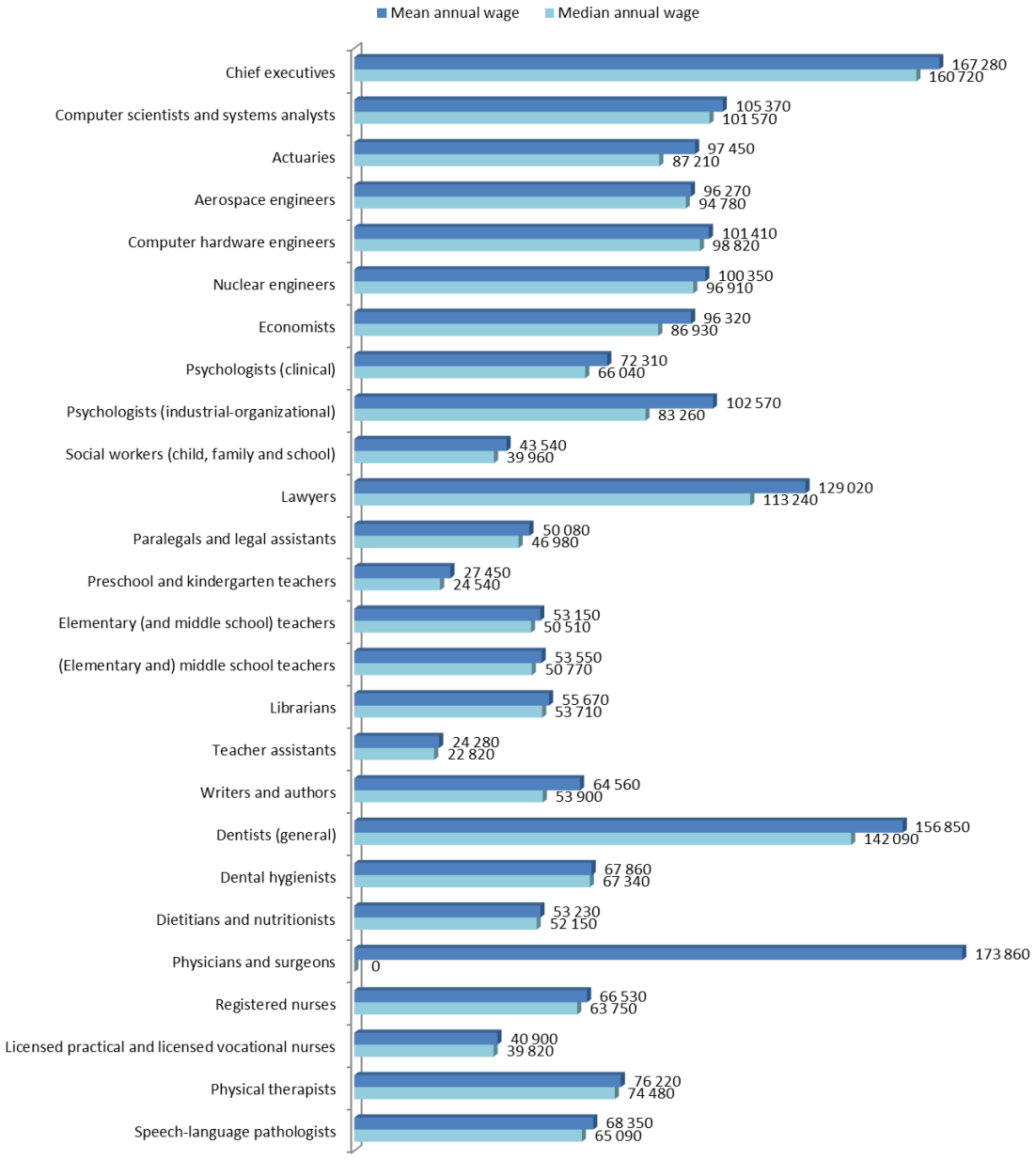
GRAPHIC 1:
Percentage of women employed for some gender segregated occupations in the United States.
(wages in USD)
Year: 2009



Source: Bureau of Labor Statistics

Considering all workers, the occupational wage gap in the United States also shows some evidence supporting the hypothesis: for male-dominated occupations with a high technological, scientific or mathematical component, such as computer science, actuary and aerospace or nuclear engineering, the mean annual wage is about 95 000 USD (see graphics 1 and 2). These are also occupations in which female employment is below 27% and, in some cases, not even registered. At the other extreme, for the female-dominated occupations (like education, where women account for more than 80% of employment), the wages drop to half

GRAPHIC 2:
Mean and median annual wage for some gender segregated occupations in the United States.
(wages in USD)
Year: 2009



Source: Bureau of Labor Statistics

or less than the previous ones. Compare the mean annual wage of computer hardware engineers and teacher assistants: in both cases, about 90% of employment is gender dominated, men in the case of computer engineers and women for teacher assistants, and the first group makes four times as much as the latter. So if the gap is so significant, why aren't more women studying computer sciences? In fact, the only female-dominated occupation

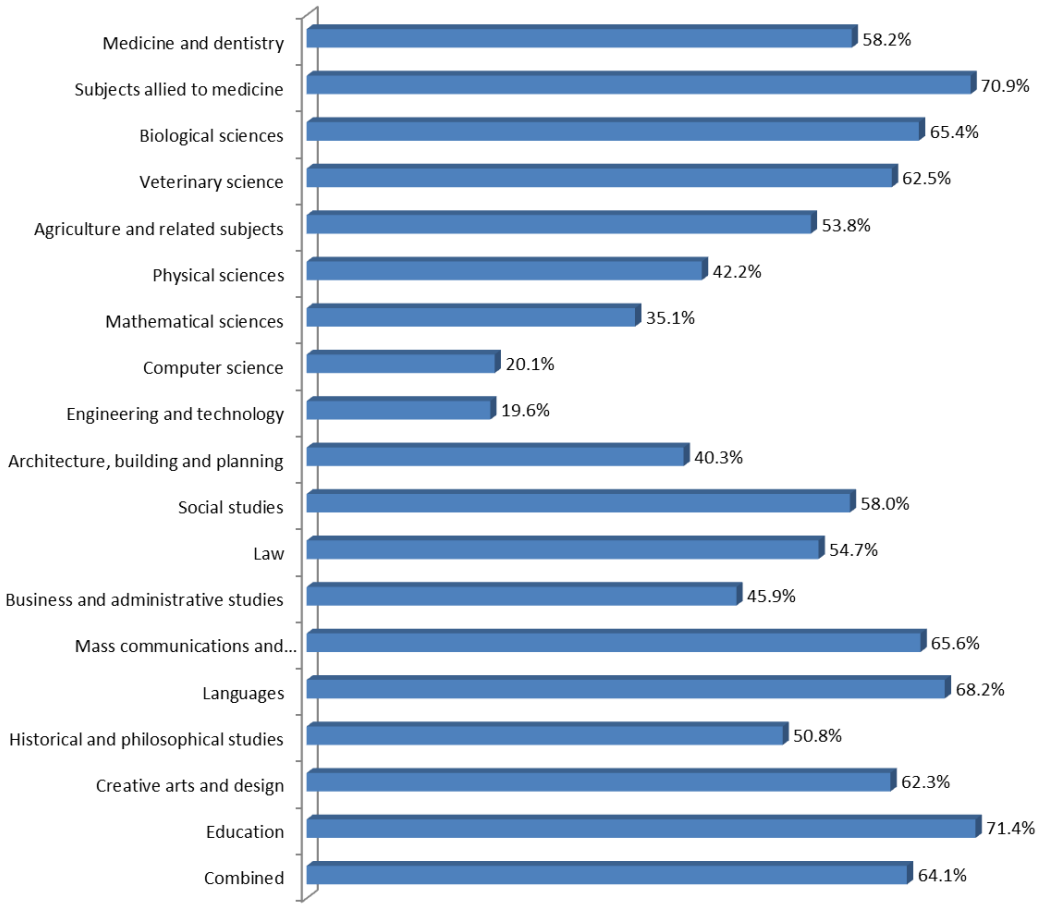
that shows an average annual wage above 100 000 USD is the industrial organization psychologists. Notice also that the wage gap is considerably high for close related occupations with strong gender segregation: dental hygienists earn about 43% of a dentist's wage, nurses make between 23% and 38% of what a doctor makes, and paralegals and legal assistants earn less than 40% of a lawyer's wage. Dental hygienists, nurses and paralegals are all female-dominated occupations, while dentists, doctors and lawyers are male-dominated. The latter also illustrates how power relations might be reproduced through this occupational segregation, since men are located in professions that represent more power, knowledge (these professions require a degree), status and wealth (dentists, doctors, lawyers) than the less trained women who work for them (dental hygienists, nurses and paralegals). Hence, it is worth asking whether tradition and the performance of gender roles are the reason why women choose not to invest in acquiring the degrees that will allow them to become dentists, doctors and lawyers and have access to those higher wages.

Although numbers do not seem to be as clear for the United Kingdom (see graphics 3 and 4), data from this country also exemplifies the existence of gender segregation among graduates in their fields of study: as it was the case with the United States, the percentage of female graduates in the United Kingdom for subjects like mathematics, engineering, technology and computer sciences is 35% or lower, while it tends to be high (above 60%) in female dominated-fields of study, like education and languages. But the percentage of female graduates in physics is above 40% and more than half of the graduates that obtained their qualification in health (medicine and the likes), biology or veterinary were women, suggesting less segregation than that observed in the United States, where these fields of study are still dominated by men. Similarly, the wage gap between the female and male-dominated fields of study is not as pronounced as the one observed for the United States[2]. Still, the male-dominated fields of study mentioned before have mean annual salaries above the average for all subjects (i.e., above 21 286 GBP), while the more traditional female-dominated ones like education, social studies or nursing (subjects allied to medicine) show mean salaries below this

[2] Note that the data for the wage gap in the UK refers to first degree leavers, so that it reflects the wage gap of those people entering the labour market. This wage gap is expected to increase with time, as women report more intermittence and fewer opportunities in employment. For illustrative purposes, wages in this section are annual, but in the remaining of the thesis wages are measured hourly.

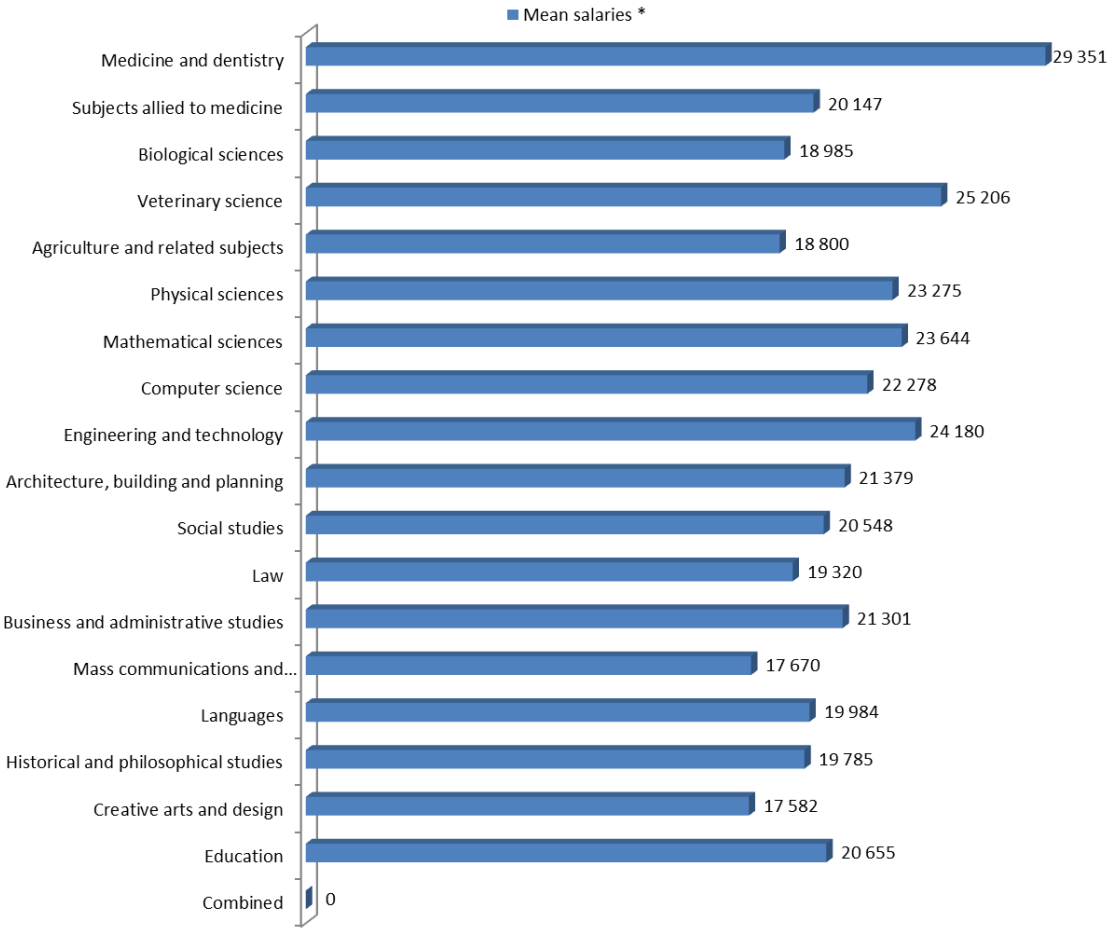
number. Again, subjects like medicine and veterinary sciences would be the exception, showing a percentage of female graduates above 50% along high mean salaries.

GRAPHIC 3:
Graduate qualifications obtained on high education institutions in the United Kingdom, by gender and subject area
(wages in GBP)
Year: 2009-2010



Source: Source: Higher Education Statistical Agency and The Complete University

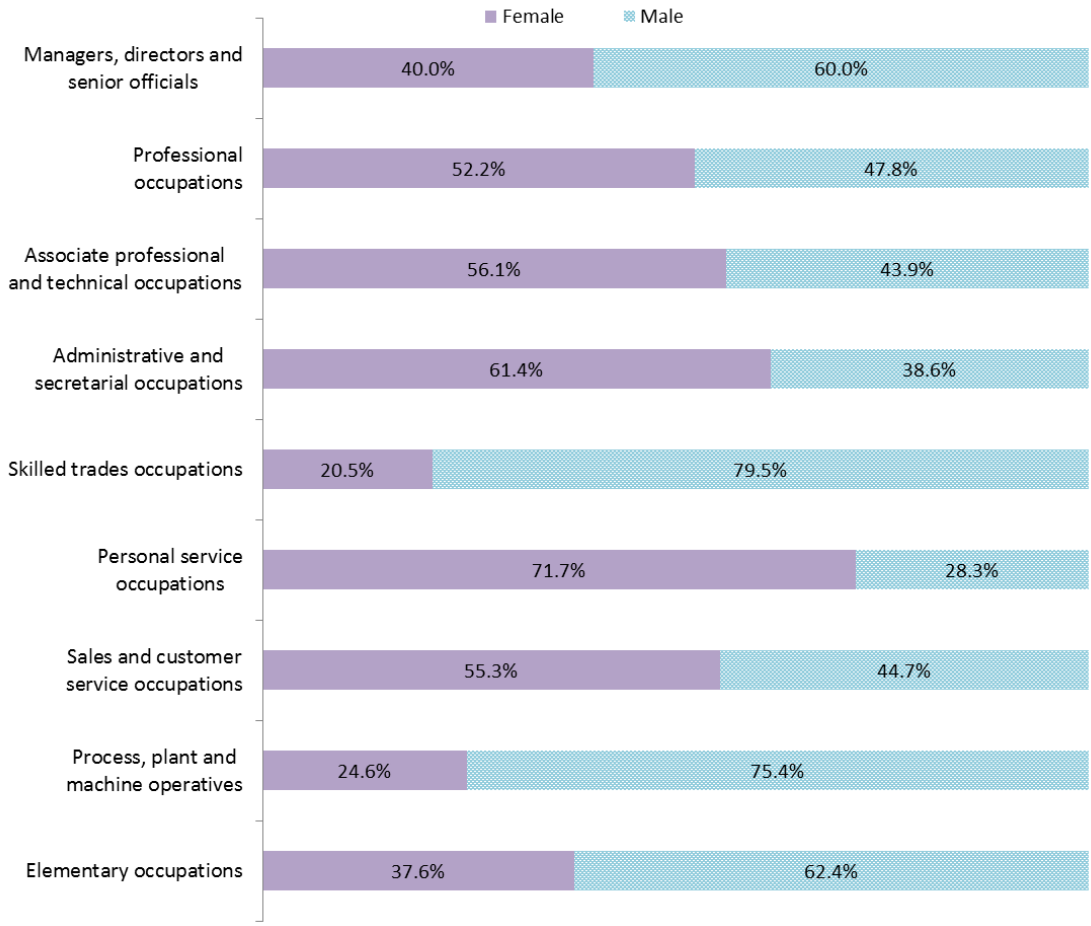
GRAPHIC 4:
Mean salaries for graduate in the United Kingdom, by gender and subject area
(wages in GBP)
Year: 2009-2010



* Mean salaries of full-time, first degree leavers entering employment or self-employment.
Source: Source: Higher Education Statistical Agency and The Complete University Guide.

Further, Graphic 5 depicts the gender composition of occupations for graduates in the United Kingdom. Among them, working women are a minority in managerial occupations; skilled trades; process, plants and machine operative and elementary occupations and are considerably over represented in administrative and secretarial occupations and personal services occupations, which include roles as care takers, a traditional female role. Finally, it's important to note that, for both genders, only about 12% of graduates work in non-professional occupations, but among those who work in professional occupations, men are 1.5 times more likely to hold managerial occupations, suggesting again a gender segregation that places men in the top positions.

GRAPHIC 5:
Occupational destination of graduates employed in the UK, by gender
Year: 2010



Source: Labour Force Survey, 2010.

Hence at first sight, there seems to be some evidence pointing to lower wages for the female-dominated fields of study. At the same time, female occupational choices also seem to deviate from the technological, mathematical careers, despite the fact that these offer higher wages than the traditional female jobs, which makes it reasonable to consider the construction of gender identity in childhood as a possible explanation for this occupational choice bias. All of the above point to the main hypothesis that this research looks into: the possible existence of an educational gender bias that discourages girls to learn, interact and feel comfortable with technology, math and science, thus reinforcing the construction of patriarchal gender identities in children. Hence, the interiorization of gender identity can help explain why girls tend to choose "female prestigious" degrees, while the high-paying degrees remain male-

dominated. This hypothesis is tested in several steps: first, the dissertation explores whether the environment a person grows in is associated with that person holding beliefs in gender equality. Secondly, it tests whether these beliefs, the exposure to mathematics, science and technology or other childhood experiences are associated with girls choosing high-earnings or male-dominated degrees. And, finally, it tests whether these degrees actually imply higher earnings for women. In all cases, the scope of the study is limited to the United Kingdom. The reason for this is that the United Kingdom has long invested in rich datasets. In particular, the 1970 British Cohort Study, a longitudinal study that has traced a cohort since birth for almost forty years, is, to my knowledge, the only longitudinal dataset with all the information required to test the hypothesis (i.e., it has information on gender attitudes, technological exposure at an early age, academic ability, degrees and earnings for the same individuals). Therefore, the implied assumption is that the United Kingdom could serve as a reference in understanding the underlying patterns and dynamics leading to degree choices for women. Also, it is worth noting that the study is approached from an Economics framework, mainly the identity economics and human capital models, although it intertwines with sociological and feminist approaches.

The following section provides a review of some of the existing literature regarding the different topics involved in the research and that influenced how the study is being approached. This literature consists of economic models with applications in the United States and United Kingdom, as well as other critical readings that complement or contest this approach. Afterwards, the research is structured in three parts. Chapter 3 is an attempt to test the hypothesis using an econometrics approach and provides, therefore, a quantitative analysis on degree choice using data from the 1970 British Cohort Study (BCS). Chapter 4 is an attempt to test the same hypothesis using data drawn from an online survey in which respondents were allowed to share their own experiences, so that such data provides richer information in terms of lived experiences and its possible sociological significance. Chapter 5 explores possible determinants for the female earnings function as well as a decomposition of the gender wage gap using information drawn from the 1970 BCS. Chapter 6 concludes with a summary of the most relevant research findings.

2. Literature review

> *""Similarly, then," said I, "if it appears that the male and the female sex have distinct qualifications for any arts or pursuits, we shall affirm that they ought to be assigned respectively to each. But if it appears that they differ only in just this respect that the female bears and the male begets, we shall say that no proof has yet been produced that the woman differs from the man for our purposes, but we shall continue to think that our guardians and their wives ought to follow the same pursuits."" (Plato, 454 d-e)*

This section presents a concise review of some of the economic literature, as well as critiques and complementary readings, limiting the framework from which the main hypothesis is stated. These are: the human capital model; the theory of discrimination; the gender gap and gender occupational segregation; the skill-bias technological change hypothesis and models on gender and identity. The models on human capital provide understandings of the economic rationale underlying decisions on investment in education and training, i.e., it provides the framework explaining how rational individuals choose how much and what to educate themselves in. It also explains what the different characteristics the market rewards individuals for are and, therefore, allows for an understanding of earnings and their composition. Models on discrimination focus on explaining wage differences among groups when there are no differences in productivity observed. These models help explain why women are consistently paid less than men taking into account institutional and other non-economic variables, such as tastes or dislikes for a particular group. In turn, models on occupational segregation look deeper into the causes of the observed gender wage gap and find that workers are allocated in different sectors according to the group they belong to, which ultimately perpetuates the gender wage gap; while models of gender and identity try to identify behavioural differences observed among women and men. That is, the latter focuses on the background, experiences and preferences that may lead one group, women in this case, to develop preferences that are not exclusively restricted to financial variables. Finally, the skill-bias technological hypothesis serves as a basis to further explore the idea that exposure to

technology may result in higher productivity levels and wages, that is, this hypothesis informs the presumption that mathematical, scientific and technological fields offer a higher standard of living through higher wages. In the following sections, these models are presented reproducing each of the authors' original notations[3].

2.1. The human capital model

According to the human capital model (Becker: 1993, first published in 1962), education is the driving force of productivity and a determinant in explaining the wage differentials: because in a competitive market real wages are determined by productivity, and education enhances productivity, the decision of getting an education –or being trained- depends on the gains of investing in it[4]. When a person decides to study, she is aware that that particular education will provide her with a new set of skills that, in turn, will increase her productivity. The market will reward this higher productivity with higher wages, creating an incentive for people to invest in education. However, there are costs associated with it, such as the direct costs of the investment –tuition fees, study materials, etc.-, the effort that the person has to exert, and indirect costs of lost wages and opportunities foregone for leaving the labour market to get an education. If the marginal gains of investing in human capital exceed its marginal costs, people would then decide to carry on the investment. At the same time, because the more able workers are more likely to succeed in training programs, the complementarity between these variables leads to a wage differential: the most able workers benefit from higher investment in human capital and, therefore, higher wages than the less skilled and less trained ones. This means that the returns on human capital are increasing.

[3] Since this section summarizes the different theories informing the hypothesis, it was decided to keep the original notation given by each author. For each case, the variables are defined accordingly. This implies that authors might differ on the notation used for a particular concept.

[4] The decision to invest in education can be taken by the firm or the individual, both of which cases are discussed below, including some of the critiques faced by this theory.

In the general form of the human capital model, Becker explains the decisions leading to on-the-job training. In this model, firms decide to invest in training for their workers on the initial period (t=0) if the following equilibrium condition is satisfied (Becker, 1993, p. 32):

$$(1)\ MP_0 + \sum_{t=1}^{n-1} \frac{MP_t}{(1+i)^t} = W_0 + k + \sum_{t=1}^{n-1} \frac{W_t}{(1+i)^t},$$

where:

MP_t: marginal productivity of labour at time *t*,

W_t: wage rate at time *t*,

k: outlay on training,

n: number of periods and

i: discount interest rate.

According to equation (1), a firm would invest in training up to the point where the present value of the flow of marginal productivities of labour would equal their respective marginal costs, which are given by the present value of the wages paid to the employees and the cost of training. Because training also implies an opportunity cost of the production foregone from spending time on training ($MP_0' - MP_0$), Becker includes a new term *C* that captures this opportunity cost and the cost of training, *k*. Further, by rearranging terms and defining *G* as the present value of the net profits from training labour, the above condition becomes (Becker, 1993, p.p. 32-33):

$$(2)\ MP_0 + G = W_0 + C \text{ , with } G = \sum_{t=1}^{n-1} \frac{MP_t - W_t}{(1+i)^t} \text{ and } C = MP_0' - MP_0 + k$$

That is, the marginal costs of training, expressed by the term $W_0 + C$, must equal the gains expected from it ($MP_0 + G$): if the net flow of expected marginal productivities of labour was higher than the marginal cost of training, the firm would have an incentive to keep investing up to where (2) is satisfied. On the other hand, if the present value of such net revenues were lower than the costs of training, the firm will cut back on the investment in human capital. Becker points out that *G-C* are the net returns from training, which implies that MP_0 need not be equal to W_0. In fact, MP_0 only equals W_0 if *G* equals *C*. Hence, the firm

might pay wages above the marginal productivity of labour during the training period if it expects this training to result in higher future net profits. And, because workers would be paid according to their productivities, those workers with higher net returns would receive higher wages.

Further, Becker offers a variant of his model to explain schooling decisions. In this version, a student's net earnings, *W*, equal the differences between potential earnings, MP_0, and total costs, *C*, which again include both the opportunity cost of foregone earnings (MP_0-*MP*) and the direct costs of schooling (Becker, 1993, p. 52):

$$(3)\ W = MP_0 - (MP_0 - MP + k) = MP_0 - C$$

Because the result is similar to the more general model, Becker draws parallel conclusions:

> *"Thus schooling would steepen the age-earnings profile, mix together the income and capital accounts, introduce the negative relation between the permanent and current earnings of young persons, and (implicitly) provide for depreciation on its capital." (Becker, 1993, p. 52)*

His arguments are as follows: because people give up earnings early in life to get some schooling, the initial earnings are lower than if no investment was done. At the same time, schooling enhances productivities and thus increases future earnings, which is why the age-earnings curve is steepened by schooling. The second argument refers to the complementarity between labour and capital: schooling results in higher productivities of labour associated with increasing returns on human capital. Thirdly, more time and effort put into schooling are associated with higher opportunity costs that should reflect in much higher returns in the future. And, finally, because the returns on schooling are a flux over time, it is more profitable for younger people to invest in schooling than older people, simply because they have more periods left after schooling from which they will collect these returns. Therefore, as people grow older, investing in human capital becomes more costly and their capital depreciates in time. In his empirical findings, Becker reports a rate of college return for

urban male whites in 1939 of about 14.5% and of about 13% for all male whites in 1949, using data from the 1940 and 1950 Census in the United States, which show significant rates of returns on college education (Becker: 1993, pp. 169-170).

In line with Becker's model, Mincer (1970) showed that earning inequality increases as the rate of return on education increases, so that the earning gap widens for higher levels of ability and schooling. In this theoretical model, the ratio of annual earnings between two individuals with a constant flow of earnings would be given by (Mincer, 1970, p. 7):

$$(4)\ k_{2,1} = \frac{E_{S_1}}{E_{S_2}} = \frac{e^{-rS_1}(1-e^{-rn_1})}{e^{-rS_2}(1-e^{-rn_2})},$$

where:

$k_{2,1}$: ratio of annual earnings between individuals 1 and 2,

E_{Si}: annual earnings of individual *i*,

r: discount rate,

S_i: years of schooling of individual *i*, and

n_i: years of working life of individual *i*.

Further, if people work for a considerable amount of periods ($n_1 = n_2$), individual 1 has no schooling (s_1=0) and individual 2 has a level of schooling s (s_2=*s*), the ratio of annual earnings tend to $k_s \rightarrow e^{rs}$, i.e., the excess earnings reported by individual 2 are due entirely to her investment in schooling. Taking this limit and applying a logarithmic transformation allows solving for a rate of return to schooling (Mincer, 1970, p. 7):

$$(5)\ lnE_S = lnE_0 + rs$$

Hence, Mincer shows three relevant arguments in explaining the wage distribution. First, he shows that "*percentage differentials in earnings [are] a linear function of time spent at school*" (Mincer, 1970, p. 7). That is, investment in human capital results in higher earnings, even when it implies postponing the years of work, since schooling is the major determinant of wage differentials. The relationship is linear, as depicted in (5). Secondly, the exponential components in (4) explains why, even if education was symmetrical, the earnings function

would be positively skewed: those people at the right tail of the schooling distribution would be rewarded with much higher earnings than the ones at the middle of the distribution, thus, the earnings distribution is positively skewed. And, thirdly, he shows that the rate of return on schooling (*r*) similarly influences the earnings distribution: for higher rates of return or higher dispersion on schooling, the earnings function would exhibit higher positive skewness. Therefore, barriers to schooling would result in a more uneven society (Mincer, 1970, pp. 7-8). Moreover, in the model's general form, Mincer defines the gross earnings function as:

$$(6)\ E_{ji} = X_{ji} + \sum_{t=0}^{j-1} r_{ti}\, C_{ti}\ ,$$

where:

E_{ji}: earnings in period *j* of individual *i*,

X_{ji}: earnings stream that individual *i* would receive if no investment was done,

r_{ti}: rate of return on the investment in period *t* for the individual *i*, and

C_{ti}: total previous net investments in human capital.

The above equation shows that earnings have two components: those earnings expected from an initial endowment, which correspond to the initial ability of the individual, and those that stem from the investment in human capital. Further, Mincer (1970, p. 8) defines the net earnings (Y_{ji}) as those excluding the current investment in human capital (C_{ji}):

$$(7)\ Y_{ji} = X_{ji} + \sum_{t=0}^{j-1} r_{ti}\, C_{ti} - C_{ji}\ ,$$

Both of these equations show that ability, or an individual's initial endowment, also plays a role in explaining the wage differential. Mincer also argues that because the most productive people are more likely to have higher earnings, they face lower costs of financing their investment in human capital, so they would also be more prompt to effectively invest in education. This would explain the even more skewed earnings distribution in the presence of barriers to schooling: schooling and ability complementarity is strengthened when people have to finance their education based on their expected future earnings.

As discussed in the introduction, traditional models fail to explain the gender wage gap. In later models, Becker has argued that women earn less than men because they choose activities that require less effort, invest less in marketable human capital due to an anticipation of marriage and require flexible working hours (Becker: 1991, pp. 41, 64-79). Similarly, Polachek (1981) argues that individuals choose not only the level of human capital, but a type of human capital that varies with occupational characteristics. Since intermittency in the labour market participation may cause atrophy (a loss of skills in some occupations), individuals who expect some intermittency in their labour supply will choose occupations with small atrophy rates, which are, in turn, associated with low penalties and low wages. Hence, female occupational choices might reflect their decision to temporarily drop out of the labour market, which is consistent with Becker's argument about women investing less in market capital and exerting more effort at home. In fact, Dolton and Makepeace (1987) find that the presence of children affects female earnings, suggesting that the human capital model might be mispecified if this is not accounted for. Further, Gronau (1988) argues that participation in the labour force and training decisions are endogenous to the human capital model, so that as the probability of dropping out of the labour market increases, the probability of investing in training decreases and vice versa. So the gender wage gap persists because demographic changes (mainly motherhood decisions) affect the probability of women dropping out of the labour market or getting trained, and this results in women being employed in occupations characterized by lower levels of training, atrophy rates and wages.

These arguments have been widely contested: Reskin and Hartmann (1986, p. 71) argue that the human capital model is unable to explain the observed job segregation, since there is no strong evidence suggesting that women choose their occupation planning to leave the labour force in the future or that sex typical occupations punish women less for their leaves from the labour market. To these arguments, Walby (1988, pp. 15, 24) adds that the human capital model neglects history and the power relations between the sexes. Similarly, Irwin (2005, p. 14) argues that, since these models focus on individual decision-making, the individual agency is seen as detached from social structures, history and culture.

2.2. Discrimination and the gender wage gap

Contrary to the previous explanations, in his model of discrimination, first published in 1957, Becker (1971) shows how discrimination actually works in a market context and how it ends up being detrimental to both parties. In this model, Becker defines the taste for discrimination as including both prejudice (dislike for a particular group) and ignorance (lack of knowledge about the efficiency of one group). According to this definition, a person exhibits a taste for discrimination if she is willing to forfeit income or pay to avoid working with someone (Becker, 1971, p.14). This level of discrimination is quantified by the discrimination coefficient, a measure of the percentage of the wage lost by discrimination. On the contrary, a person exhibits nepotism when she is willing to favour her own group. Becker shows that this taste for discrimination affects relative prices, which in turn affect investment decisions that end up reducing trade. Hence, contrary to some beliefs, discrimination not only negatively affects its victims; it also affects the group that discriminates by ultimately reducing its production. Becker also shows that complete segregation is also more prejudicial to the minority group than trade with discrimination because in the former all gains from trade are lost.

Formally, the market discrimination coefficient (MDC) between two groups of workers *W* and *N* who receive wages π_w and π_n is defined as "*the proportional difference between these wage rates*" (Becker, 1971, p. 17):

$$(8) \quad MDC = \frac{\pi_w - \pi_n}{\pi_n}$$

A more general form of this market discrimination coefficient might also be given by the difference in the ratios of the group wage rates relative to the scenario without discrimination (w_i^0) (Becker, 1971, p. 17):

$$(9) \quad MDC = \frac{\pi_w}{\pi_n} - \frac{\pi_w^0}{\pi_n^0}$$

In his effective discrimination model, Becker assumes that both groups live apart, markets are perfectly competitive and labour and capital from *W* are perfect substitutes for labour and

capital from *N*, respectively. If initially they only trade factors of production and *W* exports capital and *N* exports labour, each factor's price would equal its marginal productivity regardless of who its owner is. However, if *W* starts discriminating against *N*, they will start paying less to *N* for their factors of production and importing less labour, which reduces *N*'s net returns. Because *W*'s capital is complementary to *N*'s labour, *N* will import less capital from *W*, thus reducing *W*'s net returns as well. Consequently, the equilibrium production for both *N* and *W* are reduced. Probably, the most important conclusion of this model is that both groups suffer a reduction on their welfare as a consequence of discrimination, not just the group that is being discriminated against. In his empirical findings, Becker focuses on the discrimination in the United States against African Americans and shows that, due to differences in capital, in a scenario without discrimination, African Americans would earn about 66% of the white wage. However, in the scenario with discrimination, they earn 57% of it. Despite this, Becker also shows that this scenario is preferable to one of complete segregation, in which African Americans would only earn 39% of the white wage, since all gains from trade are lost (Becker, 1971, p. 29).

Following Becker, Oaxaca (1973) estimated the discrimination coefficient between genders in the United States for whites and African Americans, while controlling for individual traits (number of children, education, health problems, marital status, etc.). The discrimination coefficient is defined by Oaxaca (1973, p. 694) as:

$$(10) \qquad D = \frac{W_m/W_f - \left(W_m/W_f\right)^0}{\left(W_m/W_f\right)^0},$$

where:

W_m/W_f: male to female wage rate

$\left(W_m/W_f\right)^0$: male to female wage rate with no discrimination which would equal the rate of marginal productivities between males and females in a competitive market .

By applying a logarithmic transformation, the discrimination coefficient takes the form (Oaxaca, 1973, p. 695):

$$(11) \qquad \ln(D+1) = \ln(W_m/W_f) - ln\left(W_m/W_f\right)^0$$

Because there is no information about the real wage ratio in absence of discrimination, Oaxaca examines two scenarios: either the real market wage is that paid to women (in which case the observed male wage has a nepotism premium to use Becker's terminology) or the real market wage is that paid to men (in which case women are punished by discrimination with a lower wage). He then estimates the wage structure for each of the *n* groups as (Oaxaca, 1973, p. 695):

$$(12) \qquad \ln(W_i) = Z_i'\beta + \mu_i \,,$$

where,

W_i: the hourly wage rate for agent *i*,

Z_i': vector of individual characteristics,

β: vector of coefficients,

μ_i: disturbance term.

Further, he derives a new expression for the wage differential (Oaxaca, 1973, p. 696):

$$(13) \qquad \ln(G+1) = \Delta Z'\hat{\beta}_f - Z_m'\Delta\hat{\beta} \,,$$

where:

$G = (\overline{W}_m - \overline{W}_f)/\overline{W}_f$: proportional differences between the average male ($\overline{W}_m$) and female ($\overline{W}_f$) wages,

Z_i': vector of mean values of the regressors for *i*, and

$\hat{\beta}_f$: vector of estimated coefficients.

In the scenario in which the female wage structure represents the market structure without discrimination, the wage differential is decomposed in two: a wage differential due to differences between the group characteristics and one responding merely to discrimination (Oaxaca, 1973, p. 696):

$$(14) \qquad ln\left(\widehat{W}_m/W_f\right)^0 = \Delta Z'\hat{\beta}_f$$

$$(15) \qquad \ln\left(\widehat{D+1}\right) = -\bar{Z}'_m\Delta\hat{\beta}$$

Similarly, if the male wage structure represents the market structure without discrimination, the wage differential is decomposed in (Oaxaca, 1973, p. 697):

$$(16) \qquad \ln(G+1) = \Delta Z'\hat{\beta}_m - Z'_f\Delta\hat{\beta}\ ,$$

$$(17) \qquad ln\left(\widehat{W}_m/W_f\right)^0 = \Delta Z'\hat{\beta}_m$$

$$(18) \qquad \ln\left(\widehat{D+1}\right) = -\bar{Z}'_f\Delta\hat{\beta}$$

In a more recent paper, Oaxaca and Ransom (1994) further decompose the discrimination coefficient into three components: (i) the premium that is paid to the favoured or preferred group (whites or men, etc.), (ii) the wage disadvantage, i.e.the cut in the wage rate by which the minority group is punished (women, blacks, etc.) and (iii) a productivity differential which does not respond to prejudice, but rather to different traits exhibited by the groups. Notice, however, that the reasons for this productivity differential might as well be a result of previous discrimination, such as lack of educational or training opportunities for the minority group which reflect in this group being less skilful. In this case, the decomposition is given by (Oaxaca and Ransom, 1994, p. 7):

$$(19) \qquad \ln(G_{wb}+1) = \ln(\delta_{w0}+1)\ln(\delta_{0b}+1)\ln(Q_{wb}+1)\ ,$$

where:

$G_{wb} = W_w/W_b - 1$: gross wage differential between whites (W_w) and blacks (W_b),

$\delta_{w0} = W_w/W_w^0 - 1$: differential between the current white wages and their wages without discrimination (W_w^0),

$\delta_{0b} = W_b^0/W_b - 1$: differential between the wages blacks would have received without discrimination (W_b^0) and their current wage, and

$Q_{wb} = W_w^0/W_b^0 - 1$: wage differential between whites and blacks due to productivity.

Empirically, they estimate the previous model as (Oaxaca and Ransom, 1994, p. 8):

$$(20) \qquad \ln(G_{wb}+1) = \bar{X}_w'\left(\hat{\beta}_w - \beta^*\right) + \bar{X}_b'\left(\beta^* - \hat{\beta}_b\right) + (\bar{X}_w - \bar{X}_b)'\beta^* \ ,$$

where:

$\bar{X}_i'$: vector of mean values of the regressors,

$\hat{\beta}_w$: vector of estimated coefficients,

$\beta^* = \Omega\hat{\beta}_w + (I - \Omega)\hat{\beta}_b$: vector of coefficients when there is no discrimination,

$\Omega = (X'X)^{-1}X_w'X_w$: proposed weighting matrix for estimating the scenario with no discrimination.

2.2.1. Empirical literature

Using data from the 1967 Survey of Economic Opportunity, Oaxaca found that barriers of entrance and occupational segregation are the major factors in explaining discrimination in the United States, much more than the differences in wages for equal jobs (Oaxaca, 1973, p. 708). At the time, he estimated discrimination coefficients of 40% for whites and 45% for African Americans with discrimination explaining 77.7% and 93.6% of this differential, respectively. Controlling for industry, occupation and class of workers, results in a reduction of the discrimination coefficient to 29% for whites and 25% for African Americans, with more than 55% of it being explained by discrimination (Oaxaca, 1973, p. 704). He also found that the rate of return on the investment in human capital is higher for men than women, which could also help explain the gender wage gap (Oaxaca, 1973, p. 707). His results, therefore, point to occupational segregation as the main reason in explaining the gender wage gap. Recalling the examples on graphics 2 and 3, this means that although a female doctor earns less than a male doctor, the greatest disadvantage for women is not this, but rather the fact that most women working in health are not the doctors but nurses, who earn less than the female doctor and much less than the male doctor. Therefore, if more women could become

doctors instead of nurses, or lawyers instead of paralegals, the gender wage gap would be significantly reduced.

Later, evaluating the three-fold decomposition model for gender wage differentials in the 1988 Current Population Survey, Oaxaca and Ransom (1994, p. 15) find that, if the female wage is taken as the base scenario, male overpayment in the United States is close to 32% with a male productivity advantage close to 2%, whereas if male wages are taken as the standard, women are underpaid, on average, around 26% of the market wage with a male productivity advantage close to 7%. Hence, in their findings the productivity advantage is always small, so that male work is valued above women's without it being justified by fundamental differences.

Similarly, Wright and Ermisch (1991) estimate a discrimination coefficient for the United Kingdom in 1980 ranging between 20% to 25%, most of which (88.2%) remained unexplained by individual characteristics. More recently, men working full-time in the 2004 Workplace Employment Relations Survey have been found to earn 14 log per cent more than women, most of which (82.14%) is not explained by individual traits, after controlling for occupation, industry, workplace, region and female presence in the workplace and occupation (Mumford and Smith, 2009). In this case, occupational segregation and the proportion of female employees in the workplace are also found to be significant in explaining the gender wage gap. This reflects the same pattern observed for the United States and commented above, according to which occupational segregation is key in understanding the gender wage gap. Walby (1988, p. 1) also points out to occupational segregation as the main cause for the gender wage gap in the West. In contrast, Glover and Kirton (2006, p. 32) argue that the gender wage gap in the United Kingdom obeys to an unequal pay related to traditional gender roles and the mechanisms and structures used in establishing wages, instead of occupational segregation as such, since progressive countries have smaller gender wage gaps despite their occupational segregation. That is, they argue that a political commitment to set wages more equally is possible, regardless of the gender composition of occupations, if the society decided to value occupations similarly. In a more extreme view, Hakim (2006, p. 284) denies any association between occupational segregation and the gender pay gap, despite the vast research providing evidence otherwise.

The persistence of the wage gap is also associated with a slower growth of wages for women and a higher intermittency of their labour supply: Booth, Francesconi and Frank (2003) reveal that women have a lower rate of return to promotion (1.3%) than men (4.7%). And, Manning and Swaffield (2008) found that, for the United Kingdom, the gender wage gap increases over time due to smaller growth on female wages, rather than the initial level of human capital or occupation. On entry, female wage growth is 2.5 p.p. lower than the male wage growth and the gap increases to 2.8 p.p. after 5 years and 0.4 p.p. by year 10 (Manning and Swaffield, 2008, p. 991). Because of these differences in the wage growth, the gender wage gap is almost 25 log point after ten years. However, a significant part of the gender gap remains unexplained by experience. In fact, they show that, even for women with no children and no absences from the labour market, their wage is about 8 log points below that of men after ten years of work experience. Among their findings, the authors point out that part-time and intermittent employment, as well as greater constraints to change jobs, are the key determinants of the evolution of the female wage and the widening of the gender gap over time. Notice that, although their findings do not contradict this thesis' initial hypothesis, they do find that occupational choice is not a determinant in the evolution of the wage differential. Nonetheless, other studies, which would be mentioned later, do point out to the contribution of the field of study in explaining the gender gap, a topic that is worth studying because even if the evolution of female wages does not respond to the career choice, it does determine the initial level, i.e., the base from which to start growing.

In general, there is an extensive literature regarding the gender wage gap in the United Kingdom, which consistently estimates it to be above 10% (Lanning *et al*., 2013, p.14). Among such literature, it is of particular interest to mention that which has looked into the gender wage gap using the 1970 British Cohort Study, since this is the dataset used throughout most of this thesis, so that such calculations can later provide a point of comparison for the estimations of chapter 5. Makepeace, Dolton and Joshi (2004) calculate that, at age 30, this particular cohort exhibits a gross wage differential of 0.082 log points for full-timers; so that full-time working women would earn about 12% more if they were paid as men are (Makepeace, Dolton and Joshi, 2004 p.255 and Joshi, Makepeace and Dolton, 2007, p.39). These authors also find that the gender wage gap tends to increase over time due to changes in the explained characteristics of individuals, mainly the intermittency in the labour supply of

women. This is consistent with Neuburger, J., Kuh, D. and Joshi, H. (2011, p.269) findings of an increasing wage gap, so that women of this particular cohort earned about 90% of a man's median pay in their twenties but only 86% to 80% in their thirties. Neuburger also estimates a raw gender gap at ages 30 and 34 of 0.17 to 0.22 log points, respectively (Neuburger, 2010, p.193). And, Lanning *et al.* (2013, p.103, p.21) estimate that the gender pay pag is about 29% at age 38 but drops to 25% for graduates.

The gender wage gap can also be decomposed using quantile analysis, which focuses on the wage distribution instead of the mean. Using this methodology for the United States, Blau and Kahn (2006) provide evidence of a glass ceiling effect, despite the narrowing of the gender wage gap around the mean over the past decades. Although the female mean wage relative to the male's wage in the US had narrowed to 91% by 1998, the authors argue that the narrowing of the gender wage gap actually slowed down at the top of the distribution and even increased during the 1990s. This suggests that the structural problems women might face vary according to their position in the distribution and that women at the top face more inequality relative to their male peers.

Kassenböhmer and Sinning (2010) also argue that the gender wage gap in the United States narrowed more for the lowest part of the distribution (13%) than the upper part (4%) between 1993 and 2006; and this responded to difference factors: while the gap closed in the upper segment mainly due to educational attainment, most of the gap along the wage distribution is explained by work history and a deterioration of male wages at the bottom. Two things are worth noting: in first place, education is the mobility factor that gives access to higher earnings, which is true both for women and men, and (ii) what mainly affects women, particularly those in the lower part of the distribution, is their work history, so that temporarily leaving the labour market or not being able to constantly switch jobs holds female wages back; and women are vulnerable to both of these because of motherhood. Finally, the authors also show that an important part of the wage gap remains unexplained: 50% for the upper part of the distribution and about 80% for the lower part (Kassenböhmer and Sinning, 2010, p. 16-17).

Research in the UK has mixed evidence supporting the hypothesis of a glass ceiling effect: for example, Connolly and Long (2008, p.4) document an average gender pay gap of

around 17% for female working women that increases up to 20%-30% at the top end of the distribution. And, Arulampalam, Booth and Bryan (2004, p.6) find evidence of a glass ceiling effect in Europe, and estimate that, in the UK, the gender wage gap is higher than 20% in the public sector and around 30% in the private one. In contrast, Blackaby, Booth and Frank (2005, p. F94) find some evidence of small diminishing gender gaps among UK academics in 1999. Using data from the 1970 British Cohort Study, Lanning *et al*. (2013, p.21) report a smaller gender pay gap for graduates than all workers and Neuburger (2010, p. 181) presents estimates of a smaller gender gap among qualified full-time workers than among unqualified ones due to higher returns on qualifications for women in the 1970 British Cohort Study.

In general, evidence suggests that the gender wage gap seems to be explained in part by occupational segregation; changes in individual characteristics, particularly the intermittency of female labour supply; part-time employment and a probable glass ceiling, but a high percentage of it remains unexplained.

2.3. Occupational segregation and female labour participation

The first series of papers mentioned in the previous section found that occupational segregation, defining occupations as specific to one group, was a key determinant in understanding the gender wage gap, since women tend to concentrate in low paid jobs (Lanning *et al*., 2013, pp. 18-20). Occupational segregation could be understood simply for its historical precedent, but admitting that some occupations have always being defined as exclusive for women or men does not provide an answer for their persistence, unless one is willing to admit custom as a rational argument for it. But then again, custom is not a valid argument in explaining why someone who has the skills and productivity to perform a job and generate profit to a specific sector is not being hired in that sector. Further, it is not entirely true that sex typing has always being defined the same for all occupations, since occupations are associated with one gender or the other depending on the context and culture and some

of them even shift throughout time[5]. Why then would people discriminate up to the point of creating separate spheres for women and men? Goldin's pollution theory of discrimination (2002) offers an answer to this.

According to this theory, the need for prestige is what drives men to discriminate against women and create entry barriers for occupations as well as paying women less for doing a similar job as men. The labour market is part of a social construct and as such, it has history associated with it. The female incursion into the labour market means that men have to start sharing a sphere that they consider theirs with women. Because prejudice dictates that women are less able than men and because markets have imperfect information and are always vulnerable to shocks, men fear that female entrance into an occupation might signal a negative technological change for the occupation, or as Goldin calls it, a "deskilling" of the occupation. Men in the occupation then feel threatened because they are afraid that society will value their work less in terms of prestige. It is their identity and masculinity that gets jeopardized. The market could signal otherwise by compensating men for working with women, since a higher wage would mean that the occupation still enjoys prestige and entails a certain level of skills, but this would be too costly for the firms. Instead, the firms opt to create new occupation or hire women in lower occupations, even if this means that they will be overqualified. In turn, women choose female-dominated occupations.

To illustrate this model, Goldin gives some examples of the evolution of certain occupations, such as teaching, meat trimming or typing, where the inclusion of women into the profession came hand in hand with a new set of what Goldin (2002, p.22) calls "*secondary*

[5] Some authors have also studied sex typing of occupations as a sociological process linked to the construction of gender. For example, Hartmann *et al*. (1986, pp. 27-38) look at the feminization process of telephone operators, publishing and secretarial occupations, which were all initially male occupations. Glover and Kirton (2006, pp. 29-30) points out how certain occupations are associated with different genders according to culture and history, such as typist and hairdressers who are female in the Western world but male in the Middle East and Africa. Similarly, Hartmann *et al*. (1986, p. 7) point out the cases of Denmark, Poland and the former Soviet Union, where dentists are traditionally female, and that of servants in India, where the majority of servants are male, in clear contrast with the tradition in the Western world.

sex characteristics", traits assumed to be needed to work in a particular occupation. In general, she points out that occupations that become feminized are redefined as delicate, in line with a more "feminine" profile. Further, she argues that, when integration occurred, as in the piece-rate compositors, men were compensated with higher wages: men were paid 36% more than women in this example (Goldin, 2002, p.24). But, segregation in occupations as chief clerks, accountants and office managers among others was a clear policy in the 1950s, when only men were allowed to these positions. Finally, she also argues that earnings tend to decrease as the percentage of women increases within an occupation, but they rise once the occupation becomes a feminine one, i.e., the female percentage is 50% or higher (Goldin, 2002, p.30).

This model then explains why occupational segregation persists over time, since it takes a considerable amount of periods for society to identify the real level of female ability and correctly assign the occupational prestige. Men have a reason for creating the entry barriers, since they want to protect their prestige, and because men openly oppose the entrance of women and create believable threats, women respond by choosing occupations labelled as appropriate for them in part because they fear intimidation at work. Therefore, women do incur costs when they opt for more prestigious, male-dominated occupations, and these costs are high and take the form of stigmatization and harassment in the workplace. As a result, men and women end up working in very similar occupations, but because they are labelled differently, women end up earning less for a similar job as the men. At the same time, this occupation offers them, at least in appearance, a safer environment than in the original male-dominated occupation. Goldin also argues that, because career women go to segregated occupations instead of competing against men, this segregation might actually help explain why wage discrimination appear to be lower for career women, which would be a contrary argument to Oaxaca's findings (Goldin, 2002, p.30). Despite this, the author does warn us that occupational segregation is not efficient in the long run, since women are being barred from spheres in which they could perform as well or even better than some of the men already working in it. Finally, Goldin suggests that the credentialization of occupations, an explicit certificate validating the level of skills required to enter an occupation, is a possible solution to this problem, since men distance themselves from women, not because they dread them, but because they fear the market signals, which can be addressed with the credentialization.

Goldin's arguments are consistent with sociological theories on job segregation. For example, Reskin and Hartmann (1986, p. 38-41, 48) argue that sex typing of occupations historically has excluded women from work or occupations by reproducing the gender beliefs that disqualify women for their assumed attributes (weakness, irrationality, lack of commitment, etc.); or to protect their femininity and propriety. They also argue that theories on patriarchy see occupational segregation as an institutionalized mechanism aimed at forcing women into the lower wages and keeping them dependent on men. At the same time, this would discourage women to enter the labour market, thus increasing the supply of free labour in the household; all of which would be directed to reproduce and reinforce the relations of power between the genders. Similarly, Witz (1988, p.p. 74-75) and Glover and Kirton (2006, p. 35) refer to the concept of exclusionary closure, according to which certain groups might mobilize their power to restrict and control their labour supply in order to gain financial status. For Walby (1988, p.p. 14-17, 40), occupational segregation is also associated with occupational closure and historical and social struggles and inequalities. Walby also argues that women also choose not to become technologist or hold top jobs because of the social and emotional cost they would have to pay for not abiding to social and gender rules. And, for Cockburn (1988, p.p. 34-35), job segregation obeys to male separatism: male resistance to be dominated and associated with the same status as women. Finally, Goldin's argument that women in non-traditional occupations may face higher levels of harassment or hostility at work could be backed up by evidence: according to a study in the United States cited by Stanko (1988, p. 96), sexual harassment was experienced by almost all women (98%) in non-traditional occupations, more than twice as much as the number reported in traditional occupations (48%). In all these cases, job segregation results as a struggle for prestige, power and access to financial resources in which one group (the men) benefits from an initial advantage.

There is a parallel between Goldin's pollution theory of discrimination and Power's (1975) model of circular causation for explaining female segregation and the gender wage gap.[6] According to Power, women are placed in lower status occupations and enjoy less advantageous jobs than men as a consequence of institutionalized discrimination and

[6] Although Power's model is prior to Goldin's, these authors seem to have reached their arguments separately, since Power's work is not mentioned in Goldin's paper.

segregation which create a vicious cycle: employers have an incentive to resist female entrance in an occupation because this increases their profits. At the same time, male employees and trade unions also have an incentive to do this because of their dislike for female co-workers and their own fear that their job would be reclassified as a less prestigious one, which at the same time creates a threat and stops women from entering the occupation. Because fewer women are willing to enter, men have more power to discriminate against them, creating a circular relationship between male resistance and female entrance in an occupation. According to Power's argument, different social variables influence the interaction between male resistance and female entrance to an occupation, such as labour legislation, how media portrays women, female household responsibilities and self-esteem, as well as a differentiated education between women and men that leads them to develop different goals and personalities. Power also elaborates on how an occupation might change its "sex identity"; meaning that the social value of an occupation can vary over time, allowing for men to leave the occupation and for women to enter it. This happens when the skills required for an occupation decrease, followed by a decrease in wages, which pushes men into higher valued occupations and offering an opportunity for women to fill the void left by men.

Hence, there are at least three parallels between these two models: in both of them, (i) the segregation of occupations by gender allow firms to pay lower wages to women, (ii) the feminization of an occupation signals the deskilling of that occupation, and (iii) the threat of losing social prestige is an important part in explaining male resistance to female work. However, Goldin's model proves superior because it is able to mathematically formalize the relationship among the different agents and variables; (ii) contrary to Power, who seems to assume an innate male taste for discrimination against women, Goldin's model explains discrimination not as a dislike of women, but through men's self-interest in their own social standing and (iii) Goldin is able to offer a solution to the conflict in terms of her model (credentialization), which Power only manages to do in a more abstract and general way.

However, Power's model sets a precedent on how social variables, such as prestige and gender roles, influence the interaction of economic agents and market outcomes. Power also offers three definitions on what constitutes a female occupation both conceptually and methodologically:

1. According to the first definition, "*female occupations are those which replicate women's household functions and/or household sex relationships*" (Power, 1975, 226), which means that a female occupation has a social content that relates the activities of that occupation to characteristics socially identified with femininity (nursing, care-takers, etc.), the private household environment and a relationship of power of men (authority) over women (subordinates). This too resembles Goldin's argument that female occupations are redefined as "delicate" in order to be coherent with a concept of femininity but, contrary to Goldin, Power places special emphasis on the transfer of male power and female subjection from a private sphere (the household environment) to a public one (the firm).

2. The second definition is derived from Oppenheimer, and offers a methodological perspective according to which "*an occupation is described as disproportionately female (male) if women (men) form a higher proportion of workers in that occupation than they do in the total labour force*" (Power, 1975, 226). This means that methodologically, an occupation can be identified as female if it attracts more women relative to the overall female participation in the labour market. Hence, an occupation could be defined as female even if the majority of the people in it are men, as long as the proportion of women in it is higher than the female labour participation.

3. Finally, the third definition is both conceptual (as is the first one) and methodological (as definition 2). Referring to Epstein, Power describes a feminine occupation as "*one where the majority of workers is women, and where, there is an associated normative expectation that this is as it should be. Thus female occupations are those in which work relationships require men to be in authority over women and where the nature of the work is often derivative of housework."* (Power, 1975, 227). This is consistent with the first definition, but offers an even more strict measurement than the definition derived from Oppenheimer, since a female occupation would now require at least 50% of the people employed in it to be women.

These definitions seem adequate in identifying female occupations. In particular, the third definition will be used later on when defining both the female occupations and subject

fields of study. The reason for it is that it provides a stricter definition than (2) and is consistent with (1). Also, this definition seems intuitive: since there are two genders, it seems logical to define occupations binary, so that a majority of women is strictly understood (>50%). However, other authors use a three-fold categorization which includes a class denominated as "integrated" that groups those occupations or subjects the authors consider to have a close to parity distribution: for Sullivan, Joshi and Leonard (2008, p.321) and Hakim (2002, p. 450) this includes, those with a female participation between 40% to 60%; and for Hakim (1998, p.30), those with a female participation between 25% to 55%. Hakim (1998) argues that integrated occupations are characterized by being more qualified, have higher earnings, status and include managerial and professional occupations with self-employment, so that they should be treated separately. Because a three-fold decomposition requires drawing a threshold somehow arbitrarily[7] it was decided to use the binary definition provided by Power (1975). Also, because this research is concerned with degrees, excludes self-employment and separates the concept of a degree being dominated by one gender from it being highly valued, it seems more useful to use two different binary variables to analyze these two traits, instead of a single three-fold variable.

Female labour participation grew in the twentieth century, but came to a halt in the 1990s: since then, about 76% of married college graduate women in their thirties work and this indicator shows no sign of increasing overtime (Goldin, 2006, p.14). Despite this, Goldin argues the gender gap narrowed during this period because women now hold more job experience, identify with their career, have more market relevant-skills, invest more in their human capital and adventured themselves into less-traditional careers after the introduction of anti-discrimination laws:

> *"Both men and women increased their majors in business administration, but women did to a greater extent and reduced their concentrations in the more*

[7] There is no single consensus on where the line should be drawn to define an occupation as feminized nor is there a consensus on what the acceptable presence of women should be in such occupations. For instance, in discussing what percentage of women should be acceptable for women in the sciences, arguments vary from 15% to 50% (Glover, 2000). Hence, using a binary categorization seems more intuitive, although the choice of a binary or three-fold classification could be deemed as *ad hoc* in any case.

> *traditional female fields of education, literature, languages and home economics. Women's majors shifted from those that were "consumption" related to those that were "investment" related" (Goldin, 2006, p.10)*

This might have helped close the gender wage gap, but occupational segregation is still significant and, as shown before, women still represent a small percentage of the graduates in the most traditional, male-dominated careers. Moreover, a significant percentage of women did shift from the consumption-related to the investment-related careers, but they did not move to the scientific-related careers as quickly to take advantage of the opportunities that these offer. It seems as if men hold the leading careers in the market and women enter them afterwards and in smaller numbers.

Education might be an important factor in closing the gender wage gap, especially because there has been a reversal of the college gender gap, so that now more women enrol in college than men. In the United States, the gender gap went from 6.7% in 1957 to -9.1% in 1992, thus showing a female advantage (Goldin, Katz and Kuziemko, 2006, p. 143-144). In the UK, girls outperform boys at school since 1996 and are the majority of university students since 1992 (Lanning *et al*., 2013, p.14 and Gregory and Connolly, 2008, F1), they have higher aspirations, stay longer in school (Schoon and Polek, 2011, p. 212) and are more qualified than boys (Glover, 2000, p.43 and Joshi, Makepeace and Dolton, 2007, p. 45). This phenomenon can be explained by an increase in the first age of marriage, higher availability to contraception (Goldin and Katz, 2002) and through the higher expectations that girls now hold on college returns which, in turn, respond to the female perception of better opportunities in the labour market. There is also a positive relation between the girls' performance in mathematics and reading scores with their chance of completing college (Goldin, Katz and Kuziemko, 2006, p. 144). This better performance in mathematics and reading might be controlling for the girls' interests on building better skills, but it is also worth questioning if this relation might also motivate girls to diversify their occupational options.

The models depicted in this section show that occupational segregation needs to be understood from a broader framework than just the mainstream economic approach, by including social variables that can explain how jobs shape people's own identity and how they

are valued in society. At the same time, these show that access to education and life planning may be effective policies in counteracting occupational segregation as one of the main sources of market discrimination.

2.4. Subject choice within education and the wage gap

Choices regarding university education can help explain the wage gap observed among different groups. In order to assess how subject fields of study contribute to earnings, Machin and Puhani (2002) estimated earning functions for graduates in the United Kingdom and Germany using the Blinder-Oaxaca decomposition while controlling for the subject of degree. It is of special interest that, one of their reasons for studying this topic is the segregation in fields of study between genders and the potential influence this could have on the gender gap, which is also the main motivation of the present research:

> "*in both Britain and Germany, males are more heavily represented in engineering/technology and physical/mathematical sciences, whereas women have a much larger share of graduates in language studies and humanities, creative arts, and education. (…) males [concentrate] in (higher paid) science-related subjects and females in (lower paid) arts subjects*" (Machin and Puhani, 2002, p. 3).

Using data from the 1996 Labour Force Surveys, the authors find that the subject of degree is significant in explaining the gender wage gap. For example, including a variable for degree categories increases the explained component of the gender gap from 24% to 56% in the United Kingdom and from 21% to 41% in Germany. As other control variables are added, the subject of degree still represents an increase of 14 p.p. and 8 p.p. in the United Kingdom and Germany, respectively (Machin and Puhani, 2002, p.5).

Later, Machin and Puhani (2005) replicate their model using data from 2000 and including France in their research. As before, they find a trend in all countries, with men specializing in more technological-oriented, higher-earnings careers and women specializing in

education and languages, as well as similar gender wage gaps: 24% in Britain, 17% in France and 25% in Germany. For their preferred specification of the model, the authors find that "*the explained gap increases from between 9 to 54 percent to between 14 to 70 percent*" when they include the subject of degree (Machin and Puhani, 2005, p.10). Further, they find that only in Britain the graduate gender wage gap has closed over time due to an increase of the number of women studying more technological-oriented careers; whereas in France no change in trend is observed; and in Germany the gender wage gap actually increases (Machin and Puhani, 2005, p.16). Hence Machin and Puhani's studies support the hypothesis that the choice of subject of degree can help explain the observed lower relative wages of graduate women in the labour market.

Using data from the United Kingdom, Chevalier (2011) estimates a 0.28 log point gap among the subjects of degree, with medicine, subjects allied to medicine, architecture and engineering as the degrees with the highest earning premiums and linguistics, communication and creative art graduates at the lowest end. At the same time, Chevalier finds that A-level scores are significant in explaining the wage gap among subjects of degree, since people with high A-levels tend to earn more as well as enter high-earnings programmes (Chevalier, 2011, p. 10). For example, medicine, dentistry, mathematics, economics, law, philosophy and languages have average A-level scores above 22; and of these, medicine, mathematics and economics also have one of the highest average earnings, above £25 000 per year. On the contrary, people from education seem to enjoy a premium early in their careers, since they enjoy relatively high earnings despite having low average A-level scores. However, Chevalier also finds that the highest variability in wages is not among the subject of degrees, but within them, being economics and education the subjects with the highest volatility, close to 20%. Further, he looks into the wage differentials of the highest and lowest quantiles and finds that math, law, arts, information technology, economics and finance show the greatest inequalities (Chevalier, 2011, pp. 13-14).

Finally, regarding the gender wage differential, Chevalier finds that men tend to earn more in subjects associated with higher earnings, while women earn more in lower-earnings subjects, which is consistent both with Power's and Goldin's arguments discussed in the previous section. In particular, he estimates that men earn a premium in "*Economics (+0.17),*

law (+0.12), IT (+0.09), subjects allied to medicine (+0.08), while female graduates earn significantly more than male in the following: Education (+0.22), Mixed subjects without science (+0.21), Linguistic (+0.14), History and Philosophy (+0.09) and Mixed subjects with a science (+0.09)" (Chevalier, 2011, p. 13). More recently, Chevalier (2012) also argues that science graduates not only earn a wage premium but are also more satisfied with their job when working in a scientific occupation (i.e., science graduates in a scientific occupation are happier than other science graduates in non-scientific occupations), although there is no difference between job satisfaction among scientific and non-scientific graduates. Moreover, he finds a positive relation between having a father in a scientific occupation and choosing this type of degree. The latest raises two questions: (i) why are not more people enrolling into scientific programs of study and (ii) how strongly can a role model influence someone's preference for a particular degree?

All of these papers show that there is, in fact, a trend for graduate women to enrol in lower-paid degrees, while men specialize in the more technological and profitable subjects. They also show that the subject field of the university degree is significant in explaining the gender wage gap. Given the supporting evidence, it is worth looking further into this problem and try to shed some light on what drives women to opt for these type of degrees instead of the more profitable ones, which is what this dissertation attempts to do.

2.5. Skill-bias technological change and the wage gap

The previous sections discussed whether education could give women access to higher wages. Intertwined with education, we find the development of technology and the need to encourage building skills associated with the most dynamic sectors in the economy. In particular, computer science is perceived as offering the biggest opportunity for economic development (Glover, 2000, p.79). Whereas the human capital model would suggest that access to technology might increase productivity and the wages associated with it, other arguments are more sceptical about the influence of technology in female wages. For example, Hartmann et al. (1986, p. 128, 169-172) argue that new technologies increase women's employment problems and work controls while decreasing job satisfaction; and

because women are less likely to study mathematics, science, computer and technology, they are less likely to benefit from them; while Reskin and Hartmann (1986, p. 32) link the introduction of new technologies to transitional female employment that allows firms to later fire or reallocate women in lower positions. Likewise, although Walby (1988, p.p. 32-38) agrees that the development and introduction of new technologies might create new jobs, she does not believe them to contribute to the reduction of job segregation, since the latest is promoted by the employers and technology is associated with masculinity, so that men would be the ones taking over the new jobs. In line with this, Glover (2000, p.2) argues that, even if quantitative feminization took place in such occupations, it would not guarantee its vertical integration, since women can still be kept in the lower jobs of the occupational hierarchy[8]. Hence, there is not a single hypothesis about how technology might impact female employment and wages.

In line with the human capital model, the skill-bias technological change hypothesis results of particular interest (Krueger, 1993). According to this, technological shocks, like the development of new forms of production, come hand in hand with an increase in the demand for high skilled workers, who, in turn, experience an increase in their productivity, since they have complementary abilities with technology. Thus, their increase in productivity results in higher wages relative to those of the unskilled labour. That is, new technologies require higher productivity of labour, pressing for more productive and skilled workers, at the same time that firms face new skill requirements and working conditions change. Initially, because the stock of human capital is fixed at any given moment, the wages of the skilled labour would increase, widening the wage gap between the skilled and unskilled workers. This is a signal for the unskilled workers to invest in training. However, if the demand for skilled labour continues growing at a faster pace than the supply, the wage differential between skilled and unskilled workers would still widen in the long run, resulting in a more uneven distribution of income.

[8] Hakim (1996, 2002 and 2006) argues that most women are not career oriented, but rather adapt work to their maternity choices, which leads them to choose female or integrated occupations, part-time jobs and flexible hours that fit better into their lifestyles, implying that most women choose not to get ahead and climb up the hierarchy.

To test this change in the wage structure, Krueger initially estimates an earnings function with an ordinary least square model using data from the Current Population Surveys in the United States for October, 1984 and 1989 (Krueger, 1993, p. 37):

$$(21) \qquad lnW_i = X_i\beta + C_i\alpha + \epsilon_i \ ,$$

where:

W_i: wage for individual *i*,

X_i: individual characteristics of *i*,

C_i: dummy variable indicating computer use,

β, α: coefficients and

ϵ_i: residual term.

Krueger finds that the wages of those who used computers at work were between 10% and 15% higher than those who didn't (Krueger, 1993, p. 35). He also shows that the wage differential between those workers who used computers and those who didn't increased 6.6 p.p. between 1984 and 1989 and even after controlling for other variables, the wage differential, although reduced, still persisted: in this case, the gap increased 2.1 p.p. during the observed period, so that by 1989, the wages of workers that used computers at home were 20.6% higher (Krueger, 1993, p. 38). Indirectly, this suggests that the use of computers reflect higher productivities, such as having a set of abilities positively regarded by the market. Krueger also observed that the wage gap for computer skilled labour was increasing over time and estimated that computer use explained between a third and a half of the increase in the return on schooling during the 1980s: in particular, he estimates that the return on education increased in about 1 percentage point during the period studied, but this increased to about 1.6 if computer use was taken into account (Krueger, 1993, pp. 33 and 51). As stated before, this suggests that the demand for skilled workers grows faster than the supply, making it more profitable to invest in human capital. However, his findings also showed that the growth rate of the return on schooling was lower for women (0.53%) than men (1.26%), despite the fact that women use more computers at work. Likewise, Blau and Kahn (2006, p.63) argue that women could benefit from computerization, since this increases their share of work hours, which, in turn, could help narrow the gender wage gap.

However, this hypothesis has been contested by Di Nardo and Pischke (1997) and Card and Di Nardo (2010). The former argue that computer use does not adequately proxy technological change, but rather other type of information, such as occupational wage differentials; while the latter argue that the periods of technological change do not coincide with a widening of the wage gap between skilled and unskilled workers, so that evidence does not really support the skill-biased technological change hypothesis. In contrast, Weinberg (2000) argues that the introduction of computers might have weakened the entry barriers of women into certain occupations, thus giving them access to higher wages.

In the United Kingdom, Lanning *et al*. (2013, p.20-21) find evidence that, for two cohorts (those born in 1958 and 1970), professional women earn 3 and 1.8 times as much as their peers in unskilled work, respectively. Similarly, Crawford and Cribb (2013, p.4) provide evidence that mathematical skills during childhood are positively associated with earnings at age 30 for the 1970 British Cohort Study. And, Dolton and Makepeace (2004, p. 121) argue that computer use does have an earnings premium: 10-12% for women and 12% to 16% for men. These suggest that skilled workers are significantly more valued than unskilled workers and that there is some evidence supporting the hypothesis of a technological premium.

In general, the skill-biased technological change hypothesis proposes an interesting relationship between the development of new technologies that alter production and the wage structure among different groups. If the skill-biased technological change hypothesis holds and women tend to invest less in technological abilities, this may help explain the gender wage gap, which is one of the issues this dissertation aims to deal with.

2.6. Identity economics and gender roles

Akerlof and Kranton (2000, 2002, 2005, 2010) introduced sociological concepts of identity in the utility function of economic models to explain how the search or reaffirmation of one's self can lead to different outcomes than those obtained from the traditional models. The authors define identity as "*a person's sense of self*" (Akerlof and Kranton, 2000, p. 715). Although identity might not always be understood as a conscious decision, the authors argue

that people do behave as if they want to conform to or fit a specific identity of their choice[9]. With more or less degrees of freedom, we do ultimately choose how we express and project ourselves to others. According to these authors, identity (I_j) for individual *j* is based on social categories (C_j), groups into which people can be assigned according to their exhibited traits (ϵ_j). In turn, social categories are defined around an ideal (*P*): a standard or archetypical conception of what the members in the category should be. The initial endowment or traits a person has pushes her closer to certain categories than others, but it is the person's behaviour what ultimately signals which category she wants to belong to. People then take into consideration these variables as well as the actions of others (a_{-j}) and decide on their own actions (a_j) and identity that maximizes their utility (Akerlof and Kranton, 2000, p. 719):

$$(22) \qquad max_{a_j, I_j} U_j = max_{a_j, I_j} U_j(a_j, a_{-j}, I_j) \text{ , subject to } I_j = I_j(a_j, a_{-j}, C_j, \epsilon_j, P).$$

For example, women and men are social categories and there are social expectations that define how a woman is supposed to behave, which is different from how a man behaves, so that a person is considered a woman (man) as long as she represents this feminine (masculine) ideal. If a person is born female, members of society will identify her as a woman. She will soon learn to reproduce the behaviour assigned to this category and identify herself as belonging to it. She could also decide to identify herself as a man, but this would imply higher costs for her, since her sex places her closer to the category of women rather than that of men.

Notice that the categories are defined socially and since they break the members of society into different groups or classes, these classes are assigned different meanings and social status. Since social classes can be ordered, belonging to one category or another places the individual in different levels of social status. Note also that individuals shape their identities immersed in a social context. Therefore, the level of satisfaction an individual derives from her identity responds to both her own actions, which she controls, and that of

[9] Although this definition is opened to criticism, identity is defined this way in order to formalize it within the economic model. However, from a broader, sociological perspective, identity is not understood as being fixed, but rather a continuous and changing process that involves reflexivity and agency (see, for example, Jackson and Scott, 2010, p. 122).

others. The others help define the expected behaviours from the members of the different categories, both by exhibiting certain traits and by coercing individuals to behave in a certain way. Going back to the example, in a patriarchal society being a man entails more social status than being a woman. Now, suppose that a woman in this society is competitive, enjoys playing sports, wearing trousers and short hair, which are all male traits. Considered alone, doing all these things would result in higher levels of utility for her, i.e., she is doing what she enjoys. However, her own actions reflect on others as well as herself: by not being feminine enough, this woman is threatening or at least questioning other women's femininity as well as transgressing on masculinity. Because she is not conforming to her assigned category, other people might react negatively to her: she gets to be called a tomboy, loses her female friends, has trouble getting dates with the boys she likes or gets sexually harassed. These are forms of coercion and negatively affect her utility. If the social punishment for deviating from her social category is strong enough to outweigh the gains from her actions, this girl might refrain from doing what she likes: she might give up sports, wear long hair and dresses in order to fit into the feminine ideal and feel good with herself as a woman.

In synthesis, a person's identity is then a function of their own actions and those of others, social categories, prescribed ideals and their own personal traits. This identity enters positively into the utility function, so that positive changes in identity increase utility, while negative changes reduce it. This loss of utility is explained as anxiety for not being able to fit into the prescribed category. The authors illustrate this model with the example of women entering male-dominated occupations: their transgression is punished by men, who refuse to train them and sabotage their work (Akerlof and Kranton, 2000, p. 723). Women react to this by opting for the traditionally female segregated occupations, as in Goldin's pollution theory of discrimination. Fear of coercion if they enter male occupations and gender association limit women's career options and keep them in the occupations with the lowest social status. In order to break these social dynamics, policies beyond the market instruments are needed. In fact, the authors point out that affirmative action and sex discrimination laws decreased occupational segregation in the United States from 67% to 53% between 1970 and 1990 (Akerlof and Kranton, 2000, p. 732). Similarly, anti-discrimination laws in the United Kingdom have contributed to reduce the unequal treatment in the labour market (Neuburger, 2010, p.170) and promoted a series of policies aimed at providing impartial career guidance,

apprenticeship programs to reduce job segregation, development of capabilities in science, technology, engineering and mathematics and family-friendly policies to increase female participation among others (UN CEDAW, 2011, p.p. 11, 36-38).

In a second model, Akerlof and Kranton (2002) include identity into a model of school performance. In the traditional model, school performance is determined by the amount of effort students choose to exert, while the quality of education is explained by the level of investment in education. However, Akerlof and Kranton show that the outcome varies substantially if identity is included in the model. In their version, a student's main concern is not her performance, but rather her identity: given their traits, students choose to belong to the popular group, the nerds or the burnouts, which are listed in descending order of status. Because different traits are associated with each group (beauty for the leading crowd, intelligence for the nerds and none of these for the burnouts), students choose the group in which they fit better and this determines their level of effort (nerds choose the highest level, the popular children choose an intermediate level and the burnouts the minimum). On its part, school quality is not as much determined by the level of investment (the school budget), as by the effectiveness with which it can commit its students to identify with a school ideal. If students feel they belong in the school, they will share its social goal and put more effort into studying. Ultimately, the commitment to an ideal student, not the discounted value of future income, determines the success of an educational project. Finally, the authors show that the students who don't fit in are the ones who dislike studying and perform worse.

The following is a reproduction of their formal model: in it, the student population is normalized to 1 and a student *i* maximizes her level of utility (U_i), which is given by (Akerlof and Kranton, 2002, pp. 1172, 1175):

$$(23)\quad max_{e_i} U_i = max_{e_i} U_i(wk(n_i, e_i), e_i, I_i) \text{ , subject to } I_i = I_i(e_i, c_i, \epsilon_i, P)$$
$$= max_{e_i} \left\{ p\left[wk(n_i, e_i) - \frac{1}{2}e_i^2 \right] + (1-p)\left[I_{c_i} - t(1-\epsilon_i) - \frac{1}{2}(e_i - e(c_i))^2 \right] \right\}$$

where:

w: wage rate per unit of skill,

e_i: effort,

$k(n_i, e_i) = n_i e_i$: human capital, or marketable skills built through effort and innate ability,

$\frac{1}{2}e_i^2$: pecuniary cost of effort,

I_i: identity of agent *i*, it also stands for the identity payoffs,

c_i: social categories equal to the leading crowd (*L*), nerds (*N*) and burnouts (*B*),

ϵ_i: *i*'s personal traits, and are given by *i*'s ability (n_i) and looks (ℓ_i), which are uniformly distributed on [0,1],

P: prescriptions for the ideal category, which are ℓ_i=1 for the leading crowd, n_i=1 for nerds, and no prescription for burnouts ($\ell_i = n_i = 0$), such that the ideal effort implies *e(N)>e(L)>e(B)*,

t>0: parameter indicating the identity loss from *i*'s distance from the ideal prescribed, so that the farther away *i* is from *P*, the more costly it is for *i* to try to fit into this category,

$t(1-\epsilon_i) + \frac{1}{2}(e_i - e(c_i))^2$: costs of fitting into a category in terms of identity and effort, and

p: weight on the pecuniary benefits and costs of effort, $0 \leq p \leq 1$.

For simplicity, the model assumes that the identity payoffs for the burnouts are normalized to zero, such that $I_B = 0$. Note that the above utility function weights both the pecuniary and social gains and costs of studying, and the student assigns the value of *p* according to how important she considers each of these components to be: a student who values only the economic benefits of studying would have *p*=1, whereas a student who only values her present social status in the school would have *p*=0. Further, the authors show that when students only value the economic outcomes (*p*=1), the average values of effort and human capital are given by *e=w/2* and *k= w/3*. However, if *p*=0, the solution is given by (Akerlof and Kranton, 2002, pp. 1172, 1175):

$$(24) \qquad \bar{e} = \left(1 - \frac{I_N}{t}\right)\left(1 - \frac{I_L}{t}\right)e(B) + \left[\frac{I_N}{t}\left(1 - \frac{I_L}{t} + \frac{1}{2}\frac{I_N}{t}\right)\right]e(N) + \left[\frac{I_L}{t} - \frac{1}{2}\left(\frac{I_N}{t}\right)^2\right]e(L)$$

If students only value their social status within the school, they put as much effort into their studies as their category asks them to: a smart student, for instance, might decide not to do her best (not to be a nerd), if she can be included in a more popular group. Then they argue that, when students care about their social life, a school's success would be determined by the value of the parameter *t*: schools in which their students are too far away from the ideal student would result in a considerable number of those students becoming burnouts or

dropouts, while a school who sets a standard to which its students can identify with is more inclusive and makes it easier for the students to belong to the community. Empirically, they test this model using data from the High School and Beyond survey from the United States. The authors classify the students as belonging to one of four social categories (burnouts, nerds, leading crowd and a new category of athletes) and then run logit regressions to estimate the likelihood of these students showing some particular traits. For instance, they find that burnouts show less self-esteem, show less positive attitudes towards school, belong to homes of lower socioeconomic status and are, in general, less likely to identify with school (Akerlof and Kranton, 2002, pp. 1172, 1179). Because this model provides an insight on how social variables might influence schooling decisions, it will later be taken as a baseline to develop the main model in the present research.

A vast research on behavioural economics supports the idea that behaviour can be gendered. For example, women tend to be more risk averse, shy away from competition, are less overconfident, negotiate less on their behalf, are more socially minded, have better interpersonal skills and less behavioural problems than men but are more likely to be vulnerable to stress and fear as well as more pessimistic; and are conflicted about double standards at work that demand from them to exhibit traits associated with masculinity while remaining "feminine" (Bertrand, 2010). These gendered traits have been associated with degree choice, so that people with what is defined as "masculine traits" are more likely to choose male-dominated subjects of degree (Antecol and Cobb-Clark, 2010). However different this gendered behaviour is, it is not related to performance or ability (Cotton, McIntyre and Price, 2010) but rather to how women perceive themselves (Reuben, Rey-Biel, Sapienza and Zingales, 2010), which brings us back to how gender identity is constructed and its relation to career choices.

Back in the 1960s, Friedan had already explored how gender roles influence women's choice of career. In *Feminine Mystique* (1963), Friedan denounces that the prevailing ideologies (psychoanalysis and functionalism among them,) as well as the corporate and educational agendas, impose a feminine ideal that oblige women to live vicariously through their husband and children, reducing them to motherhood and sexual objectification. Much in line with Simone de Beauvoir (1999)'s critique, Friedan calls upon women to claim their own

existence and liberties, advocating in favour of offering women a real education and a career in which they could define their own identities[10]. In Friedan's programme, the development of competences are central to building self-esteem and realizing their self-actualization (Friedan, 1963, pp. 258-260), a concept that she takes from Maslow's "*Theory of human motivation*" (Maslow, 1943) and that it is very much in line with today's capabilities approach, as developed by Sen (1999) and Nussbaum (2008, 2011).

In her analysis, Friedan shows that even college educational programmes (those that were supposedly meant to offer career opportunities to women) were strongly biased and were unable to create any kind of expectations for girls aside from becoming housewives and mothers. This feminine mystique that was created and reproduced in all social environments opposed femininity to professional careers; thus, creating an identity conflict for those women who wanted to opt for one, or as Glover and Kirton (200, p. 88) put it "*think female manager, think childless superwoman*"[11]. The following passages capture the extent of this conflict:

[10] Parallel to Friedan's analysis for the United States, Irwin (2005, p. 46) also argues that "career housewife" also emerged in the United Kingdom during the Postwar period. Both Friedan and Irwin claim that mothers served as the scapegoat in which anything could be blamed, which put great pressure on women to go back home and claim motherhood as their project in life.

[11] In contrast to these theories, Hakim (1996, 2002, 2006) appears to take an anti-feminist stance in favour of an essentialist view (she disregards much of the body of feminist literature), claiming that the social, structural and economic environments are not very important in defining preferences and that only a minority of women choose a career-oriented lifestyle. She also claims that one of the major assets women have is their own sexuality (Hakim, 2010) and advocates for the use of it as a means to get economic benefits. Her arguments seem to be founded on the premise that women are not constrained in their choices, which is perhaps naïve and simplistic, for preferences are not questioned by Hakim, but rather assumed as an absolute truth. Her approach appears to avoid the core philosophical question: why? While it is true that women are rational, free agents, their freedom cannot be taken as absolute, but rather in circumstance. Denying the influence of history, institutions and patriarchy on how preferences are shaped seems lack validity in the twenty first century and so, positions such as those of Hakim may be considered too shallow for the purposes of this dissertation that precisely asks the question: why is it that women choose a particular degree rather than another?

"scientists noted that America's greatest source of unused brainpower was women. But girls would not study physics: it was 'unfeminine'. A girl refused a science fellowship at John Hopkins to take a job in a real estate office. All she wanted, she said, was what every other American girl wanted –to get married, have four children, and live in a nice house in a nice suburb." (Friedan, 1963, p.7)

"Again, most of those who should have being studying physics, advanced algebra, analytic geometry, four years of language - and were not – were girls. They had the intelligence, the special gift which was not sex-directed, but they also had the sex-directed attitude that such studies were 'unfeminine'. (…) The influence of sex directed education was perhaps even more insidious on the high-school level than it was in the colleges, for many girls who were subjected to it never got to college". (Friedan, 1963, p.128)

Almost half a century after, Friedan's argument echoes in Goldin's or Akerlof and Kranton's economic models: identity plays a crucial role in defining career opportunities for women and the definition of this identity goes through the social need of fitting into an imposed gender role. If career options are placed opposite to femininity, the cost of pursuing a career for women is too high, since it implies asking them to renounce what they've being taught to be a cornerstone of their identity: womanhood. Above all, people want to be accepted and feel comfortable with who they are, and this search for identity is of particular importance to teenagers, just about the age in which they have to take decisions on their career options. While analysing the conflict that smart girls face between cultivating and expressing themselves and fitting into their social group, Friedan quotes a 17-year old girl with an aptitude for poetry, which highlights the relevance of coping with one's own identity. This girl told her:

"But things like that [poetry] aren't what you need to be popular. The important thing for a girl is to be popular." (Friedan, 1963, p.55)

Similar to Akerlof and Kranton's argument about the choice of effort students put into their studies, Friedan argues that smart girls would try to hide their intelligence and renounce their ambitions to appeal to their peers (Friedan, 1963, p. 138). Another crucial argument that stems from the above passages refers to the power that the sex-directed education had in creating the separate spheres between women and men. Although, women had the opportunity of getting an education, they had access to different educational programs than men, so that educational institutions helped institutionalize the segregation of occupations, offering women options that would still be considered feminine. The conflict between the ideal of femininity and professional careers varies depending on the career, and the scientific, technological occupations were defined as the most masculine. So, if a woman wants to pursue a career, it is less costly for her to opt for one of the 'feminine' ones, since these allow her to reconcile her professional project with her identity and social life. In this regard, Friedan gives the example of a girl who switched from bacteriology to home economics for the simple reason that there were no girls in bacteriology (Friedan, 1963, p. 124). According to her, occupational segregation had a reason: to allow men, who were returning from war, to reclaim their previous jobs from women, reversing the participation of women in the labour market (Friedan, 1963, p. 148). Even though sex-directed education has, at least in theory, being eliminated since then, one wonders if the underlying assumptions are still defining people's career choices.

Similar arguments as that of Friedan's are presented by Reskin and Hartmann (1986, p.p. 53-61), who claim that women in sex-atypical occupations are seen as deviant, thus questioning their femininity; and role-stereotyping limits women's possibilities to participate fully as workers, especially in the scientific community. They also argue that the socialization process contributes to limit women's choices in several ways: (i) only some occupations are signalled as being appropriate for specific genders, (ii) the sex-specific education may limit the career opportunities for women (they are not as trained in certain areas like mathematics which immediately excludes them from certain career options); they may not have complete information about their career possibilities either because (iii) they ignore their options or because (iv) they believe certain options will not be made available to them; and (v) they may rule out some options in anticipation of family and childrearing decisions. These authors also highlight the influence of the household environment in girls' career decisions. In the first

place, they argue that girls are less exposed to socialization outside of the family environment, so that they are more likely to reproduce their parent's values. Secondly, parents place higher expectations on boys than girls, especially regarding mathematics, which is part of the sex-specific socialization process. Thirdly, the parents' occupations influence how children assign sex-specificity to certain occupations: preschool children learn at an early age to recognize the most gender segregated occupations and they keep learning the stereotypes throughout childhood and adolescence. In contrast, children with working mothers are less likely to hold traditional gender-role attitudes and beliefs. Schools also play a role in the construction of occupational preferences, since counselling at school also reproduces these stereotypes and offers incomplete information to their students about their available career options. Overall, the authors argue that as children learn about sex-typed occupations, they learn to shape their preferences to fit into such stereotypes, which are influenced by their experience at home, school, role models and media. However, socialization is not static, but rather a fluent process, so that women learn and are able to change their career options as they gain work experience, learn that male-typed occupations are better paid and learn to feel less threaten about being perceived as unfeminine.

Occupational sex-typing at an early age may be highly engrained in the process of creating a self-image. According to Gottfredson (1981), individuals choose their occupation by discarding those that are inconsistent with the different stages of the development of their identity: (i) gender, (ii) social class, (iii) intelligence and vocational interests; and (iv) competencies and values. Because gender is so primal in defining identity (it corresponds to the first stage), individuals are the least likely to compromise it and more likely to sacrifice their preferred occupational choice if a conflict exists between them. This is consistent with the conflict between femininity and career choice, as documented above by Friedan (1963) and Reskin and Hartmann (1986).

Although a lot of changes have occurred since the 1960s, the feminine mystique still shapes gender identity. Recently, Orenstein (2011) studied the marked trend of gender differentiated toys and the effect they have on younger generations. Clearly, toy differentiation expands the market for the toy companies, since parents have to buy two toys, one for the girl and one for the boy, instead of one, which implies an increase in the industry's

profits. For example, Orenstein points out that Disney's Princess line reported sales of three hundred million dollars just in the first year and this indicator had increased to four billion dollars by 2009 (Orenstein, 2011, p. 14). But, in order to create such a wide segmentation, toy companies have opted to emphasize the gender stereotypes precisely at an age in which children are starting to define their identity and are more vulnerable to accept and interiorize these stereotypes (and reject everything else). By limiting the toys for girls to the pink line (all their toys come now in pink), girls are being signalled that all the other toys are not meant for them and that these are male spheres[12]. While the boys explore with all kind of toys (from building blocks to construction sets and robots), girls are left to play princess and wait for their prince to come and rescue them (Orenstein, 2011, p. 38). Orenstein finds that these generations of children who have been exposed to mainstream media and what she calls the "*girlie-girl culture*" heavily struggle to fit into the ideal: a woman that has to be both beautiful and perfect, and is valued in as much as she is desired by everyone. The following passage adequately summarizes some of her findings:

> *"I have never seen a study proving that playing princess specifically damages girls' self-esteem or dampens other aspirations. And trust me, I've looked. There is, however, ample evidence that the more mainstream media girls consume, the more importance they place on being pretty and sexy. And a ream of studies shows that teenage girls and college students who hold conventional beliefs about femininity –especially those that emphasize beauty and pleasing behaviour- are less ambitious and more likely to be depressed than their peers. They are also less likely to report that they enjoy sex or insist that their partners use condoms." (Orenstein, 2011, p. 16)*

By reaffirming the stereotype on gender roles at a young age, girls learn to identify themselves with their image: they don't perceive themselves as agents but rather as an image, an object of desire meant to please others. They also place their well-being or happiness on

[12] Concern has been also raised in the United Kingdom about how media not only reinforces gender stereotypes, but it has gone backwards in recent years (Lanning *et al*., 2013, p.6, 44). Some independent efforts have taken the initiative to fight this trend, see for example http://www.pinkstinks.org.uk/ in the United Kingdom.

others: since they don't perceive themselves as agents, their satisfaction depends on what other people think of them and they can only gain acceptance by trying to fit more and more into the ideal. The problem is that this is an ideal of sexual beauty and passiveness: just as the girls trapped by the callback home and the feminine mystique of the 1950s, girls today are as exposed to a gender ideal that presents femininity as conflicting with career plans associated with what is considered male traits, including those careers that offer the best opportunities in the market. One would expect then that growing up with this ideal of femininity would influence how girls feel about certain subjects, like math and science. This influence might not be direct, but rather subtle and mixed through the different societal signals of what femininity is supposed to be. In fact, Orenstein does show a conflicting relationship between this ideal and mathematics:

> *"Yet even can-do girls can be derailed –and surprisingly quickly- by exposure to stereotypes. Take the female college students, all good at math, all enrolled in advanced calculus, who were asked to view a series of television commercials: four neutral ads (showing, say, cell phones or animals) were interspersed with two depicting clichés (a girl in raptures over acne medicine; a woman drooling over a brownie mix). Afterward they completed a survey and - bing! - the group who'd seen the stereotyped ads expressed less interest in math - and science – related careers than classmates who had seen only the neutral ones. Let me repeat: the effect was demonstrable after watching <u>two ads</u>. And guess who performed better on a math test, coeds who took it after being asked to try on a bathing suit or those who had being asked to try on a sweater? (Hint: the latter group; interestingly male students showed no such disparity.)" (Orenstein, 2011, p. 17)*

Other studies also show evidence supporting the hypothesis that the prescribed gender roles affect a girl's relationship with mathematics and science. The first study show that mothers "*are more likely at every grade to purchase math/science items for sons than for daughters, regardless of child's grade in school*" (Jacobs *et al*., 2005, p. 255). That is, they find evidence supporting the initial part of the present research hypothesis: parents are biased to stimulate the development of mathematical and scientific skills in boys but not girls. It seems

reasonable that, if girls and boys are stimulated differently and taught that some subjects are not meant for girls, girls will not grow up to feel as comfortable about these alleged male subjects. The authors also show the existence of a positive relationship between the student's self-perceived ability in mathematics and their test scores, as well as a negative relationship between the student's interest in mathematics and the mother's traditional views (the less conservative mothers have children more interested in the subject). But, what is really interesting is that girls' interest in mathematics drop as their fathers gender identity increases, while the boys' interest increases in this environment. So, patriarchal beliefs accentuate male confidence in subjects like mathematics and science, but refrains girls from exploring them.

Gender-role socialization is therefore a subtle process in which children are imbued, and exposing children to gender-differentiated toys and different parental encouragement towards these toys is just a part of it. Consistent with Orenstein's (2011) and Jacobs *et al*.'s (2005) research, Karbownik and Myck (2011, p.p. 21-23) find that, in Poland, a household's expenditure on toys is significantly higher if the first born is a boy, but they spend more in clothing if the first born is a girl, which might reflect the different parental preferences towards their children, i.e., although parents spend the same amount of income on their children, the patterns of consumption differ in order to signal the assignment of traditional gender roles: agency for boys and beauty and objectification for girls. Also, consistent with Jacobs *et al*. (2005) are González de San Román and De la Rica Goiricelaya's (2012) arguments. Their findings indicate that the gender gap in math scores (girls perform less than boys) narrows in more gender equal societies, both at a country or regional level, when tested on OECD countries or Spain's different regions, respectively. They also find a positive relation between girls' performance in math and reading and having a working mother, but they do not observe such an outcome for boys; suggesting that more gender-equal attitudes and role models have a positive impact on girls' development and academic achievement. Similarly, in a study cited by Bertrand (2010, p. 1570), results show that girls whose first math or science teacher was female are more likely to major in math, science or engineering. Other studies replicate these results, where the teacher (rather than the mother) seems to be the role model girls follow (Reskin and Hartmann, 1986, p. 115), although the mother's gender identity has also been found to be correlated with female decisions on the labour force participation (Bertrand, 2010, p. 1574-1575).

With a broader approach, Fortin (2005) studies how gender roles influence the participation of women in the labour market for 25 OECD countries and finds that traditional gender role attitudes, religious attitudes and feeling guilt over leaving the children to go to work are negatively related to both employment (anti-egalitarian women are more likely to not work or work part-time) and closing the gender wage gap. Fortin finds these relationships to be stronger for immigrant women from more conservative backgrounds. On the contrary, women with higher education perform better in the labour market, which comes as no surprise, since they have invested more in human capital[13]. The results also show differences in the values held by women and men: the former exhibit values associated with poorer labour market outcomes (flexible hours, usefulness to society) than men (pay and competition) and are more likely to work part-time if they are married mothers with conservative values (Fortin, 2005, p.p. 425-427). These findings are consistent with Reskin and Hartmann's (1986, p. 73) argument that women with limited childcare options and who believe that working is prejudicial for children are less likely to work. These findings support that, even in a variety of countries, with diverse cultural background and political institutions, interiorizing gender roles have a significant effect on female participation in the labour market. Hence it is also worth asking if these traditional views also influence the type of job women take, which is precisely the question that is being asked throughout the present research.

The British data also supports the hypothesis that environmental and attitudinal variables are related to economic outcomes later in life. For example, Croll (2013) finds that ambitions, social class and status can explain occupational choices, despite observed misalignments between the aspirations of young people and the amount of effort or ability they are willing to exert into getting a degree. Using data from the 1970 British Cohort Study, Schoon and Polek (2011, p. 215) find social class to be related to ability; and Schoon, Ross and Martin (2007, p. 135) find that maternal education and ability in math are predictors of

[13] Of course, institutions and culture might influence differently this trend. For example, Yu argues that in a country like Japan (which is included as a late female mobilization state in Fortin's study) highly educated women face a great pressure to quit their jobs and dedicate themselves to motherhood. But even in this case, Yu (2009, p. 87) finds that an extra year of schooling decreases the probability of leaving the labor market in about 3% for Japanese women, which is consistent with Fortin's argument.

occupation. These three studies suggest that the environment (measured mainly through social class) impact the development of capabilites.

Data from the 1970 British Cohort Study also provides evidence that internal locus of control at an early age can predict both the locus of control and earnings at age 30 for women (Flouri and Hawkes, 2008, p. 429); maternal expectations (Flouri and Hawkes, 2008, p. 411) and distress (Flouri and Malmberg, 2011, p. 533) also affect the adult's sense of control and distress, respectively, thus suggesting that self-esteem at an early age and the environment one grows up in have an impact through life.

Because self-esteem is also associated with gender, girls from this cohort also tend to underestimate their ability (Schoon and Polek, 2011, p. 212). Likewise, there is evidence of the impact of sex-typing of occupations on the economic decisions of the cohort members: fewer women (3%) than men (10%) enter occupations in science, engineering or technology (Schoon, Ross and Martin, 2007, p. 135 and Schoon, 2001, p. 127), and students who wanted to become scientists were more likely to be male, withdrawn and had mathematical ability and scientific confidence (Schoon, 2001, p. 127), i.e., aspirations respond to stereotypes, so that, when choosing a degree, they try to match the ideal of it with their self-image, which is consistent with the identity economics framework. In particular, lower confidence and ability in mathematics and science seem to narrow occupational choices: self-assessed ability in science and math (English) is positively (negatively) associated with gaining a male-dominated qualification (Sullivan, Joshi and Leonard 2008); and math test scores at age 10 are positively associated with earnings at age 30 (Crawford and Cribb, 2013, p.4).

This section illustrates how the construction of gender roles can influence economic behaviour. In particular, the need for identity and acceptance by social groups may influence the way in which women perceive themselves and form expectations about what their role is in the labour market. Thus, the effort of identity economic models to integrate social interaction and try to explain how people construct their identities is a step forward in understanding economic behaviour, particularly at a microeconomic level.

2.7. Conclusion

In conclusion, the literature shows that women face fewer opportunities than men in the labour market, which can take the form of discrimination, including lower pay for the same job or lower pay in segregated occupations. The literature also suggests that women might choose to stay in segregated occupations to avoid coercion from employers or co-workers, to avoid losing prestige or to fit better into an ideal of what they should be. At the same time, the search for identity and social acceptance shapes our behaviour and this could be an important factor explaining how women feel about subjects and careers that traditionally have been considered masculine. Therefore, gender identity might be related to female career choices. The next chapters will explore these relationships empirically, in particular, with respect to the determinants of female degree choices.

3. Getting a 'girlie' education: gender beliefs and early mathematical and technological stimuli in female degree choices

"There are no differences in overall intrinsic attitudes in science and mathematics among women and men. Notice what this is not saying: it is not saying that genders are indistinguishable, it is not saying men and women are alike in any way, it's not even saying that men and women have identical cognitive profiles. What is saying is that when you add up all the things that men are good at, all the things that women are good at, you see that there is no evidence for an overall advantage for men that is going to put more men at the top of the fields in math and science and other fields if discrimination and other social factors did not exist." (Spelke, E., 2013)

3.1. Introduction

This chapter contributes to the literature on identity economics by modelling and analysing how beliefs in traditional gender roles and the development of early capabilities in mathematics and technology are associated with female degree choices. While some authors have studied the influence of gender roles in the female labour supply (Fortin, 2005; Johnston, Schurer and Shields, 2012) or female educational performance (Goldin, Katz and Kuziemko, 2006; González de San Román and De la Rica Goiricelaya, 2012), these relationships are rarely linked to technology. In contrast, this dissertation focuses not only on social norms, but also on how exposure to mathematics and technology during childhood might drive female degree choices. From a policy perspective, this could mean that career advice might come too late for women if their early childhood experiences and family background are the driving mechanisms for their degree choices.

Careers associated with high earnings in the labour market are usually related to mathematical, scientific and technological skills. However, only 5% of girls in OECD countries

expect to have a career in engineering or computer sciences (OECD, 2012); this number is as low as 3% for the cohort born in the United Kingdom in 1970 (Schoon, Ross and Martin, 2007, p. 135 and Schoon, 2001, p. 127); only about 25% of graduates in computer science and engineering are women in the United States (National Science Foundation, 2008) and this percentage drops to 20% for the United Kingdom (HESA, 2010). Fields of study are highly segregated by gender, with men not only specializing in more technological-oriented, higher-earnings degrees, like engineering or business (Machin and Puhani, 2002, 2005; Hilmer and Hilmer, 2012; Glover, 2000; Schoon, 2001; Lanning *et al*., 2013), but also earning more than their female peers within these fields, thus widening the gender wage gap within the field relative to the gap observed in lower-earnings fields dominated by women, like humanities or education (Chevalier, 2011; Glover, 2000). At the same time, technological change has been associated with higher wages for the more skilful and trained workers, which can result in an increase of the wage gap among different sectors in the labour market, as in the skilled-biased technological change hypothesis (Krueger, 1993)[14]. In the United Kingdom, computerization has been associated with an earnings premium (Dolton and Makepeace, 2004) and an increase in the share of work hours for women (Blau and Kahn, 2006); while women with professional degrees (Lanning *et al*., 2013) and workers with mathematical ability (Crawford and Cribb, 2013) earn more than their less skilled peers, thus suggesting that mathematical, technological and scientific education could help narrow the gender wage gap.

Despite the fact that, since the 1990s, women have outperformed men in school, now more women graduate from further education than men (Goldin, Katz and Kuziemko, 2006; Lanning *et al*., 2013, p.14; Gregory and Connolly, 2008; Schoon and Polek, 2011) and are more qualified (Glover, 2000; Joshi, Makepeace and Dolton, 2007), this is not reflected in a significant change in female degree choices that could narrow the gender wage gap for graduates, in part because women enter careers that are considered feminine, characterized by lower demand and wages. For graduate women, the return on education is lower than that observed for men, even after controlling for ability and unobserved characteristics (Dale and Krueger, 2011). Educational attainment has been found to narrow the gender wage gap for

[14] Although this hypothesis may not be fully supported empirically (Di Nardo and Pischke, 1997) and there is not full consensus on how technology might impact female labor (Weinberg, 2000; and Card and Di Nardo, 2010).

the upper segment of the distribution, usually associated with graduates (Kassenböhmer and Sinning, 2010). The persistence of this gender wage gap and the lower returns on education for women are not easily explained by the human capital model (Becker: 1991, 1993; and Mincer, 1970), which would predict an increase of female enrolment in degrees associated with higher productivity and returns on investment in human capital, which is not being observed.

While occupational segregation stands out as one of the most significant barriers in closing the gender wage gap (Becker, 1971; Oaxaca, 1973, Oaxaca and Ransom, 1994; Mumford and Smith, 2009) and discrimination models focus on how entry barriers for women and new female occupations characterized by lower wages are created (Goldin, 2002), the truth is that women may persistently choose to supply their labour in certain occupations even in the absence of discrimination. Particularly, in the case of female graduates, women are active agents in choosing their degree subjects and supplying their labour, which can be influenced by other social factors such as access to contraception (Goldin and Katz, 2002) and seeking individuality and prestige (Goldin, 2006).

Environmental and attitudinal variables influence how individuals shape their preferences, capabilities and their economic outcomes. For instance, ability has been associated with social class (Schoon and Polek, 2011); the internal locus of control during childhood, maternal expectations (Flouri and Hawkes, 2008) and distress (Flouri and Malmberg, 2011) are predictors of self-concept as adults; femininity and the media make girls less confident in their ability (Orenstein, 2000; Schoon and Polek, 2011); career attainment is associated with career aspirations as a teenager (Schoon and Polek, 2011); getting a male-dominated qualification is positively associated with the self-perceived ability in science and math (Sullivan, Joshi and Leonard (2008); occupational choices respond to ambitions, social class, status (Croll, 2013), maternal education (Schoon, Ross and Martin, 2007), early ability in math (Schoon, Ross and Martin, 2007 and Sullivan, Joshi and Leonard 2008) and gender (Schoon, 2001, Gottfredson, 1981); while earnings respond to mathematical ability (Crawford and Cribb, 2013) and the internal locus of control during childhood (Flouri and Hawkes, 2008). Thus, given the evidence, the social environment cannot be ignored in understanding female degree choices.

Models from identity economics (Akerlof and Kranton, 2000, 2002, 2005, 2010) provide a useful framework to incorporate how the need for acceptance, identity and status in a society with prescribed social norms and values affect individual decision-making. In this context, job segregation can result from the need to fit into a particular gender category, which is not only consistent with Goldin's (2002) approach, but with sociological and gender studies showing that sex-directed programs, gender-stereotyping in children, socialization, media exposure and ideals of femininity can limit opportunities for women and how they relate to math, science and technology (Friedan, 1963; Reskin and Hartmann, 1986; Orenstein, 2011).

For example, studies show that female role models can influence girls into studying science and math (Bertrand, 2010); that single-sex schools, where students are not exposed to the presence of the other gender, makes them more likely to get non-stereotypical qualifications (Sullivan, Joshi and Leonard, 2008) and that parents are more likely to buy toys for boys and cloths for girls (Karbownik and Myck, 2011), and more likely to buy scientific items for boys than girls (Jacobs *et al*., 2005). The latest could suggest that parents transmit to children from an early age the stereotype that agency, math and science are associated with masculinity and, thus, children would be expected to act according to these social norms later in life. Other studies show that more gender equal environments (like those found in the Nordic countries where mothers are more likely to work and religious ideology does not strongly permeate work values) help narrow the gender gap in math scores for high school students (González de San Román and De la Rica Goiricelaya, 2012) and increase female participation in the labour market (Fortin, 2005). Nonetheless, working in a scientific or non-scientific occupation does not entail any difference in the level of job satisfaction reported among graduates (Chevalier, 2012), which suggests that the different degree and occupational choices between genders could respond to different preferences associated with the interiorization of gender norms. That is, because preferences might be shaped differently for women and men due to socialization processes, even if women enter the lowest paying degrees and occupations, they would still be acting consistently with their preferences, so that they are maximizing their utility. The question then should focus on how the construction of gender limits the choices for women.

Similar to Johnston, Schurer and Shields (2012), this chapter uses data from the 1970 British Cohort Study to test whether gender-role attitudes are associated with labour market choices[15]. But, instead of focusing on all female workers, this chapter focuses on female university graduates and why they traditionally choose a type of human capital investment that can be perceived as being consistent with gender stereotyping. This does not mean to undermine other workers or their career choices, but rather to focus on a group that explicitly plans and makes investment in their further education. More precisely, if getting a higher education degree implies a significant investment (in terms of tuition, time, lost wages, etc.), why would women persistently enrol in the least profitable programs of study when they could be graduating with degrees that might offer them better opportunities in the labour market? Given that women face the same requirements as men when applying to a degree program, discrimination alone does not provide an answer for this question, so the answer must lie somewhere else. Particularly, this thesis looks at a possible existence of differentiated parental stimuli in encouraging girls and boys to develop mathematical and technological skills during childhood. The relationship between these degree choices and the wage they eventually earn in the labour market will be explored later, in chapter 5. Because male behaviour might serve as a benchmark, results are also reported for men, although women are the main group of interest.

The chapter is structured as follows: section 3.2 proposes a model within the identity economics framework. Section 3.3 introduces the dataset to be used. Thus, sections 3.2 and 3.3 provide the main assumptions and the relations expected to be observed in the dataset. Section 3.4 explores the possible link between the environment in which children develop early in life and their gender-equal attitudes of sixteen years old teenagers. Section 3.5 takes the subsample of those cohort members who invested in a university education to test whether their gender identity and their experiences with math, science and technology are related to their choice of degree, and section 3.6 concludes.

[15] Their paper looks at the association of gender roles with the probabilities of continuing into further education and working with an approach that is very similar to the one taken here. However, the main differences are: that they focus on all workers, not graduates; (ii) they estimate the probability of continuing into further education, not the probability of choosing a degree type and (iii) they consider gender roles but not the exposure to technology in their explanatory variables.

3.2. Model

Taking Akerlof and Kranton's (2002) model on school identity as a baseline, the model in this section illustrates how gender identity and the development of early capabilities may influence the degree choices of women. Assume there are two social categories (*c*): (i) those who hold gender-equal beliefs and, therefore believe that women and men can develop the same capabilities and do the same jobs; and (ii) those who conform to traditional gender-roles and believe in a natural determinism that assigns separate spheres of action to each gender. Holding traditional views is considered the norm, so that *c* will take a value of 1 for people with gender-equal beliefs and 0 otherwise. Individuals are assumed to learn to act according to their assigned gender from an early age by observing and reproducing behaviours around them, so someone born in a gender-equal environment is expected to have a different ideal of what a woman is than someone born in a traditional environment. Hence, the prescription for the ideal woman, denoted by Ω, is imposed from the outside by the environment the person is born in[16]. In a gender-equal environment the ideal woman is a rational person as capable and as deserving as a man. This prescribed ideal is denoted by Ω=1. In a traditional environment, the ideal woman, denoted by Ω=0, is weak, nurturing, giving, a care-taker, has heightened social and communication skills, lacks mathematical, scientific or technological skills and, in general, is less valued by society than a man, including the labour market.

Assume also that, by the time the person chooses her degree, she has some given characteristics ω. ω is a dummy variable that takes a value of 1 if the person exhibits relative capabilities in math, science and technology. This variable reflects the abilities, effort, taste and prior experiences that might have influenced the development of such capability. For example, children who have parental support, who participate in math and science clubs, or enrol in robotics camps might develop a taste for mathematics, science and technology and, thus, exert more effort developing their capabilities. Since these are prior experiences, the

[16] The environment comprises all spheres of social life, including the household, the school, the media, pop culture, sexuality, etc. However, in the following sections and due to data availability, only the household environment can be proxied for. Obviously, this limits, to an extended degree, the possibility of testing the hypothesis, especially because there is evidence that media and peers might have a greater influence than the household in shaping identity.

level of their relative capabilities is taken as given, which does not mean that it is taken to be innate. Since in a traditional environment, math, science and technology are associated with men, ω=1 is viewed as a male trait. By opposition, ω=0 is associated with having relative social capabilities, which is considered a feminine trait. In a gender-equal environment, however, ω would not be associated with any particular gender, since women and men would be expected to have a similar distribution of capabilities.

Assume also that the labour market for graduates is segregated into two sectors: one with a high wage that generate a lifetime payoff of w^H, and one with a lower wage rendering payoffs of w^L. The latter is the wage offered to those with degrees (d_i) that require social capabilities, such as the humanities, languages and education (d_i=0), while the former is for degrees usually associated with mathematical, scientific and technological skills, such as computer science, medicine, engineering and economics (d_i=1). *i*'s degree choice determines, along with ω, the set of *i*'s marketable skills, $k_i=k(d_i, \omega_i)$. This leads to four different types of marketable skills or human capital which will be denotes as $k_{d\omega}$. k_{11} and k_{00} refer to those people who match their relative capabilities with the type of degree program those capabilities are associated with, for example, k_{11} indicates that *i* has a high-earnings degree and relative capabilities in mathematics, science and technology. In turn, k_{10} and k_{01} indicate people who specialized in degrees that are not usually associated with their relative capabilities. Because it is assumed that the labour market values more graduates with a high-earning degree programs and those with mathematical, scientific and technological skills, then $k_{11} > k_{10} > k_{01} > k_{00}$.

Obtaining a degree is associated with economic costs (t_i), such as tuition fees, the length of study and lost wages due to training, among others. It is assumed that the high-earning degree programs are more expensive, so that if d_i=1, $t_i=t^H$ and if d_i=0, $t_i=t^L$, with $t^H>t^L$. For example, degrees in dentistry, medicine or computer science might have higher tuition fees or higher expenses regarding materials, equipment, laboratories and software. In the United Kingdom, for instance, it takes about 10 years to train as a general practitioner and 14 to become a surgeon, while it only takes 3 years to become a nurse (NHS, 2013). Individuals

then maximize their earnings, π_i, in the labour market, which is given by the market value of their human capital net of the cost of investing in it[17]:

$$(25) \qquad \pi_i = w(d_i) * k(d_i, \omega_i) - t(d_i)$$

Individuals also earn utility from their identity payoffs (I_i), which depends on how much they deviate from the ideal established for each social category. In a gender-neutral environment, the ideal is associated with a payoff I_Ω. Since holding traditional gender-role beliefs is assumed as the norm, the identity payoff for this category is normalized to 0. ecause an individuals choosing high-earnings (low-earnings) degrees are expected to have relative mathematical (social) capabilities, they face an identity cost *v* if they deviate from this prescription. Further, in a traditional environment, women will be punished if they do not abide to the gender-roles. Since high-earning degree programs are associated with masculinity in conservative environments, women who go into these degrees will have an additional identity cost *x*. When maximizing their utility, individuals take into account their earnings and their identity payoffs. If *p* indicates the weight *i* assigns to the economic earnings and *(1-p)* indicates how she values her identity payoff, then her utility function is given by:

$$(26) \qquad \max_{di} U_i = \max_{di}\{p[w(d_i) * k(d_i, \omega_i) - t(d_i)] + (1-p)[c_i I_\Omega - v((1-\omega_i)d_i + \omega_i(1-d_i)) - x(1-c_i)d_i]\}$$

In general, for given values of c_i and ω_i, *i* will choose a high-earnings degree program (d_i=1) if the following condition is met:

$$(27) \qquad p[w^H k_{1\omega_i} - w^L k_{0\omega_i}] > p(t^H - t^L) + (1-p)\{(1-\omega_i)[v + (1-c_i)x] + \omega_i[(1-c_i)x - v]\}$$

[17] For simplicity, the model is proposed as a two stage game, so that intertemporal variables such as discount rates to estimate the flow of income and costs can be simplified in the payoff described above. However, gender biased opportunities in the capital market may further compound the situation.

FIGURE 1:

Tree game payoffs

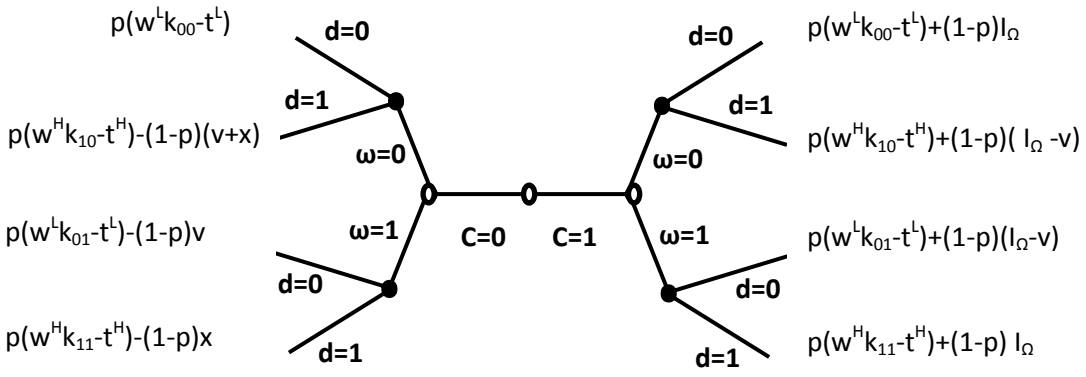


Figure 1 shows the different possible payoffs depending on the social category and relative capabilities the person is given. Notice that a woman in a gender-neutral environment (*c*=1) is not punished if she chooses a high-earning degree program; although she would still have identity costs if she does not exhibit the relative capabilities required for such program. In contrast, women in a traditional environment (*c*=0) will face the cost *x* if they choose a high-earnings degree program and this might keep some women from earning the highest wage, depending on how much weight they assign to their identity payoff. If a woman is only concerned by her economic well-being, i.e. *p*=1, she would choose a high-earnings degree if the additional gains from it outweigh the extra economic costs, that is if $w^H k_{1\omega_i} - w^L k_{0\omega_i} > t^H - t^L$. In this case, the decision is solely economic, regardless on whether the woman has relative capabilities in mathematical or social skills. In contrast, if she only cares about her identity payoff (*p*=0), she would only choose a high-earnings degree if $(2\omega_i - 1)v > (1 - c_i)x$. In this case, a woman without relative capabilities in mathematics, science and technology (ω=0) will never choose a high-earnings degree, since the cost of not matching her relative capabilities with the degree requirements is not compensated in the identity payoff. Further, in a traditional environment, a woman with such capabilities (ω=1) will only choose a high-earnings degree if the gains of matching her capabilities with the degree that requires them can outweigh the cost of not abiding with the gender-roles (*v*>*x*). This could explain why

some women persist in enrolling in degree programs with lower wages, despite having enough capabilities to obtain degrees that might secure them higher wages later on. If p=0, the only case in which women would always enrol in high-earning degrees is if they were in a gender-neutral environment (c_i=1) and if they exhibited capabilities in tune with such degrees (ω=1).

In synthesis, gender stereotyping and social scripts learned early in life might contribute in shaping the degree choices women make through the construction of their identity. If certain degrees or career paths are associated with masculinity, women might avoid these options in order to conform to an ideal of femininity, even if this implies being worse off financially. However, this will not be true for all women, but it will hold for those women who choose to accept the social norm as their own, since the cost of choosing the high-earnings degrees at an identity or emotional level might outweigh the gain in higher earnings obtained in these career paths viewed as masculine.

3.3. Dataset: 1970 British Cohort Study

The main hypothesis of this dissertation is that graduate women do not choose degrees that might help close the gender wage gap because they are discouraged by gender-stereotyping from entering these programs. This is tested using data from the 1970 British Cohort Study (BCS); a longitudinal study of people born in the United Kingdom in the week beginning April 5th, 1970. Information about cohort members was collected at ages 0, 5, 10, 16, 26, 29, 34 and 38 regarding their physical, educational and social development in the early waves; and socio-economic condition and adult life in the later waves. To the best of my knowledge, this dataset is the only one providing information both on gender beliefs between generations (mothers and cohort members), early technological skills (particularly, computational skills) and degree choices, which makes it ideal to test the hypothesis in hand[18].

[18] The 1970 BCS is managed by the Centre for Longitudinal Studies (CLS), which also has other two British cohort studies: the 1958 National Child Development Study and the Millennium Cohort Study. However, the dataset for the cohort born in 1958 does not include information regarding access to technology at an early age –due to the fact that this cohort was not impacted as early in their lives by

Variables related to the mother's attitudes and work history belong to the 5-year follow-up, the mother's age at delivery belong to the birth wave and 5-year follow-up; indicators for whether the mother worked during the cohort member's school years and the household social class are derived from the 10 and 16-year follow-ups; the variables related to the teenage individual characteristics belong to the 16-year follow-up and those related to university education belong to the 29 and 34-year follow-ups, which are the only two adult waves that specify the degree fields of study for university graduates.

As in any other longitudinal dataset, attrition problems arise both because cohort members were not surveyed in some waves or because of missing values for specific questions. Consequently, single parents, men, minorities and disadvantaged groups tend to be underrepresented in some waves (Department of Child Health, 1990, p. v; Goodman and Butler, 1996, p.p. 1.3 and A5; and Despotidou and Shepherd, 1996, p. 11). In particular, the 16-year follow-up, from which information for the teenage years is drawn, was affected by a national teachers' strike that caused serious non-responses for information regarding the school, which is why the school environment cannot be taken into account for the estimated equations. Appendix 1 specifies how nonresponse affects each of the variables used in the present study both relative to the original population and to the total responses in that particular wave. It also shows the percentage of female responses per item. Panel 1 summarizes the response rates for the variables used in estimating the cohort members gender beliefs, while Panels 2 and 3 presents the response rates associated with degree choice. For those variables in Panels 2 and 3, the response rate for the population reporting a university degree is also presented. Clearly, the percentage of responses varies greatly among the different variables. Notice that the percentage of female responses is higher than the percentage of female births traced in the first wave (48.1%) for all variables, which is consistent with men being underrepresented in the dataset, as discussed earlier. Specifically, the percentage of male responses tends to decrease in questions related to gender issues, school performance, religion and job expectations, which could eventually lead to an attrition bias. Strictly speaking, it follows that the results obtained cannot be generalized to the entire population; instead they are only relevant to the sample tested. However, they do illustrate

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the information technology revolution- and the cohort born in 2000 is too young to test the hypothesis in question, which leaves the 1970 BCS as the preferred dataset for testing the above premises.

the behaviour across time of a particular group. The research target population is working women with university degrees, a subsample located at the top of the distribution who are not as difficult to trace overtime and are not identified as being underrepresented in the waves, so that one would not expect attrition to significantly alter the results[19]. At all times, however, one might keep in mind that the intention is to focus on this particular group, since this are the people who make investment decisions in further education[20].

3.4. Construction of gender identity

The relationships expected from the model in section 2 are tested using two sets of regressions: the first one tests whether the development of gender-equal beliefs in teenagers is related to the assimilation of traditional gender roles observed in the household during childhood; that is, it explores whether the individual identifies with the social category characterizing her immediate environment. Unfortunately, it is not possible to measure other environmental variables that are expected to be at least as significant as the household environment, such as the influence of school, the media and peer pressure on identity. The second set of regressions tests whether this gender identity and other early childhood experiences, including the development of capabilities in math and technology, are related to a particular degree choice. The latter will be explored in section 3.5, while the former will be tested in this section.

3.4.1. Variable description

The first set of regressions explores whether growing up in a gender-equal environment is associated with developing gender-equal beliefs, using data from the 5, and

[19] How responses are altered by nonresponse will be addressed later in the variable discussion of sections 3.4 and 3.5.

[20] Tables 6 and 10 show the summary statistics for the relevant variables, which are discussed in the next sections.

16-year follow-ups of the 1970 BCS. The 1970 BCS is rich in information and offers many possibilities to proxy individual traits. The 16-year follow-up asks the cohort members to rate in a 3-point Likert scale (disagree, agree partly and agree fully) their agreement with the following statements: "marriage is not a real marriage without kids", "women should be allowed abortion on demand", "there is nothing wrong with sex before marriage", "girls of 16 should be able to get the pill", "women's liberation is a good thing" and "women can do the same jobs as men". Although related, these variables are lowly correlated: except for access to contraception and premarital sex (0.504), all other correlations are below 0.3, as shown in Table 2. Despite not being very highly correlated, the correlations do exhibit the expected signs: agreeing with the statement "marriage is not a real marriage without kids", the only item phrased in conservative terms, is negatively correlated to all the other statements, while the remaining correlations are positive.

TABLE 2:

Correlations observed between 3-point Likert attitudinal variables regarding gender

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
(i) Marriage not real marriage without kids	1					
(ii) Women should be allowed abortion on demand	-0.05**	1				
(iii) Nothing wrong with sex before marriage	-0.06***	0.27***	1			
(iv) Girls of 16 should be able get the pill	-0.03	0.28***	0.50***	1		
(v) Women's liberation is a good thing	-0.05***	0.03	0.03*	0.07***	1	
(vi) Women can do the same jobs as men	-0.03*	0.00	0.05**	0.08***	0.29***	1

Source: 1970 BCS, 16-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%.

It comes as no surprise that most of these questions are related to sexuality[21], since this particular wave is directed to teenagers and has some relevant sections regarding sexual health and experiences. In fact, the only item that does not relate to a personal sphere,

[21] Sexuality is understood as a "*product of the social definition and ordering of erotic life, encompassing all desires, practices and identities deemed to be erotic*" (Jackson, 2010, p.2).

marriage or sexuality is the one asking whether they believe that "women can do the same jobs as men". While the statement "women's liberation is a good thing" should be understood in all its political context, given the other questions and how it's framed it seems to imply a reference to the sexual revolution, in which case this statement can be read as related mainly to sexuality. Due to this, it was decided to create a compound variable summarizing the results from the first five items, while agreement with the statement "women can do the same jobs as men" is treated as a different variable, since it is the only statement reflecting beliefs on the labour market and equal capabilities among genders. This compound variable is constructed as an index of attitudes to gender roles regarding sex and marriage. It reflects the percentile rank of the distribution of the average responses of the items in questions[22]. Hence, it takes values from 0 to 1 with a mean of 0.5. The steps in constructing the index are as follows: (i) since the variables are measured in a 3-point Likert scale, responses are coded from 0 ("disagree") to 2 ("agree fully")[23]; (ii) the average score from these responses is calculated; (iii) and standardized. These standardized scores are then (iv) ordered and (v) ranked according to their value. The score is obtained using the Hazen plotting position formula, so that the score is given by (rank value – 0.5) / total number of observations[24]. The advantage of this index is that it provides a continuous and bounded measure with positive scores, but because the initial scale consists only of three points, the distribution is not smooth, as depicted in Graphic 6. At 16, girls and boys presented similar distributions, although girls were slightly more concentrated in the upper part of the distribution: while 42% of girls had a score below 0.5; 46% of boys did and 18% of girls scored above 0.9 while only 13% of boys did so.

In accordance with the model of section 3.2 and considering that the index above is not smooth, a binary variable was constructed using the same variables as before. In this case, the cohort member is assumed to agree with sexual equality if, on average, she expressed full agreement with the statements in hand. As before, responses to "marriage is not a real

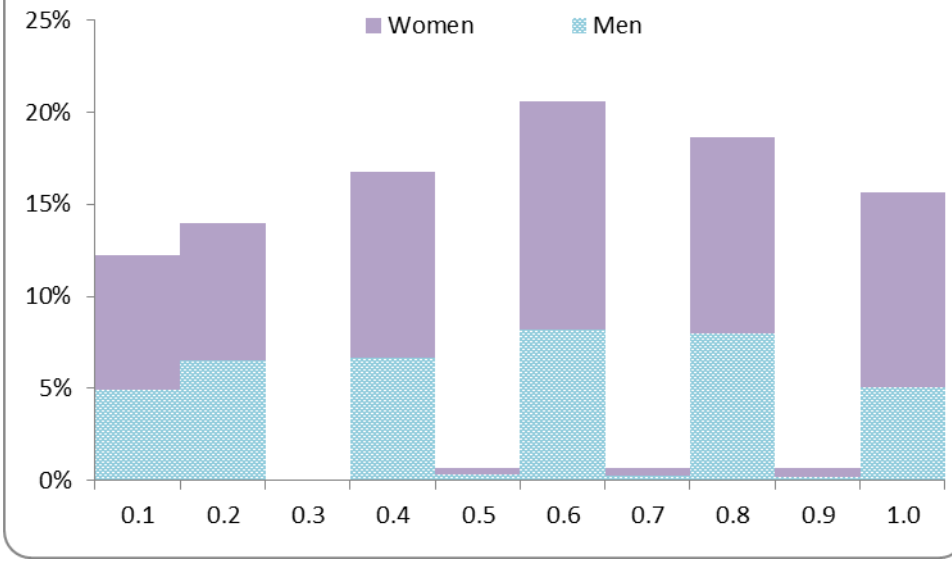
[22] This variable is constructed using a similar reasoning as that used by Johnston, Schurer and Shields (2012). In both cases an index variable is constructed in the [0,1] interval, although the items and waves used are different, since they focus on gender beliefs when the cohort members are adults and the probability of working.

[23] Agreement with the statement "marriage is not a real marriage without kids" was reversely coded.

[24] Calculations were done using Stata. For an explanation of the method and commands used, see Cox (2005).

marriage without kids" were coded in reverse order. As expected, a higher percentage of girls (37.1%) than boys (33.5%) fully agreed, on average, with sexual equality statements. A similar result is observed when a binary variable is constructed to reflect full agreement with the statement "women can do the same jobs as men". However, in this case, the differences between genders are more obvious: while most girls (65%) tended to fully agree that women can do the same job as men, only 35.5% of boys did so (see Table 4 at the end of this section). The latter reflects two important aspects: (i) girls were more likely to express gender-equal beliefs and (ii) boys were considerably more conservative in matters involving the transgression of women into the public sphere, so that a majority of boys still regarded women as being inferior in capabilities to men.

GRAPHIC 6:
Gender equality index score distribution, by gender
Age: 16 years old



Following the model in section 3.2, estimations regarding the construction of gender beliefs should test for the existence of a relationship between the cohort member's gender beliefs and the social environment surrounding her. In the 5-year follow-up mothers were asked a series of attitudinal questions, some of which regarded gender views and can serve as a proxy to measure the social environment the cohort member grew up in. These statements include: (i) "women need more from life than they can get by just looking after the home and children", (ii) "girls should accept the fact that they would marry and have children and not

think about starting a career", (iii) "women should have the same work opportunities as men", (iv) "some equality in marriage is a good thing, but by and large the husband ought to have the main say-so in family matters", (v) "there is nothing wrong with a mother going out to work if her children can be properly cared for by someone else", (vi) "a mother who leaves her children with someone else in order to go out to work is not fit to be a mother unless she needs the money for food and clothes", (vii) "a wife must sacrifice her right to go out to work once she has children", (viii) "a mother's proper place is at home with her children" and (ix) "girls are just as capable as boys of learning to be engineers". The correlation coefficients observed between these variables are depicted in Table 3. Notice that the correlation coefficients are higher than those observed for the cohort members, but in no case they are above 0.5. Notice also that the signs are as expected so that statements agreeing with equality (i, iii, v and ix) are positively correlated among them and negatively correlated with those portraying conservative views (ii, iv, iv, vii, viii), and the latter are positively correlated among them. This is true except for the correlation of "there is nothing wrong with a mother going out to work if her children can be properly cared for by someone else" with "girls should accept the fact that they would marry and have children and not think about starting a career" (0.0288) and "a mother who leaves her children with someone else in order to go out to work is not fit to be a mother unless she needs the money for food and clothes" (0.0059), which were expected to be negative. However, the correlations in both cases are extremely low and not significant in one of them, so that, in general, they show the expected signs.

TABLE 3:

Correlations observed between 5-point Likert scale maternal attitudinal variables regarding gender

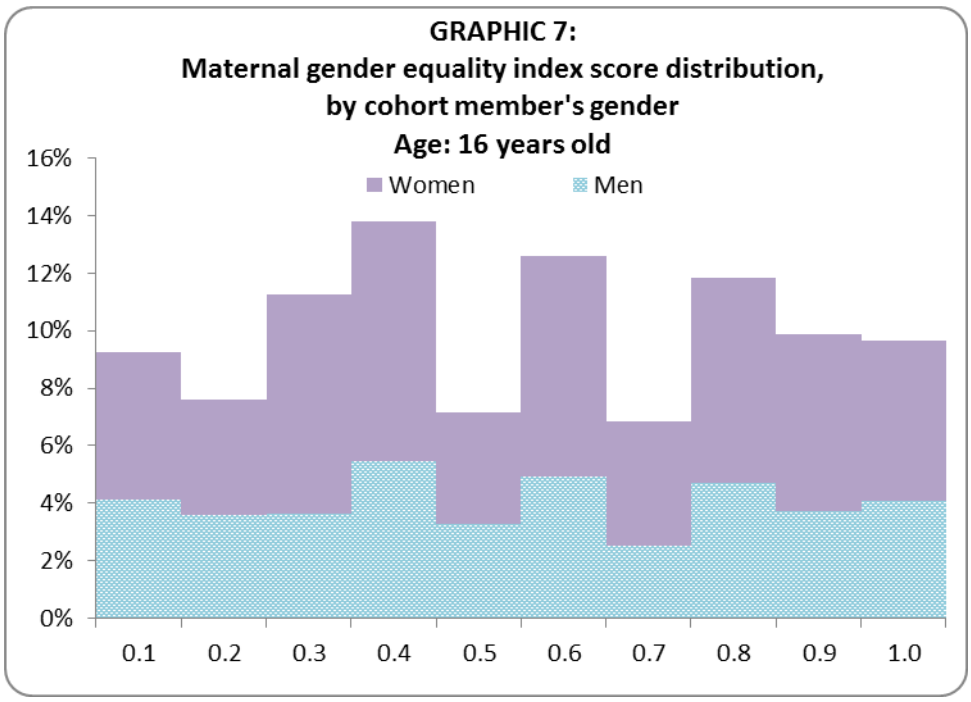
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(xi)
(i) Women need more from life	1								
(ii) Girls accept marriage not career	-0.04***	1							
(iii) Women have same work opportunity as men	0.15***	-0.14***	1						
(iv) Equality ok but husband has main say	-0.06***	0.15***	-0.19***	1					
(v) Mother can work if child care ok	0.15***	0.03***	0.09***	0.01	1				
(vi) Mother who works not fit to be a mother	-0.13***	0.11***	-0.13***	0.14***	-0.39***	1			
(vii) Wife no right to work when had children	-0.16***	0.13***	-0.14***	0.17***	-0.34***	0.44***	1		
(viii) Mothers place is in the home	-0.19***	0.08***	-0.15***	0.19***	-0.34***	0.41***	0.46***	1	
(xi) Girls able to be engineers	0.06***	-0.14***	0.26***	-0.14***	0.03***	-0.08***	-0.08***	-0.07***	1

Source: 1970 BCS, 5-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%.

As before, a compound index was created to measure the mother's agreement with gender-equal beliefs. This index measures the percentile rank of the distribution of the average maternal responses to the above statements except for statements iii and ix. Items ii, iv, vi, vii and viii were reversely code in order to show agreement with gender-equality. All the items included in the index are related to women as either mothers or wives, so that it makes sense to group them together. The statement "women should have the same work opportunities as men" is somehow similar as that later asked to the cohort members when they are 16 years old and it's very specific about women's rights while the statement "girls are just as capable as boys of learning to be engineers" captures their belief in gender-equal capabilities. Notice that the former refers to equal rights in the labour market (women should have), while the latter refers to the potential for equal capabilities (girls can), thus both these statements capture the idea of rights and capabilities implied in the statement asked to cohort members (women can do the same job as men). Also, neither of these two statements frames women as mothers or wives, which makes them different from the rest. Because of these, these two variables are treated separately. Graphic 7 depicts the distribution of the maternal gender equality score by the cohort member's gender. As expected, the mother's responses are not dependent on whether they had a daughter or a son, so that in both cases, 28% of mothers are located below a score of 0.3; and 31% are located with scores above 0.7. Because

the score is constructed as a percentile rank, it is centred at 0.5 and ranges from 0 to 1. As for the variables treated separately, these were coded as binary variables showing maternal agreement with the statements[25], so that about 4 out of 5 mothers believed that women should have the same work opportunities as men and that girls are just as capable to be engineers.



Aside from the proxies to measure gender beliefs of both the cohort members and their mothers discussed above, the cohort member's beliefs can also be influenced by their mother's actions, such as going out to work and setting an example of working, capable women in the public spheres, or environmental characteristics, such as their social class or religion. Section 3.4.3 below discusses how these variables might relate to the cohort member's gender beliefs. As for now, Table 4 below presents summary statistics for the variables used in the total and balanced samples regarding the construction of gender beliefs.

[25] Since mothers ranked their agreement in a 5-point Likert scale, these variables take a value of 1 if the mother agreed or strongly agreed with the statements. This is different from the dummy variables for the cohort members, where they only had a 3-point scale. In both cases, however, what is coded as agreement are responses higher than the middle option, i.e. "fully agree" for cohort members and "agree" and "strongly agree" for mothers.

The balanced sample consists of all the observations with no missing values for any of the variables in question. In total, the balanced sample for the first set of estimations has 2560 observations. As discussed earlier, a higher percentage of girls than boys held gender-equal beliefs, which is evident in all the variables used to proxy this. However, the mother's gender beliefs and their decision to work after the cohort member's birth are not significantly different for mothers who had a daughter than from those who had a son. The same holds for most of the control variables, except that girls tend to care more than boys about what their mothers think of them[26].

Table 4 also presents the summary statistics for the total responses in the sample. As shown in Panel 1 of Appendix 1, the birth cohort consists of 17.196 individuals but this number drops to 11.615 observations in the 16-year follow-up. Further, missing values causes the balanced sample to drop down to 2560 individuals, just 22% of the 16-year follow-up or almost 15% of the initial group. Despite this significant loss of observations, the summary statistics between the total and balanced samples do not differ significantly. The percentage of mothers that worked since the child's birth is slightly lower for those in the balanced sample, but the mothers reporting to work when the child was 10-16 years old is higher in this case. In both cases, the mother's average age at delivery was close to 26 years of age but observations in the balanced sample seem to have a slightly higher representation of households from higher social classes (professional and managerial-technical), more stable (less single parents, less changes in family composition, more children), Christian and British, Irish or white homes. This is consistent with unstable household and disadvantaged groups being more difficult to trace through time. However, the summary statistics do not seem to reflect significant variations in the responses between the total and balanced sample, suggesting that attrition might not be a significant problem.

[26] This variable was included as a control to capture the weight teenagers assign to their mother's beliefs. Since there is no information on paternal gender beliefs, the focus is placed in the mother.

TABLE 4:

Summary of descriptive statistics related to gender identity, by respondent's sex

(total and balanced samples, values as percentages)

	Total sample			Balanced sample		
Balanced sample 1	**Total**	**Female**	**Male**	**Total**	**Female**	**Male**
Total				2560	1531	1029
Fully agrees that women can do the same job as men	52.7%	65.1%	35.8%	53.1%	65.6%	34.5%
Average sexual equality score	0.500	0.513	0.476	0.503	0.515	0.485
Agrees with sexual equality	35.5%	37.9%	32.3%	35.7%	37.1%	33.5%
Average maternal gender equality score	0.500	0.502	0.496	0.499	0.501	0.495
Mother believed women should have same work opportunities	81.1%	80.9%	81.3%	83.0%	81.3%	85.5%
Mother believed girls are just as capable to be engineers	78.6%	78.4%	78.7%	81.1%	80.9%	81.3%
Mother worked since child's birth	28.9%	29.3%	28.6%	25.9%	26.6%	24.7%
Mother worked at least once between 1980-1986	69.9%	70.2%	69.7%	77.9%	76.6%	79.8%
Mother regularly worked during child's infancy	22.8%	23.2%	22.4%	22.4%	22.8%	21.9%
Care about what your mother thinks about you	73.4%	79.3%	65.4%	75.4%	80.4%	67.9%
Mother's age at delivery	25.8	25.8	25.8	26.1	26.0	26.2
Household social class						
Professional	5.9%	5.7%	6.0%	6.9%	6.1%	8.2%
Managerial-technical	28.7%	28.8%	28.5%	34.6%	34.6%	34.8%
Skilled non-manual	21.0%	21.0%	20.9%	23.3%	21.9%	25.5%
Skilled manual	29.0%	28.6%	29.3%	23.0%	25.0%	20.1%
Partly skilled	10.3%	10.3%	10.4%	7.4%	7.6%	7.1%
Unskilled	2.4%	2.4%	2.4%	1.7%	1.6%	1.8%
Others	2.8%	3.1%	2.5%	3.0%	3.3%	2.5%
Grew up with siblings in the household	83.8%	84.2%	83.4%	86.7%	86.9%	86.3%
At least one sister in the household	49.9%	49.4%	50.4%	49.3%	48.1%	50.9%
Known changes in family composition	18.8%	19.1%	18.5%	16.5%	16.7%	16.3%
Cohort member has a single parent	10.0%	10.2%	9.8%	7.2%	7.3%	7.0%
Cohort member has a religion	92.9%	93.4%	92.2%	93.9%	94.1%	93.7%
Cohort member is Christian	88.8%	89.0%	88.6%	92.1%	91.9%	92.4%
Cohort member is British, Irish or white	95.6%	95.7%	95.6%	98.0%	97.8%	98.4%
Country of birth place						
England	83.9%	84.4%	83.4%	84.8%	85.3%	84.0%
Wales	5.1%	5.0%	5.2%	6.1%	5.7%	6.6%
Scotland	9.5%	9.3%	9.7%	8.5%	8.4%	8.7%
Others	1.6%	1.4%	1.7%	0.7%	0.7%	0.7%

Source: 1970 BCS, birth, 5, 10 and 16-year follow-ups.

3.4.2. Model specification

Following the reasoning of the model in section 3.2, the first set of estimates should test whether individuals choose an identity (believing in gender equality or not) dependent on whether they accept or not the prescriptions of the social categories in their environment. That is, this first set of estimates should test whether teenagers do, in fact, accept and identify with the same values and scripts that they observe in their households. In order to do this, gender identity (I) for teenager i is proxied using three different variables, which implies three different estimations to test this hypothesis. In the first scenario, gender identity is measured as a binary variable reflecting gender equal beliefs concerning female labour and abilities, so that I_i equals 1 if i fully agrees with the statement "women can do the same jobs as men" (i.e., non-traditional identity) and 0 otherwise (traditional gender roles). Following the same logic, in the second scenario I_i is proxied by a binary variable indicating full agreement (1) with gender equality regarding sex and marriage, while the third scenario proxies I_i as a continuous variable in the interval [0,1] measuring the agreement with equality in sex and marriage, where 0 represents total disagreement and 1, total agreement.

The social category in which i is placed (c_i) is proxied by five variables reflecting the household environment: (i) the maternal gender equality index score (c_1), which measures the maternal beliefs towards wives and mothers working; binary variables indicating maternal agreement in earlier years with the statements (ii) "women should have the same work opportunities as men" (c_2), which highlights women's labour rights and (iii) "girls are as capable as boys to become engineers" (c_3), which reflects beliefs in the development of female capabilities; a binary variable indicating (iv) whether i's mother had a regular job after the child's birth (c_4) and (v) if she was working at some point during the cohort member's school years (either at age 10 or 16). The first three variables reflect gender-equal beliefs from the previous generation that can be transmitted to the child[27], while the latest two reflect early exposure to working women and can serve as an example of women's ability to perform jobs the same as men. If I_i is positively related to these variables, this can be interpreted as

[27] The dataset used does not offer information on paternal beliefs, which is why only the maternal beliefs are considered when proxying the household environment. Likewise, there is no information available to measure the gender norms the cohort member is exposed to at school.

children acquiring gender beliefs by example (c_4 and c_5) and by ideological transmission (c_1 to c_3). When I_i is measured as a binary variable, the relationship between *i*'s gender identity and her household environment is captured by a binary response model that estimates the response probability of *i* having gender-equal beliefs, derived from the following latent variable model:

$$(28) \qquad I_i^* = \beta_0 + \sum_{j=1}^{5} \beta_j c_{j,i} + \beta_6 f_i + \sum_{k=1}^{11} \beta_k q_{k,i} + \varepsilon_i$$

where, f_i is a control binary variable indicating that *i* is female, ε_i is an error term, and β_j are the coefficient values. q_j refers to eleven control variables, which reflect different aspects or characteristics of the environment the teenager grew up in[28]. In the third scenario, I_i is measured as a continuous variable, so that it is estimated using ordinary least squares. In this case, the independent variables are the same as those specified in equation (29).

3.4.3. Probit estimation results for believing that women can do the same job as men

Table 5 provides the coefficient estimations (columns 1-6) and average marginal effects (columns 7-12) for the probit results for the teenager's response on whether they agreed or not with the statement that "*women can do the same job as men*" considering equation (29). Results are presented for the whole sample as well as for each gender considered separately. Columns 1-3 and 7-9 present the results from the initial model, while columns 4-6 and 10-12 include the control variables. Despite a low explanatory power of the

[28] These include eight binary variables identifying whether *i* (i) cares very much about what her mother thinks of her (q_1); (ii) has any siblings living in the same household (q_4); (iii) has any sisters living in the household (q_5); (iv) has experienced any changes in the family composition (q_6); (iv) is in a household with a single parent (q_7); (v) has a religion (q_8); (vi) is Christian (q_9); and (vii) self-identifies as British, Irish or white (q_{10}). It also includes two discrete variables identifying (viii) the latest known household social class (q_3), and (ix) the cohort member's country of birth (q_{11}) and a continuous variable for the mother's age at delivery (q_2).

models (the pseudo R^2 is never over 8%), these results provide limited supporting evidence for the initial hypothesis that the household environment might help shape the gender beliefs towards the labour market for girls (at a confidence level of 90% without control variables), but it does not hold for boys (columns 3 and 6), since the models for boys are not significantly different from one with no regressors.

The results reveal that the mother's belief on whether girls are just as capable as boys of learning to be engineers is significant in explaining the cohort member's belief for girls (columns 2 and 5) and for the pooled samples (columns 1 and 4). For girls, having a mother that believes that girls are just as capable as boys of becoming engineers increases the probability of fully agreeing that women can do the same job as men in about 5 percentage points (p.p.). Hence, this suggests that mothers with convictions about women's equal capabilities in the labour market can transmit this belief to their daughters. However, neither the maternal gender equality index nor the maternal belief that women should have the same opportunities as men are significant, *ceteris paribus*. This does not support the initial hypothesis, since one would have expected a positive and significant relationship among these variables, in particular, the maternal agreement with the statement that women should have the same work opportunities as men. Nonetheless, it is significant that the only attitudinal variable related to cohort members agreeing that women can do the same job as men is that one associated with the potential of girls to develop equal capabilities as men.

Similarly, having a working mother at an early age also shows a positive relation to believing that women can do the same job as men in these two cases. For girls, the average probability of agreeing that women can do the same job as men increases in about 7 p.p. when their mother worked since the child's birth. These results are consistent with other studies, where gender-equal attitudes are positively associated with educational performance (González de San Román and De la Rica Goiricelaya, 2012) and human capital investment (Johnston, Schurer and Shields, 2012) or where parental risk attitudes are associated with school track choices for girls (Wölfel and Heineck, 2012), but not for boys. However, *ceteris paribus,* having a working mother when the cohort members were in school age is only

significant for the pooled and male samples, not for girls[29]. The data seems to suggest a pattern according to which female behaviour is more responsive to gender norms than male behaviour. This is consistent with other studies using the 1970 British Cohort Study, where maternal behaviour or attitudinal variables have either no effect on the male samples (Flouri and Hawkes, 2008, p. 411) or a smaller one than that observed on girls (Flouri and Malmberg, 2011, p. 533 and Schoon, Ross and Martin, 2007, p. 139). It is also worth noting that having a working mother and a mother that believes that women can be engineers have similar marginal effects, so that the transmission of certain gender beliefs and the example set by working might have similar impacts in shaping the daughter's beliefs.

In general, the control variables are not significant when added into the model, except for the variable controlling for gender in the pooled samples (columns 1 and 4). This is expected, since gender norms do not vary across countries, social class, religions or family size. For women (column 5), however, caring about what their mother think of them is significantly but negatively associated with girls' gender beliefs, so that as the cohort members are more sympathetic to their mothers, they tend to express more conservative views regarding gender equality in the labour market[30]. The average marginal effect of this variable over the probability of agreeing that women can do the same job as men is similar to that estimated for the initial variables of interest (around 7 p.p.). Similarly, having siblings in the household is also associated with women expressing less gender-equal views but this is not associated with the gender of those siblings *ceteris paribus*. Meanwhile, having older mothers is negatively associated with men expressing gender-equal beliefs (column 6), which could suggest a generational effect on the transmission of gender beliefs; although one has to keep in mind that this model was not significantly different from one with no covariates. As mentioned earlier, being a woman is the variable that increases the most (in more than 30 p.p.) the probability of expressing gender-equal beliefs, which could be due to the fact that this variable

[29] Other estimations also included an interactive term between a mother that worked since the child's birth and working later during the child's infancy, but these were never significant. While it is of interest to test the type of job the mother held to see if this influences the cohort member's response, this data is not available.

[30] The interacting term of this variable with the initial variables or interest is never significant and is not reported, but exercises were estimated to test for this relationship.

captures all the other elements associated with gender roles omitted in the model, such as the gender roles learned at school, those portrayed by media or peer pressure. As mentioned earlier, the literature argues that these actually have a bigger effect than the household environment on shaping identity, so it is unfortunate these variables cannot be controlled individually rather than through the gender variable.

TABLE 5:

Probit estimates for believing women can do the same job as men

	Probit coefficient estimations						Average marginal effects					
	All (1)	**Female (2)**	**Male (3)**	**All (4)**	**Female (5)**	**Male (6)**	**All (7)**	**Female (8)**	**Male (9)**	**All (10)**	**Female (11)**	**Male (12)**
Maternal gender equality index	0.0007	-0.016	0.0259	-0.0142	-0.0084	0.0181	0.0002	-0.0059	0.0095	-0.0052	-0.0031	0.0065
	(0.093)	*(0.1212)*	*(0.1452)*	*(0.0941)*	*(0.1233)*	*(0.1479)*	*(0.0341)*	*(0.0444)*	*(0.0533)*	*(0.0344)*	*(0.0447)*	*(0.0533)*
Women have same work opportunity as men	0.0242	0.0513	-0.0228	0.03	0.0576	-0.0145	0.0089	0.0188	-0.0084	0.011	0.0209	-0.0052
	(0.0705)	*(0.0877)*	*(0.1181)*	*(0.071)*	*(0.0885)*	*(0.1209)*	*(0.0259)*	*(0.0321)*	*(0.0434)*	*(0.026)*	*(0.0321)*	*(0.0436)*
Girls just as capable to be engineers	0.1122*	0.141*	0.0688	0.1169*	0.1518*	0.0687	0.0413*	0.0516*	0.0252	0.0428*	0.0551*	0.0248
	(0.0667)	*(0.0853)*	*(0.1065)*	*(0.0674)*	*(0.0865)*	*(0.1092)*	*(0.0245)*	*(0.0311)*	*(0.0391)*	*(0.0247)*	*(0.0313)*	*(0.0393)*
Mother had regular job after child's birth	0.1168*	0.1891**	0.0091	0.1	0.1945**	-0.0388	0.0428*	0.0692**	0.0034	0.0365*	0.0706**	-0.014
	(0.0601)	*(0.0778)*	*(0.0954)*	*(0.0608)*	*(0.0792)*	*(0.0976)*	*(0.0219)*	*(0.0283)*	*(0.035)*	*(0.0221)*	*(0.0286)*	*(0.0352)*
Mother worked at least once between 1980-1986	0.12*	0.0778	0.1926*	0.1094*	0.0603	0.1904*	0.0441*	0.0285	0.0707*	0.0401*	0.0219	0.0686*
	(0.0627)	*(0.0789)*	*(0.104)*	*(0.0659)*	*(0.0836)*	*(0.1102)*	*(0.023)*	*(0.0288)*	*(0.038)*	*(0.0241)*	*(0.0303)*	*(0.0396)*
Control variables												
Care what your mother thinks				-0.0763	-0.2076**	0.0724				-0.0278	-0.0753**	0.0261
				(0.0607)	*(0.0865)*	*(0.0886)*				*(0.022)*	*(0.0312)*	*(0.0319)*
Mother's age at delivery				-0.0065	0.0026	-0.022**				-0.0024	0.0009	-0.0079**
				(0.0052)	*(0.0068)*	*(0.0086)*				*(0.0019)*	*(0.0024)*	*(0.0031)*
Household social class												
Professional (omitted category)												
Managerial-technical				0.0717	-0.0424	0.1717				0.0263	-0.0154	0.0619
				(0.1075)	*(0.1472)*	*(0.1635)*				*(0.0394)*	*(0.0534)*	*(0.0589)*
Skilled non-manual				0.1458	-0.0141	0.2844*				0.0533	-0.0051	0.1025*
				(0.1124)	*(0.1543)*	*(0.1697)*				*(0.0411)*	*(0.056)*	*(0.0609)*
Skilled manual				0.0707	-0.066	0.2111				0.0259	-0.024	0.0761
				(0.1127)	*(0.1521)*	*(0.1751)*				*(0.0413)*	*(0.0552)*	*(0.063)*
Partly skilled				0.0672	-0.0161	0.1197				0.0246	-0.0058	0.0431
				(0.1373)	*(0.1836)*	*(0.2155)*				*(0.0503)*	*(0.0666)*	*(0.0777)*
Unskilled				0.0857	0.1517	0.0164				0.0314	0.055	0.0059
				(0.2222)	*(0.3047)*	*(0.349)*				*(0.0813)*	*(0.1105)*	*(0.1258)*
Others				0.0548	-0.1812	0.3225				0.0201	-0.0658	0.1163
				(0.1846)	*(0.2338)*	*(0.3109)*				*(0.0676)*	*(0.0848)*	*(0.112)*

… table 5 (continued)…

	Probit coefficient estimations						Average marginal effects					
	All (1)	**Female (2)**	**Male (3)**	**All (4)**	**Female (5)**	**Male (6)**	**All (7)**	**Female (8)**	**Male (9)**	**All (10)**	**Female (11)**	**Male (12)**
Siblings in the household				-0.135	-0.2458**	0.0216				-0.0491	-0.0892**	0.0078
				(0.0847)	*(0.1121)*	*(0.1349)*				*(0.0305)*	*(0.0405)*	*(0.0486)*
Sisters in the household				0.0433	0.0551	0.0233				0.0158	0.02	0.0084
				(0.0562)	*(0.0723)*	*(0.0901)*				*(0.0205)*	*(0.0262)*	*(0.0325)*
Known changes in family composition				0.0597	-0.0483	0.1954				0.0218	-0.0175	0.0704
				(0.0841)	*(0.1121)*	*(0.128)*				*(0.0306)*	*(0.0407)*	*(0.046)*
Single parent				0.0578	0.0805	0.078				0.0211	0.0292	0.0281
				(0.1211)	*(0.162)*	*(0.1851)*				*(0.044)*	*(0.0588)*	*(0.0667)*
Cohort member has a religion				-0.064	-0.0123	-0.234				-0.0233	-0.0045	-0.0844
				(0.2367)	*(0.2808)*	*(0.4702)*				*(0.0859)*	*(0.1019)*	*(0.1695)*
Cohort member is Christian				0.182	0.1836	0.2589				0.0666	0.0666	0.0934
				(0.2161)	*(0.2489)*	*(0.4487)*				*(0.079)*	*(0.0903)*	*(0.1617)*
Cohort member is British, Irish or white				-0.1578	-0.2777	0.0301				-0.0571	-0.1008	0.0109
				(0.2123)	*(0.2565)*	*(0.4034)*				*(0.0759)*	*(0.093)*	*(0.1455)*
Country of birth place												
England (omitted category)												
Wales				-0.018	0.0515	-0.1189				-0.0066	0.0187	-0.0429
				(0.1086)	*(0.1458)*	*(0.1669)*				*(0.0397)*	*(0.0529)*	*(0.0601)*
Scotland				-0.0697	-0.0029	-0.2136				-0.0255	-0.0011	-0.077
				(0.0933)	*(0.1219)*	*(0.1518)*				*(0.0342)*	*(0.0442)*	*(0.0546)*
Others				0.148	0.1726	0.1629				0.0536	0.0626	0.0587
				(0.3177)	*(0.4229)*	*(0.4871)*				*(0.1136)*	*(0.1534)*	*(0.1756)*
Female	0.8059***			0.8203***			0.3119***			0.3159***		
	(0.0523)			*(0.0532)*			*(0.0191)*			*(0.0193)*		
Constant	-0.6372***	0.1456	-0.6056***	-0.356	0.5822	-0.359						
	(0.0977)	*(0.1137)*	*(0.1513)*	*(0.3237)*	*(0.4116)*	*(0.5581)*						
Observations	2560	1531	1029	2560	1531	1029	2560	1531	1029	2560	1531	1029
LR chi^2	253.98	10.95	4.27	266.6	26.83	26.54						
Prob > chi^2	0	0.0524	0.5118	0	0.2631	0.276						
Pseudo R^2	0.0718	0.0056	0.0032	0.0753	0.0136	0.02						

Source: 1970 BCS, birth, 5, 10 and 16-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%; standard errors in parenthesis.

3.4.4. Probit estimation results for believing in gender equality in sex and marriage

Table 6 presents the coefficient estimations (columns 1-6) and average marginal effects (columns 7-12) for the probit results for agreeing with gender equality in sex and marriage. Data is presented in the same format as Table 5 and, like Table 5, it has a very low explanatory power with low pseudo R^2. However, most models are different from a model with no regressors at the usual confidence levels and all are at an 89% confidence level. The results suggest that the transmission of gender beliefs between mothers and daughters differs depending on the topic in hand: while the maternal gender equality score, which is related to how the mother perceive women in their role as mothers and wives, and the belief that women should have the same work opportunities as men, which relates to women's rights, were not significant in explaining the daughter's belief that women can do the same job as men, they are significant in explaining the cohort member's belief in sexual equality, both in the female (columns 2 and 5) and pooled (columns 1 and 4) samples. Not only that, the latter is also significant for the male sample (columns 3 and 6). For girls, for example, increasing the maternal gender equality score from 0 to 0.5 increases the estimated average probability from 33% to 37%, *ceteris paribus*. Further, a maternal score of 1 increases the estimated average probability to 41.2%; that is 8.2 p.p. over a mother with a score of 0, *ceteris paribus*. At the same time, having a mother who believes that women should have the same opportunities as men increases, on average, the probability of agreeing with gender equality in sex and marriage in, at least, 8 p.p., in all cases (columns 7-12), *ceteris paribus*.

However, believing that girls can be engineers, which addresses an issue of capabilities is no longer significant. The same is true for having a working mother, *ceteris paribus*. Thus the variables that influenced the belief in equal capabilities are different from those that influence how the cohort members view gender equality in sex and marriage. Hence, girls with mothers with a more liberal view of motherhood and marriage and mothers who advocate for more equal rights for women are more likely to hold liberal attitudes towards their sexuality. In turn, working mothers and mothers who believe in equal capabilities are more likely to have daughters that believe in equal capabilities.

As before, the control variables are not significant except for the gender (column 1) and caring about what their mother think of them in the case of the pooled and female samples (columns 1 and 2). Therefore, once again, being close to the mother is associated with more conservative views: on average, being close to the mother decreases the probability of women agreeing with gender equality in sex and marriage in about 12 p.p., *ceteris paribus*. In this case, being a woman increases the probability of agreeing with gender equality in sex and marriage in around 4 p.p., a lower effect than that observed for the probability of agreeing that women can do the same job as men.

TABLE 6:

Probit estimates for believing in gender equality regarding sex and marriage

	Probit coefficient estimations						Average marginal effects					
	All (1)	**Female (2)**	**Male (3)**	**All (4)**	**Female (5)**	**Male (6)**	**All (7)**	**Female (8)**	**Male (9)**	**All (10)**	**Female (11)**	**Male (12)**
Maternal gender equality index	0.1909**	0.2199*	0.1475	0.1692*	0.2048*	0.1301	0.0706**	0.0825*	0.0534	0.0619*	0.0755*	0.0461
	(0.0928)	*(0.1202)*	*(0.146)*	*(0.0941)*	*(0.1225)*	*(0.1489)*	*(0.0342)*	*(0.0449)*	*(0.0527)*	*(0.0343)*	*(0.045)*	*(0.0527)*
Women have same work opportunity as men	0.2535***	0.2272**	0.3018**	0.2342***	0.217**	0.2787**	0.0908***	0.0853**	0.1092**	0.0832***	0.08**	0.0987**
	(0.0724)	*(0.0893)*	*(0.1238)*	*(0.0731)*	*(0.0903)*	*(0.1273)*	*(0.0248)*	*(0.0333)*	*(0.0444)*	*(0.025)*	*(0.0331)*	*(0.0448)*
Girls just as capable to be engineers	-0.0091	-0.003	-0.0186	-0.0177	0.001	-0.0582	-0.0034	-0.0011	-0.0067	-0.0065	0.0004	-0.0206
	(0.0669)	*(0.0859)*	*(0.1068)*	*(0.0677)*	*(0.0874)*	*(0.1095)*	*(0.0248)*	*(0.0322)*	*(0.0386)*	*(0.0249)*	*(0.0322)*	*(0.0388)*
Mother had regular job after child's birth	0.0143	-0.0086	0.0508	-0.0029	0.0001	0.0308	0.0053	-0.0032	0.0184	-0.0011	0	0.0109
	(0.0595)	*(0.0759)*	*(0.0958)*	*(0.0604)*	*(0.0773)*	*(0.0981)*	*(0.0221)*	*(0.0285)*	*(0.0346)*	*(0.0221)*	*(0.0285)*	*(0.0347)*
Mother worked at least once between 1980-1986	0.0401	0.0391	0.0433	0.0089	0.0084	-0.0036	0.0148	0.0147	0.0157	0.0033	0.0031	-0.0013
	(0.0629)	*(0.0792)*	*(0.1034)*	*(0.066)*	*(0.0841)*	*(0.1087)*	*(0.0231)*	*(0.0297)*	*(0.0374)*	*(0.0241)*	*(0.031)*	*(0.0385)*
Control variables												
Care what your mother thinks				-0.1874***	-0.3371***	-0.019				-0.0698***	-0.1243***	-0.0067
				(0.0598)	*(0.0826)*	*(0.0888)*				*(0.0225)*	*(0.03)*	*(0.0314)*
Mother's age at delivery				-0.0069	-0.0074	-0.0061				-0.0025	-0.0027	-0.0022
				(0.0052)	*(0.0067)*	*(0.0085)*				*(0.0019)*	*(0.0025)*	*(0.003)*
Household social class												
Professional (omitted category)												
Managerial-technical				0.0145	-0.0075	0.031				0.0054	-0.0028	0.011
				(0.1069)	*(0.1465)*	*(0.1584)*				*(0.0396)*	*(0.054)*	*(0.0561)*
Skilled non-manual				-0.0202	-0.099	0.0677				-0.0074	-0.0365	0.024
				(0.1118)	*(0.1537)*	*(0.1651)*				*(0.0413)*	*(0.0567)*	*(0.0584)*
Skilled manual				-0.0588	-0.1274	0.0486				-0.0215	-0.047	0.0172
				(0.1123)	*(0.1519)*	*(0.1701)*				*(0.0413)*	*(0.056)*	*(0.0602)*
Partly skilled				-0.0543	0.1026	-0.3509				-0.0199	0.0378	-0.1243
				(0.1372)	*(0.1815)*	*(0.219)*				*(0.0503)*	*(0.0669)*	*(0.0773)*
Unskilled				-0.1272	0.1604	-0.6282				-0.0459	0.0591	-0.2225
				(0.2242)	*(0.2904)*	*(0.3887)*				*(0.0797)*	*(0.107)*	*(0.1372)*
Others				-0.2634	-0.1008	-0.775**				-0.0922	-0.0372	-0.2744**
				(0.1919)	*(0.238)*	*(0.3697)*				*(0.0651)*	*(0.0877)*	*(0.1303)*

… table 6 (continued)…

	Probit coefficient estimations						Average marginal effects					
	All (1)	**Female (2)**	**Male (3)**	**All (4)**	**Female (5)**	**Male (6)**	**All (7)**	**Female (8)**	**Male (9)**	**All (10)**	**Female (11)**	**Male (12)**
Siblings in the household				-0.1387*	-0.1082	-0.1839				-0.0516	-0.0399	-0.0651
				(0.0835)	*(0.1081)*	*(0.1333)*				*(0.0315)*	*(0.0398)*	*(0.0471)*
Sisters in the household				0.0417	0.0072	0.096				0.0152	0.0026	0.034
				(0.0563)	*(0.0723)*	*(0.0913)*				*(0.0206)*	*(0.0266)*	*(0.0323)*
Known changes in family composition				0.1278	0.066	0.2102				0.0475	0.0243	0.0745
				(0.0835)	*(0.1109)*	*(0.1296)*				*(0.0314)*	*(0.0409)*	*(0.0457)*
Single parent				-0.1034	-0.0628	-0.1878				-0.0372	-0.0232	-0.0665
				(0.1212)	*(0.1602)*	*(0.1921)*				*(0.0427)*	*(0.059)*	*(0.0679)*
Cohort member has a religion				-0.2086	-0.2594	0.0223				-0.0787	-0.0956	0.0079
				(0.2352)	*(0.2807)*	*(0.4682)*				*(0.0908)*	*(0.1034)*	*(0.1658)*
Cohort member is Christian				-0.1246	-0.0788	-0.326				-0.0465	-0.0291	-0.1155
				(0.2155)	*(0.2499)*	*(0.4505)*				*(0.0817)*	*(0.0922)*	*(0.1594)*
Cohort member is British, Irish or white				0.0337	0.0437	0.1469				0.0123	0.0161	0.052
				(0.2116)	*(0.2523)*	*(0.4099)*				*(0.0765)*	*(0.093)*	*(0.1451)*
Country of birth place												
England (omitted category)												
Wales				0.0734	0.0348	0.0841				0.0272	0.0128	0.0298
				(0.1073)	*(0.143)*	*(0.1651)*				*(0.0401)*	*(0.0527)*	*(0.0585)*
Scotland				0.0416	-0.0128	0.1049				0.0153	-0.0047	0.0371
				(0.0921)	*(0.1203)*	*(0.1464)*				*(0.0341)*	*(0.0444)*	*(0.0518)*
Others				-0.1796	-0.137	-0.1663				-0.0631	-0.0505	-0.0589
				(0.3275)	*(0.4329)*	*(0.5128)*				*(0.1103)*	*(0.1596)*	*(0.1816)*
Female	0.1071**			0.1358**			0.0395**			0.0494**		
	(0.0522)			*(0.0532)*			*(0.0192)*			*(0.0192)*		
Constant	-0.7681***	-0.6521***	-0.7923***	-0.0217	0.2471	-0.3003						
	(0.0996)	*(0.1163)*	*(0.1567)*	*(0.3229)*	*(0.4069)*	*(0.5628)*						
Observations	2560	1531	1029	2560	1531	1029	2560	1531	1029	2560	1531	1029
LR chi^2	25.28	13.21	9.16	58.06	45.42	34.7						
Prob > chi^2	0.0003	0.0215	0.103	0.0001	0.0035	0.0557						
Pseudo R^2	0.0076	0.0065	0.007	0.0174	0.0225	0.0264						

Source: 1970 BCS, birth, 5, 10 and 16-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%; standard errors in parenthesis.

3.4.5. Ordinary least square estimation results for gender equality in sex and marriage score

Table 7 presents the ordinary least square estimations for the gender equality in sex and marriage score, a continuous variable to measure agreement with gender equality in sex and marriage. As in the previous cases, the model has a low explanatory power, despite being different from a model with no regressors in most cases, although it is not different from a model with no regressors for the male sample with no controls (column 3). Thus, once again, it is difficult to explain how men construct their gender beliefs. Because this variable is a variation of the binary variable discussed in section 3.4.4, it comes as no surprise that the maternal gender equality score and the maternal belief that women should have the same work opportunities as men are significant again for the pooled (columns 1 and 4) and female (columns 2 and 5) samples. For example, a 1 point increase in the maternal gender equality score (that is going from non-equality to equality) increases the sexual equality score by over 9 p.p. in the female sample (columns 2 and 5), ceteris paribus, a similar value to that estimated in the probit model (which was over 8 p.p.). Having a mother who believes that women should have the same work opportunities as men increases the score in about 4 p.p, *ceteris paribus*. As it was the case for the binary variable for gender equality in sex and marriage, the variables associated with equal capabilities (girls are just as capable to be engineers) and working mothers (after the cohort member's birth and during school age) do not explain the gender equality in sex and marriage score of the cohort member. This reinforces the premise that beliefs in gender equality associated with different spheres in life might be influenced by different variables.

Once again, the control variables are not significant except for gender (column 1); caring about what their mother think of them (columns 1 and 2) and changes in family composition for men. Being close to the mother is now associated with more conservative views in all cases, including men, although the effect is 2.5 times higher for women (-0.0909) than men (-0.0358). Being a woman increases the gender equality in sex and marriage score in around 4 p.p., a similar value as the average marginal effect estimated in section 3.4.4 for the binary version of this variable. Finally, experiencing changes in the family composition is positively associated with men expressing gender-equal beliefs (column 6), which could

suggest that this experience (losing or getting a parent) can make boys more sensitive to gender issues.

TABLE 7:

Ordinary least squares estimates for gender equality in sex and marriage index

	All (1)	Female (2)	Male (3)	All (4)	Female (5)	Male (6)
Maternal gender equality index	0.0628***	0.0963***	0.0116	0.0562***	0.0935***	0.0043
	(0.0205)	*(0.0269)*	*(0.0314)*	*(0.0205)*	*(0.027)*	*(0.0316)*
Mother: women should have same opportunities	0.0407***	0.0444**	0.0395	0.0373**	0.0409**	0.0322
	(0.0155)	*(0.0196)*	*(0.0254)*	*(0.0155)*	*(0.0195)*	*(0.0257)*
Girls just as capable to be engineers	0.011	0.01	0.0126	0.009	0.011	0.0057
	(0.0147)	*(0.0192)*	*(0.0228)*	*(0.0147)*	*(0.0192)*	*(0.0231)*
Mother had regular job after child's birth	0.0027	-0.0002	0.0053	-0.0035	0.0023	-0.0053
	(0.0132)	*(0.0171)*	*(0.0207)*	*(0.0132)*	*(0.0171)*	*(0.0209)*
Mother worked at least once between 1980-1986	0.0241*	0.0193	0.0359	0.0133	0.0052	0.0219
	(0.0138)	*(0.0177)*	*(0.022)*	*(0.0143)*	*(0.0185)*	*(0.023)*
Control variables						
Care what your mother thinks				-0.063***	-0.0909***	-0.0358*
				(0.0131)	*(0.0186)*	*(0.0188)*
Mother's age at delivery				*-0.0023***	*-0.0018*	*-0.0031**
				(0.0011)	*(0.0015)*	*(0.0018)*
Household social class						
Professional (omitted category)						
Managerial-technical				0.015	0.0197	0.0072
				(0.0233)	*(0.0323)*	*(0.0338)*
Skilled non-manual				0.0073	0.0008	0.0148
				(0.0244)	*(0.0338)*	*(0.0353)*
Skilled manual				-0.0009	0.0091	-0.0131
				(0.0245)	*(0.0334)*	*(0.0364)*
Partly skilled				0.0095	0.0497	-0.0501
				(0.0298)	*(0.0403)*	*(0.0448)*
Unskilled				0.0058	0.0488	-0.0476
				(0.0478)	*(0.0647)*	*(0.0713)*
Others				-0.0836**	-0.0639	-0.1355**
				(0.0402)	*(0.0519)*	*(0.0654)*
Siblings in the household				-0.022	-0.0108	-0.0341
				(0.0183)	*(0.024)*	*(0.0284)*

… table 7 (continued)…

	All (1)	Female (2)	Male (3)	All (4)	Female (5)	Male (6)
Sisters in the household				0.0044	0.0072	-0.0015
				(0.0122)	*(0.0159)*	*(0.0192)*
Known changes in family composition				0.0352*	0.0121	0.0643**
				(0.0183)	*(0.0246)*	*(0.0277)*
Single parent				-0.016	0.0053	-0.043
				(0.0263)	*(0.0353)*	*(0.0401)*
Cohort member has a religion				-0.0612	-0.073	-0.0529
				(0.0517)	*(0.0625)*	*(0.0983)*
Cohort member is Christian				-0.0189	-0.0163	-0.0077
				(0.0473)	*(0.0554)*	*(0.094)*
Cohort member is British, Irish or white				0.0269	0.0458	-0.017
				(0.046)	*(0.0555)*	*(0.0851)*
Country of birth place						
England (omitted category)						
Wales				-0.0105	-0.0114	-0.0148
				(0.0235)	*(0.0318)*	*(0.0352)*
Scotland				-0.0063	-0.0196	0.0066
				(0.0202)	*(0.0267)*	*(0.0313)*
Others				-0.1118	-0.1109	-0.0981
				(0.0688)	*(0.0909)*	*(0.1061)*
Female				0.0404***		
				(0.0116)		
Constant	0.4094***	0.4079***	0.4053***	0.5688***	0.5742***	0.6418***
	(0.02)	*(0.0256)*	*(0.0323)*	*(0.0702)*	*(0.0897)*	*(0.118)*
Observations	2560	1531	1029	2560	1531	1029
F	5.8	5.41	1.44	4.03	3.23	1.54
Prob > F	0	0.0001	0.2089	0	0	0.0499
R^2	0.0112	0.0174	0.007	0.0367	0.047	0.0341

Source: 1970 BCS, birth, 5, 10 and 16-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%; standard errors in parenthesis.

The fact that estimations in this section are similar to those obtained in the probit model for a binary measurement of sexual equality provides some evidence of robustness. In general, the results estimated for the construction of gender identity are weak, although they do support the hypothesis that gender beliefs may be influenced (even if this influence is not as high as expected) by the attitudes and behaviours regarding gender equality reflected in the environment the cohort members grew up in.

3.5. Degree choice

3.5.1. Variable description

According to the model presented in section 3.2, *i* chooses her degree depending on the relative capabilities she has developed, her gender identity and the weight she assigns to the economic and identity payoffs. Two binary variables were constructed to identify the female and high-paying degrees using data from the Labour Force Survey[31], which comprises quarterly information from 1993 to 2010. This period contains information about the labour market around the time the cohort members were starting to work. It also covers the years for which data was collected (1999-2000 and 2004), which indicates that the cohort members probably had similar information about the market when they were studying. Further, since this dissertation focuses on understanding why women typically choose career paths that are considered traditionally female, it is appropriate to take into account all the information available regarding the labour market, in order to identify the permanent characteristics associated with the different fields of study.

Referring to Epstein, Power describes a feminine occupation as "*one where the majority of workers is women, and where, there is an associated normative expectation that this is as it should be."* (Power, 1975, p. 227). Following this concept, a degree is classified as being female (male) if the majority of workers in that field are women (men) throughout the period observed. As discussed in section 2.3, this definition was chosen because it is both conceptual and methodological. It also seems intuitive, since it is clear where the threshold (50%) should be[32]. At the same time, because this variable is constructed in parallel to the

[31] Since the 1970 British Cohort Study reports degrees as string variables, they were coded following the classification used in the Labour Force Survey (Office for National Statistics, p.p. 109-137), so that the coding could later be used to construct the two binary variables identifying the high-earnings and female-dominated degrees.

[32] Because the classification was constructed using data from 66 periods of observations, if a degree crossed the threshold, it would be classified as female-dominated only if the overall female participation in the field of study for the whole period (1993-2010) was over 50% and the field reported a majority of women in, at least, 60% of the periods observed. While these criteria can be considered *ad hoc*, they

classification of high-earnings degrees, it seems convenient to have two binary variables to capture the separate effects of gender predominance and market value of the field of study. Female-dominated subject fields of study are listed in Appendix 2. In general, these include degrees in health, humanities, languages, communication, arts and education.

Similarly, a field of study is defined here as having high earnings if, on average, either the gross average weekly pay or the gross average hourly pay in the main job for full-time workers in the Labour Force Survey dataset is in the top quintile of the respective earnings distribution. The high earnings subject fields of study are depicted in Appendix 3. Besides a few subjects related to languages and crafts, most of the high earnings subjects fields of study refer to law degrees or degrees that require skills in mathematics, science or technology. The latter include degrees related to (i) economics and management, (ii) mathematics, statistics and computer sciences, (iii) human and veterinary medicine and related studies, and (iv) engineering. Hence, the data from the labour market does support the initial hypothesis that the high-paying degrees tend to be associated with technological, scientific and mathematical skills. At the same time, notice that more than three quarters of the fields of study associated with high-earnings are also classified as being male-dominated. This too supports the general notion that women do not enrol in high-earnings degree choices.

The second set of estimations looks at how the cohort member's gender beliefs, the development of mathematical and technological capabilities and other characteristics at age 16 are related to the degree choices documented in the 29 and 34-year follow-ups. In this case, the balanced sample drops to 537 observations, since it focuses on the population that reported having a degree at 29 or 34. Panels 2 and 3 of Appendix 1 show the percentage of responses per variable relative to those cohort members who hold a university degree, the total responses in the 29 and 34-year follow-ups and the initial population reported in 1970. The balanced sample consists of those graduates for whom no data is missing and represents only 14% of those who report having a university degree and less than 5% of the initial population. It also reports that men are underrepresented in all variables, which is consistent

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were defined to ensure that the fields of study classified as female are, in fact, associated with a social expectation about female predominance over time in that particular field.

with a lower male response rate. Table 8 presents selected descriptive statistics for this set of variables both for the balanced and total samples.

According to this, men are more likely to choose the male-dominated subjects than women to choose female-dominated subjects, suggesting that men are less likely to cross over to non-traditional career options. Nearly half the men decide to study a subject associated with the highest wages in the labour market, whereas only about a third of the women choose this type of degree. For the balanced sample, a considerably higher percentage of those women who agreed that women can do the same job as men studied subjects associated with higher wages than those who didn't agree with such statement (72% relative to 52.8%), suggesting that gender identity is associated with the type of degree chosen. As expected, the summary statistics also show that women have a slightly higher average score in their sexual equality index, which is consistent with men showing more conservative views than women.

A higher percentage of boys than girls developed technological capabilities, which is consistent with the hypothesis that gender stereotyping encourages boys, but not girls, to explore and feel comfortable with this subject. This gap is more obvious when cohort members were asked if they had capabilities in electronics, since the percentage of men who claim to understand electronics is 2.5 times higher than the percentage of women. And, about two thirds of graduates in high-earning or male-dominated fields of study knew how to write computer programs at an early age and more than half of those who reported understanding electronics at age 16 went into high-paying degrees, suggesting that early stimuli in these fields might encourage teenagers to enrol in high-paying degrees. Similarly, students placed at the top 15% of their class represent a higher percentage of those who later obtained degrees in high-paying (70.7%) and male-dominated (61.4%) fields of study; and about four fifths of those in such fields considered themselves to be good at mathematics. Thus, developing capabilities and confidence in mathematical and technological subjects could influence teenagers into enrolling in higher-earnings degrees.

TABLE 8:

Summary of descriptive statistics related to degree choice, by respondent's sex

(total and balanced sample, values as percentages)

	Total responses in unbalanced sample**			Descriptive statistics for unbalanced sample			Descriptive statistics for balanced sample		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
Total							537	271	266
Degree in a high-paying field *	3838	1912	1926	42.8%	32.1%	53.4%	41.3%	34.3%	48.5%
Degree in a female-dominated field *	3838	1912	1926	40.0%	57.5%	22.7%	32.4%	51.3%	13.2%
Believes women can do the same job as men	8279	4941	3338	53.1%	64.9%	35.6%	46.9%	59.4%	34.2%
Average sexual equality score	8383	4995	3388	0.499	0.513	0.478	0.531	0.551	0.511
Average ability score at age 5	15321	7970	7351	0.512	0.507	0.518	0.587	0.580	0.594
Top 15% of academic ability	5223	2884	2339	19.6%	18.4%	21.1%	56.6%	53.9%	59.4%
Believes to be good at mathematics	8281	4913	3368	45.3%	37.6%	56.6%	68.5%	59.0%	78.2%
Can write computer programs	7214	4090	3124	54.2%	46.3%	64.5%	57.2%	44.6%	69.9%
Understands electronics	9503	5634	3869	28.4%	14.1%	49.3%	39.1%	22.5%	56.0%
Job: Having high earnings/wages matters very much	8556	5057	3499	42.8%	36.9%	51.3%	44.9%	39.5%	50.4%
Job: Helping others matters very much	8574	5080	3494	44.7%	52.7%	33.1%	34.5%	45.4%	23.3%
Job: Working with figures matters very much	8475	5013	3462	8.8%	7.5%	10.8%	12.5%	9.6%	15.4%
Job: Having a real challenge matters very much	8509	5032	3477	37.2%	37.8%	36.3%	50.3%	50.2%	50.4%
Job: Making or building things matters very much	8485	5023	3462	9.4%	5.1%	15.5%	3.7%	3.0%	4.5%

Source: 5, 16, 29 and 34-year follow-ups.

* As percentage of graduates.

** Total observations for each variable in the 1970 BCS.

It is common for defenders of naturalistic arguments (Brizendine, 2007, 2010 and Antecol and Cobb-Clark, 2010) to claim that certain choices, particularly degree choices, are associated with innate traits instead of social constructs or past experiences. Further, sometimes a social stigma is assumed that associates certain type of subjects (like mathematics, for instance) with innate abilities. This view can be problematic because it neglects the possibility of developing capabilities in favour of a more deterministic approach. For example, a naturalistic approach would simply argue that women do not go into the high-earnings occupations because they lack the ability for mathematics, without ever questioning if they do, in fact, lack that ability or if they are properly stimulated to develop it. While abilities are important, it seems also important to focus on how they are developed and whether people have a proper environment for flourishing. At the same time, noncognitive ability has proven to be as important as cognitive ability in explaining economic behaviour (Heckman, Stixrud, Urzua, 2006), so that including variables related to experiences seem as relevant as controlling for ability. In the 5-year follow-up, cohort members took a human figure drawing test, an English picture vocabulary test, a profile test and a copying designs test. A score showing the percentage of correct responses for each test was estimated. The

average of these scores is then included in the analysis as a measure of ability. Therefore, this variable captures early cognitive ability and is measured in a [0, 1] interval.

It is important to note that the educational system in the United Kingdom might also limit the student's university options. Requirements to enter a particular degree program depend on the subjects taken for the Advanced Level General Certificate of Education (A-level). High school students, therefore, specialize in particular subjects and this might limit their university options later on. In fact, for the 1970 BCS, the percentage of A-level exams taken in science, technology, engineering and mathematics (STEM) is positively correlated with getting a high-earnings degree (0.0309) and negatively correlated with getting a female-dominated degree (-0.2186) at the standard confidence levels. And while 3 out of 4 men take at least an A-level exam on a STEM subject, only 1 out of 2 women do so, which also supports the hypothesis that a gender bias might influence how teenagers feel about particular subjects of study. However, this variable cannot be considered for the regression analysis due to missing values[33]. Despite this limitation, such variable would be expected to reflect a similar behaviour as that captured by the school performance and technological variables in the regression analysis.

Because nonresponse rates might be of concern, Table 8 also presents the summary statistics for the total sample. By comparison, the balanced sample might have a smaller number of men with high-earnings and female-dominated degrees relative to the percentages observed in the total sample, as well as a smaller percentage of women who believed that women can do the same job as men when they were 16 years old. At the same time, the average gender equality score is higher in the balanced sample, which could suggest a relationship between more educated people and more gender equal beliefs regarding sex and marriage. Since the balanced sample is restricted to those cohort members reporting a university degree, it is expected for this group to show higher ability, performance in mathematics and technological capabilities, which is the case. As for job preferences, those who value helping others or building things are underrepresented in the balanced sample, while those who like to work with figures or like challenges are overrepresented.

[33] The 16-year follow-up suffers from a high level of nonresponses that does not allow for the inclusion of variables such as grades by subjects, certain academic interests and school characteristics.

3.5.2. Model specification

Two different probit models are estimated in order to explore the degree decisions (d_i). In the first model, the dependent variable is a binary variable identifying whether or not *i* studied a degree associated with a high-paying wage, as defined above. In the second model, the dependent variable indicates whether or not the degree chosen is in a field dominated by women. In each case, the response probability of choosing d_i=1 is derived from the following latent variable model:

$$(29) \qquad d_i^* = \gamma x_i + \xi_i \,,$$

where *x* is the matrix of individual characteristics, γ is the coefficient vector and ξ is the error term. The underlying assumption from the model in section 3.2 is that students acquainted with technology, math and science might have a stimulus to study a high-earnings degree; the same as girls with a more gender-equal identity who exhibit relative capabilities in these fields of study. The individual characteristics considered for the estimations include: two proxy variables for having gender-equal beliefs (the binary variable indicating agreement with the statement that women can do the same job as men and the gender equality score discussed in section 3.4), an ability score, the overall performance in previous studies, previous exposure to technology, relative ability in mathematics and a set of job aspirations. The student's performance at school is proxied by a binary variable indicating if *i* belongs to the top 15% of academic ability in her class, while ability is measured as a compound variable summarizing the average ability in a set of exams taken at age 5. Similarly, the relative ability in math takes a value of 1 if the teenager believes themselves to be good at math and 0 otherwise; this is a subjective measure, reflecting both a real ability in mathematics as well as self-confidence in it. Exposure to technology is captured via two binary variables, showing whether the teenager was able to write a computer program or understood electronics by the age of 16, which reflects the development of technological capabilities at an early age. Finally, the teenager's measure of job aspirations include five binary variables showing whether *i* highly values having a job with high earnings or wages, helping other people, working with figures, having challenges and building or making things.

3.5.3. Estimation results for degree choice

The main hypothesis of this thesis is that gender norms, especially the stereotyping of subjects by gender, might dampen girls' degree choices by signalling to them that some careers (including the high-paying degree options) are not appropriate for their role as women. The coefficient estimates and average marginal effects for the probability of studying a high-paying degree dependent on the covariates specified in equation (30) are presented in columns 1-3 and 7-9 of Table 9, respectively[34]. As before, the results are presented for the pooled sample and for women and men alone[35]. Except for men (column 3), these results reveal that, believing in equal labour capabilities, is significantly and positively associated with studying a high-paying degree. For women, believing that women can do the same job as men increases the average probability of studying a high-earnings degree in 14.7 p.p. (column 8), *ceteris paribus*. In contrast, beliefs regarding gender equality in sex and marriage are not significant, all else equal.

Results do not support the hypothesis that early ability is associated with high-earnings degrees, *ceteris paribus*. This variable is only significant for the pooled sample (column 1) and it's negatively associated with high-earnings degrees, so that children who had higher scores in the ability tests carried out at age 5 do not end up in the highest paying fields of study, *ceteris paribus*. They also indicate that being at the top 15% of the class is positively associated with studying a high-earning degree program in all three cases. However, the average marginal effect of this variable is almost three times higher for men (28.15 p.p.) than it is for women (9.94 p.p.) , *ceteris paribus*. It could be argued that these two variables capture

[34] To facilitate comparison later on, table 11 also presents the results for the probability of studying a female-dominated degree in columns 4-6 and 10-12.

[35] Regressions were also estimated for the 29 and 34-year follow-ups pooled sample, for both waves separately and women and men independently. The results were found to be consistent, with the estimates for the pooled sample presented here. However, if results are estimated for each wave separately, the number of observations is reduced significantly and below the minimum amount needed for a probit estimate. Regressions were also estimated including a Heckman adjustment for the probability of going to university. However, the Mills lambda for this exercise was not significant and causes a significant loss of observations in the sample.

the same effect. However, one would presume this is not the case, since there is a history of eleven years between the two of them, i.e., "being at the top 15% of the class" at age 16 reflects accumulated socialized experiences and a development of capabilities that are not captured at age 5, the most important of which is the school experience. Also, the tests applied when the cohort members were 5 are designed to provide objective measures of ability, while the assessment on school performance at 16 is given by the teacher[36]. Self-reported ability in mathematics is not found to be significant in any of the estimates for either gender, *ceteris paribus*. The results for these three variables suggest that girls are more likely to enrol in high-earnings degrees if they develop capabilities and perform well during their school years rather than it being dependent on preschool abilities.

The data reveals that developing technological capabilities at an early age is positively associated with choosing to study a high-paying degree; providing supporting evidence to the initial hypothesis: writing a computer program is significantly associated with boys studying a high-paying degree (column 3), while understanding electronics is so for girls (column 2), *ceteris paribus*. Both variables are significant for the pooled sample (column 1). It could be that these variables are working through each other when considering the genders separately, so that one of them stops being significant. More interestingly, the average marginal effect associated with understanding electronics for women (an increase of 20.12 percentage points) is higher than that associated with believing that women can do the same job as men (14.66 p.p.), *ceteris paribus*. This raises the question of whether providing the right stimulus in the educational process regarding science and technology could outweigh the gender bias that discourages girls from entering the high-earning career options. The results shown may support this premise.

Among job aspirations, helping others and wanting to make or build things are not significant variables in explaining the decision to choose a high-paying subject field. It is unexpected that wanting to have high earnings is negatively associated with studying a high-earnings degree for women and does not seem to explain the degree choice for the pooled

[36] Recall that the 1986 wave of this study was impacted by a teacher's strike. Since this variable was provided by the cohort's teacher, its inclusion limits the sample to only those students for whom the teacher answered the questionnaire.

and male samples, *ceteris paribus*. This result contrasts with Hilmer and Hilmer's (2012) finding that majoring in business and engineering, which are part of the high-earning degrees, is positively associated with valuing financial well-being. On the other hand, working with figures, which reflects a taste for mathematics, is positively related to choosing a high-paying degree, especially for girls, whose average probability is increased in almost 25 p.p., *ceteris paribus*. Interestingly, all things equal, wanting a job with real challenge discourages people from entering a high-paying program, which seems counterintuitive. This variable turns out to be significant both for women (column 2); and for women and men considered together (column 1), but not for men alone (column 3), which suggests that women might have different preferences or definitions of what a challenge is in a work place. Finally, being a woman is not associated with studying a high-paying degree at the standard confidence levels (its p-value is 0.118), *ceteris paribus*.

Columns 4 to 6 and 10 to 12 of Table 9 present the coefficient and average marginal estimation results for the decision to study a female-dominated subject field. As discussed earlier, the high-earnings subject fields are mainly male-dominated, although this is not a strict condition, so that some female-dominated fields, such as medicine or clinical psychology, are located at the top of the wage distribution. However, because high-earning degrees are predominantly male-dominated, it is interesting to test whether the variables determining the choice of a high-earning degree have the opposite effect in determining the choice of a female-dominated degree. For the decision to study a female-dominated degree, results show that the belief that women can do the same job as men is not significantly different from zero for men (column 6), but it is significantly and negatively associated with it for the pooled (column 4) and female (column 5) samples. So, believing that women can do the same job as men decreases the probability of enrolling in a female-dominated degree by more than 10 p.p. for women, *ceteris paribus*. That is, a more gender-equal belief decreases the probability of women perpetuating the traditional female roles. It is also interesting that, while the gender equality in sex and marriage score is not significant for women, it is positively associated with men studying a female-dominated degree. This is also true for the pooled sample. For example, an increase from 0 to 0.5 in the score is associated with an increase of the estimated average probability of 6.9 p.p, *ceteris paribus*. Further, a score of 1 increases the estimated average probability to 23.97%, an increase of 18.65 p.p. over a score of 0, *ceteris paribus*.

Academic ability does affect female and male decisions differently: while being at the top 15% of the class is positively related to men studying female-dominated subjects (column 6), the relationship is negative for women (column 5). Thus, being at the top of the class reduces the probability of women studying traditional programs in 17.16 p.p., *ceteris paribus*, which is consistent with the previous finding of the best female students moving into high-earning degrees. At the same time, a higher ability score at age 5 is positively associated with studying a female-dominated degree for the pooled (column 4) and female (column 5) samples, so that each increase of 0.1 points in the ability score increases the probability of studying a female-dominated degree in about 5 p.p. for women, *ceteris paribus*. Those students who claim to be good at mathematics are less likely to choose a study field dominated by women in all the estimates (columns 4-6); with average marginal effects close to a decrease of 20 p.p. in the probability of studying a female-dominated degree, *ceteris paribus*, which suggests that developing confidence and mathematical abilities could encourage girls to choose less traditional career paths. This is expected, in particular because early ability in math has been found to be related to occupation (Schoon, Ross and Martin, 2007, p. 138); gaining a male-dominated qualification (Sullivan, Joshi and Leonard, 2008) and earnings (Crawford and Cribb, 2013, p.4). Students who were able to write a computer program by age 16 are less likely to choose to study a female-dominated subject. This holds true for the pooled data (column 4) and women (column 5), but not for men (columns 6), for whom the coefficient is not significantly different from zero and exhibits a similar average effect as that observed for being good at mathematics for women, so that developing mathematical and technological abilities might encourage women to move out of the traditional fields of study. Understanding electronics, which positively influenced women into studying a high-paying degree, has no significance on whether the student chooses a female or a male-dominated program of studies, *ceteris paribus*. As mentioned earlier, it might be that this and other non-significant variables may be working through other variables measuring similar traits.

The coefficients for career aspirations raise a question on the role of economic aspirations in choosing a degree program[37]. According to the human capital model (Becker, 1993), people's expectations of future earnings play a crucial role in labour decisions such as

[37] It may also be that the teenagers didn't really know what their aspirations were at the time or that they responded based on what they think adults want to hear.

studying a specific degree program. However, wanting high earnings is not found to be significant in explaining this decision, nor the choice for a high-earning degree program. In contrast, wanting to help other people is an important determinant for choosing a female-dominated subject field, in all cases, but particularly for women. Wanting to help other people, which could be associated with the female role of care-taker in a traditional environment, increases the probability of girls choosing a female-dominated degree in 12.8 p.p., *ceteris paribus*, thus supporting the initial hypothesis. Wanting to work with numbers in a job, which reflects a taste for mathematics and positively influences women to choose high-paying subjects, negatively influences them to choose a female-dominated career (column 5). This variable is also significant when pooling women and men together (columns 4). On the contrary, wanting to build or make things and wanting a job with a real challenge positively affect women's decisions to choose a female-dominated subject. As expected, being a woman makes it more likely to study a female-dominated field by increasing the average marginal probabilities in 28.7 p.p., *ceteris paribus*, thus suggesting that there might still be other constructed gender differences than those captured in the observed characteristics included in the models that might deter women from entering this kind of degrees. For example, this could be capturing girls' expectations to be discriminated in male-dominated fields or having more access to promotions in female-dominated ones.

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TABLE 9:

Probit estimates for degree choice

	Probit coefficient estimations						Average marginal effects					
	High-earnings degree			Female-dominated degree			High-earnings degree			Female-dominated degree		
	All (1)	Female (2)	Male (3)	All (4)	Female (5)	Male (6)	All (7)	Female (8)	Male (9)	All (10)	Female (11)	Male (12)
Women can do the same job as men	0.2844**	0.4909**	0.0299	-0.2856**	-0.3319*	-0.1756	0.0963**	0.1466***	0.0105	-0.0748**	-0.1072*	-0.0309
	(0.1252)	*(0.1943)*	*(0.1769)*	*(0.1397)*	*(0.1823)*	*(0.2433)*	*(0.0419)*	*(0.056)*	*(0.0618)*	*(0.0356)*	*(0.058)*	*(0.0427)*
Average sexual equality score	-0.2859	-0.4409	-0.2478	0.4077*	0.0502	1.0823**	-0.0969	-0.1316	-0.0866	0.1087*	0.0162	0.1906**
	(0.2048)	*(0.3049)*	*(0.3021)*	*(0.2282)*	*(0.3024)*	*(0.4285)*	*(0.0691)*	*(0.0901)*	*(0.1051)*	*(0.0602)*	*(0.0977)*	*(0.0746)*
Average ability score at age 5	-1.1137**	-1.07	-0.9679	1.0153*	1.6668**	0.4989	-0.3776**	-0.3195	-0.3383	0.2706*	0.5385**	0.0879
	(0.4742)	*(0.7287)*	*(0.6633)*	*(0.5274)*	*(0.7097)*	*(0.9347)*	*(0.1582)*	*(0.2149)*	*(0.2288)*	*(0.1395)*	*(0.222)*	*(0.1648)*
Top 15% of academic ability	0.5909***	0.3328*	0.8053***	-0.0948	-0.5312***	0.7182***	0.2049***	0.0994*	0.2815***	-0.0255	-0.1716***	0.1265***
	(0.1292)	*(0.1951)*	*(0.1825)*	*(0.1422)*	*(0.1876)*	*(0.2768)*	*(0.0436)*	*(0.0574)*	*(0.0565)*	*(0.0385)*	*(0.0578)*	*(0.0478)*
Good at mathematics	0.2323	0.1276	0.2505	-0.725***	-0.5568***	-1.2444***	0.0795	0.0381	0.0876	-0.215***	-0.1799***	-0.2192***
	(0.1422)	*(0.1984)*	*(0.2213)*	*(0.1462)*	*(0.1888)*	*(0.2825)*	*(0.0488)*	*(0.0592)*	*(0.0768)*	*(0.0452)*	*(0.0583)*	*(0.0467)*
Can write computer program	0.2796**	0.1347	0.3343*	-0.3834***	-0.4956***	-0.1943	0.0959**	0.0402	0.1169*	-0.1057***	-0.1601***	-0.0342
	(0.1239)	*(0.1766)*	*(0.1914)*	*(0.1334)*	*(0.1736)*	*(0.2559)*	*(0.0425)*	*(0.0526)*	*(0.0658)*	*(0.0375)*	*(0.0536)*	*(0.0451)*
Understands electronics	0.35***	0.6737***	0.1955	-0.0494	0.1081	-0.0635	0.1229***	0.2012***	0.0683	-0.0132	0.0349	-0.0112
	(0.1298)	*(0.2106)*	*(0.1766)*	*(0.1497)*	*(0.2147)*	*(0.2413)*	*(0.0464)*	*(0.0593)*	*(0.0613)*	*(0.0401)*	*(0.0693)*	*(0.0425)*
Have high earnings/wages	-0.0205	-0.3123*	0.2767	-0.1155	0.0217	-0.3029	-0.007	-0.0933*	0.0967	-0.0308	0.007	-0.0534
	(0.1208)	*(0.1824)*	*(0.1711)*	*(0.1342)*	*(0.1779)*	*(0.2339)*	*(0.0409)*	*(0.0536)*	*(0.0589)*	*(0.0357)*	*(0.0575)*	*(0.0408)*
Help others	0.0713	0.0167	0.1601	0.3771***	0.3956**	0.5124**	0.0242	0.005	0.056	0.1052***	0.1278**	0.0902**
	(0.1276)	*(0.1794)*	*(0.1968)*	*(0.1353)*	*(0.173)*	*(0.2476)*	*(0.0432)*	*(0.0536)*	*(0.0686)*	*(0.0388)*	*(0.0543)*	*(0.043)*
Work with figures	0.4612**	0.8349**	0.0235	-0.381*	-0.8933**	0.2564	0.1612**	0.2493***	0.0082	-0.0976*	-0.2886**	0.0452
	(0.1816)	*(0.3258)*	*(0.2399)*	*(0.2304)*	*(0.3746)*	*(0.3211)*	*(0.0635)*	*(0.0938)*	*(0.0839)*	*(0.0557)*	*(0.1174)*	*(0.0566)*
Real challenge	-0.251**	-0.4386**	-0.0734	0.1771	0.3303*	-0.3224	-0.0849**	-0.131**	-0.0257	0.0473	0.1067**	-0.0568
	(0.1189)	*(0.1776)*	*(0.1741)*	*(0.1299)*	*(0.1691)*	*(0.2344)*	*(0.0397)*	*(0.0513)*	*(0.0608)*	*(0.0346)*	*(0.0535)*	*(0.0411)*
Make or build things	0.2197	0.5563	-0.2851	0.5522*	1.0132*	0.6578	0.0755	0.1661	-0.0997	0.1561	0.3273*	0.1158
	(0.3089)	*(0.534)*	*(0.4103)*	*(0.3298)*	*(0.5685)*	*(0.4667)*	*(0.107)*	*(0.1588)*	*(0.1431)*	*(0.0961)*	*(0.1808)*	*(0.0811)*
Female	-0.2063			0.9805***			-0.0707			0.287***		
	(0.1321)			*(0.1452)*			*(0.0455)*			*(0.0418)*		
Constant	-0.2209	-0.1133	-0.506	-1.1288***	-0.2589	-1.2867**						
	(0.3384)	*(0.476)*	*(0.4727)*	(0.3713)	(0.4566)	(0.633)						

… table 9 (continued)…

	Probit coefficient estimations						Average marginal effects					
	High-earnings degree			Female-dominated degree			High-earnings degree			Female-dominated degree		
	All (1)	Female (2)	Male (3)	All (4)	Female (5)	Male (6)	All (7)	Female (8)	Male (9)	All (10)	Female (11)	Male (12)
Observations	537	271	266	537	271	266	537	271	266	537	271	266
LR chi^2	88.49	61.21	42.47	167.35	66.39	35.98						
Prob > chi^2	0	0	0	0	0	0.0003						
Pseudo R^2	0.1215	0.1756	0.1152	0.2474	0.1768	0.1737						

Source: 1970 BCS, 5, 16, 29 and 34-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%; standard errors in parenthesis.

3.6. Conclusion

This chapter considers the hypothesis that learning gender roles from the surrounding environment early in childhood can have a negative economic impact on women in the long-run, by inducing them to develop preferences that would keep them in fields of study that offer lower wages. Encouraging girls from an early age to develop mathematical and technological skills could help offset this gender bias, by stimulating them into choosing degrees with a higher rate of return in the labour market. The results present some supporting evidence in favour of this hypothesis.

The regression results provide some evidence supporting the hypothesis that teenagers are likely to reproduce the household environment through the construction of their gender identity. Both growing up with a working mother and having a mother that believes in gender equality are positively associated with women believing that they can perform just as well as men in the labour market. At the same time, cohort members express more gender equal beliefs regarding sex and marriage if their mothers believed in equal opportunities for women and had a more liberal view on what constitutes women's roles as mothers and wives. Thus, not all beliefs regarding gender might be influenced by the same factors, rather they seem to be more specific to the matter in hand (capabilities, sexuality, etc.). Overall, these estimations have low explanatory power, which could be due to difficulties in capturing environment characteristics related to how adults interact with children and how the environment might impact upon their behaviour in general, particularly, some variables might be omitted due to unavailability of data (such as schooling, peer pressure and media consumption).

The results also provide supporting evidence to the hypothesis that (i) gender identity might influence degree choices of women and (ii) this might be counteracted by stimulating them to feel comfortable with mathematics and technology. It also shows that, although not exact, choosing a high-earnings field of study has parallels to choosing a male-dominated one: specifically, if a variable is positively (negatively) associated with choosing a high-earning degree, the same variable will either be negatively (positively) or not significantly associated with the choice for a female-dominated degree. In particular, believing that women can do

the same job as men, being in the top 15% of the class, understanding electronics and wanting to work with numbers are positively related to women studying high-paying degrees. Ability at an early age, which the literature sometimes assumes as an innate trait, does not turn out to be associated with having a high-earnings degree. Similarly, being good at mathematics and developing programming skills at an early age are associated with a smaller chance of women persisting in a female-dominated career choice. In contrast, wanting to help other people is related to studying female-dominated degrees. Finally, being a woman may make it more likely to choose a female-dominated subject and less likely to choose a high-earning degree, suggesting that there is still some important social variables not captured in the model that could further explain the gender segregation among fields of study. From a policy perspective, these results suggest that not stereotyping mathematical and technological subjects as male and encouraging girls to develop early capabilities related to these fields, as well as promoting more gender-equal environments, may encourage girls to enrol in degree programs that offer higher economic opportunities in the labour market.

4. A mixed methods approach to female degree choices

> *"First; that the alleged superior adaptation of women to certain occupations, and of men to certain others, does not even now exists, to anything like the extent it is pretended. Secondly; that so far as it does exist, a rational analysis of human character and circumstances tend more and more to shew, that the difference is principally if not wholly the effect of differences in education and in social circumstances, or of physical characteristics by no means peculiar to one or the other sex. Lastly, even if the alleged differences of aptitude did exist, it would be a reason why women and men would generally occupy themselves differently but no reason why they should be forced to do so." (Mill, J.S. and Taylor Mill, H., 1998, p. 45)*

4.1. Introduction

The last chapter used an econometrics approach to identify any observed relationship between gender beliefs and exposure to mathematics and technology at an early age with the degree choices of women using the 1970 British Cohort Study. The results provide some supporting evidence that women with gender-equal beliefs and who develop technological and mathematical capabilities early in life are more likely to graduate from high-earnings degrees. However, there are some caveats related to these conclusions. In particular, given the quantitative nature of the dataset and the econometric approach used to derive the estimates, there is no qualitative information about how women experience their relationship with technology, mathematics, the university or the labour market. In order to fill in this gap, a survey was run among female academic staff members at the University of York to gather information about their experiences when choosing their degree. This survey uses a combination of closed and open ended questions that provide both quantitative as well as qualitative information. This chapter focuses on analysing the results derived from this survey,

particularly those referring to how respondents interpreted and experienced the process leading to their degree choices.

Because this thesis' research question revolves around female choices, it was decided to design the questionnaire specifically for female respondents. Firstly, results from the previous chapter showed that male behaviour may not be an appropriate benchmark to study female choices (recall that the models were even non-significant for men), so that what influences female preferences may be different from what influences male preferences[38]. Secondly, the focus of this research is to understand why is it that women do not choose the high-paying degrees, a behaviour that at first seems inconsistent with the mainstream economic theories. Since men do choose these degrees and are more likely to end up with higher wages, their behaviour can be explained by the economic models (they behave as predicted by the theory), so men have never being the target population of the research. And thirdly, it is not within the scope of this research to study masculinity. While men play their part in keeping fields of study and occupations segregated, and this may be as detrimental to them as it is to women, and femininity cannot be understood without masculinity, it is probably men who have to take the active role in contesting masculinity. For a woman, the question should start by asking herself: "why am I here, could I be better off?", not "why is he there?" The first question should be about her, if she wants to free herself from the social imperative that tries to turn her into a being for others.

This chapter is structured as follows: section 4.2 describes the dataset; section 4.3 provides a descriptive as well as a qualitative analysis of the information gathered and section 4.4 provides a qualitative analysis much in the line of the model presented in section 3.2. Finally, section 4.5 concludes.

[38] For example, while one of the main concerns for women is to fit into a particular standard of beauty in order to fit social expectations, men's main concern is to be tough and a good provider (Brown, 2010). Both are a huge burden and they both respond to the same patriarchal framework, but they require to be addressed separately. As a woman, one is inclined to understand femininity first.

4.2. Dataset

The survey was designed in order to gather information on women about the degree choice process. In particular, the survey aims at gathering information on how personal aspirations and traditional gender roles imposed in the household or the school could have influenced the respondent's degree choice; how women feel and interpret their experiences with mathematics, science, technology and other extracurricular activities as girls; and whether they had a role model or a childhood experience that influenced their degree choice. Later, the survey questions women on their working experience and their level of satisfaction with their degrees and their jobs. Appendix 4 contains the survey questionnaire, as approved by the Economics, Law, Management, Politics and Sociology Ethics Committee of the University of York on May 22nd, 2012.

Because universities develop professionals, a university campus seems like the best option to survey professional working women in a wide variety of subject fields. At the same time, it offers a safe environment and easily available contact information about potential respondents. Because of these, the University of York female academic staff was chosen as the survey population. A list was made with the names and email addresses of all the women listed as academic staff in the academic departments, research and teaching centres of the University. This led to 818 identified potential respondents. However, this also has some caveats, among which is worth mentioning three: firstly, since all the respondents work for the same institution, the surveyed population will not reflect the differences in wages observed in the labour market[39], however, since the primary focus is not on the wage differential itself but in the different experiences leading to one degree or the other, this difference with the labour market is not as important as having respondents with a wide variety of degrees. Secondly, people who stay in academia are a subgroup of all graduates. Arguably, academics are more oriented towards research and learning and were probably among the best students in their class, so that surveying academics might introduce a bias in this regard. At the same time, because academics are a more homogenous group than all professional women, the

[39] Although some differences in wages might exist among departments or research centres, one would not expect these differences to be as wide as those observed in the labour market.

associations observed among certain variables might not be as strong for this group as it would be for the rest of the female professional population. For example, considering that academics tend to be better students, it is expected that they might reflect a weaker aversion to mathematics. Likewise, since they work in the same environment, it is expected to observe less variability on their economic ambition and so on. This suggests that the associations observed among this group are expected to be stronger for the whole of the population, or equivalently, if a relationship between two variables is strong enough to be significant within this group, one would expect this relationship to persist in the whole female population as well. That is, if the relationships tested in the hypothesis hold in a homogenous group such as academics, it will presumably hold for the graduate population. And thirdly, respondents are self-selected, since they join the questionnaire voluntarily, so most likely the respondents are more interested in or have higher awareness of gender and social issues.

The survey was designed exclusively for this research, although some of the questions are based on those from the 1970 British Cohort Study. The purpose of this was to gather similar information as that in the cohort study plus the qualitative information regarding gender, experiences with mathematics, science and technology and the process of choosing a degree, in order to complement what could not be addressed in the previous chapter due to data availability. An initial draft was designed by February, 2012 and revised by an expert in feminist and sociological research. Modifications were made according to her suggestions. A pilot survey was applied to a group of five women in the Economics department, which allowed testing the survey, getting feedback, measuring estimated times of completion and checking that the platform worked adequately before getting the final version.

The survey was uploaded in the SurveyMonkey platform (www.surveymonkey.com) which allows respondents to answer the questionnaire online either in one or several sessions, depending on their time availability. This platform also complies with confidentiality and data protection requirements; and facilitates coding the results later on. It was estimated the survey would take a maximum of 30 minutes to complete and respondents were allowed to give as much information as they felt comfortable with. The 818 potential respondents received an email invitation to participate in the survey, of which 144 agreed to participate during the three weeks the survey was opened, for a response rate of 17.6%, which is

considered adequate for an online survey[40]. When answering the survey, each respondent was assigned an identification number, so that they cannot be individually identified.

Most of the respondents (70.1%) hold a PhD and less than 10% have a bachelor degree as their highest educational level, as shown in Table 10. More importantly, 36.8% of responses were from people with a degree in a high-earnings subject field[41], a percentage similar to that observed for women in the British Cohort Study. As expected, most respondents hold a degree in a female-dominated field of study (77.8%), however, this percentage is higher in comparison to that observed in the 1970 BCS for degree holders (54.6%) and comes closer to the distribution of women in female-dominated occupations (70%). This higher response from academics in female-dominated fields of study could be attributable to a higher willingness to participate in surveys from academics in such fields, which are associated with the humanities and, therefore, are more used to taking part in surveys and ethnographic studies. It was not possible to obtain information regarding the actual distribution of female academics in the university, so the respondents' distribution cannot be compared to the distribution of the original population. Given that information about potential respondents was collected through the internet, it is not possible to know beforehand the subject profile of the 818 potential participants. However, from these, 22.5% worked in a department or centre related to a high-earnings field of study and 46.2%, in a department or centre related to a female-dominated field of study. From the responses collected, 16.7% worked in a department or centre related to a high-earnings field of study and 45.8%, in a department or centre related to a female-dominated field of study. Thus, it was more difficult to collect responses from women working in a department or centre related to a high-earnings field of study and this group might be slightly underrepresented.

[40] For example, from a sample of 199 online surveys, Braun Hamilton (2009) found a total response rate of 13.35%.

[41] For consistency, degrees in this chapter were classified using the same criteria discussed in sections 2.3 and 3.5.1, which consists of two binary variables identifying (i) high-paying fields of study at the top 20% of the wage distribution vs. the ones at the bottom 80% and (ii) female-dominated vs. male-dominated fields of study.

TABLE 10:

Educational level and degree types

	Observations	Percentage
Highest educational level	**144**	**100%**
Bachelor	10	6.9%
Masters	33	22.9%
PhD	101	70.1%
High-earning subject field	**144**	**100%**
Top 20%	53	36.8%
Bottom 80%	91	63.2%
Female field of study	**144**	**100%**
Female degree	112	77.8%
Male degree	32	22.2%

Source: Online survey.

About two thirds of the respondents grew up in the United Kingdom, so that a significant percentage comes from a different cultural background. And one would also expect their experiences to vary according to their age, which ranges from 24 to 60 years old, with participants being, on average, 41 years old[42]. Finally, most of the people willing to participate in the survey are at the bottom of the academic ranking: 47.1% of the respondents are research or teaching fellows or part of the managerial and support staff; 22.1% of respondents are lecturers, 5.1% are senior research associates, 10.3% are senior lecturers, 12.5% are Professors and 2.9% are Emeritus Professors. Information was also gathered concerning the income and variables related to it. However, due to missing information, it was decided not to look into this topic, but rather to concentrate on the process leading to the degree choice.

4.3. Descriptive analysis

The next sections present the main results for the different sections of the questionnaire. Special emphasis is placed on the open-ended questions, where respondents had an opportunity to express their own views and share their personal experiences. When

[42] All 4 Emeritus Professors reported an age of 60.

enough quantitative data is available, correlation coefficients between the variables and the degree choice are presented in order to identify which variables might be significantly associated with degree choices. Later, the most relevant of these variables are tested in a binary response model.

4.3.1. Degree choice

This section explores the main reasons students consider when choosing a degree as well as the influence other people might exert on them when taking such decision.

4.3.1.1. Reasons for choosing a degree

Respondents were asked to identify their main reason for choosing their degree program after being asked to rate different possible reasons that may influence the decision to pursue a university degree. Regardless of the type of degree, most respondents state that their main reason for choosing a particular degree program is getting an academic education and learning more about a specific subject, as shown in Table 11. In comparison, all the other reasons have a much smaller weight in making a degree choice. Notice, however, that to be economically independent and to study or work with mathematics or science are also more relevant main reasons in choosing a degree program for those women with high-earnings or male-dominated degrees. At the same time, wanting to earn a high income is also relevant as a main reason to get a high-earnings degree. In all four groups about 6% of the respondents claim that "wanting to help other people or creatures" was their main reason for choosing their degree program. Finally, job security is not a main reason for choosing a degree, which is interesting, considering that respondents ended up working in academia, a sector characterized by offering job security.

TABLE 11:

Main reason for choosing a degree program, by degree choice

All observations	High-earnings		Female-dominated	
	Bottom 80%	Top 20%	Male-dominated	Female-dominated
Observations	90	52	30	112
To earn a high income, be well off financially	2.2%	7.7%	3.3%	4.5%
Job security	0.0%	1.9%	0.0%	0.9%
To be economically independent	2.2%	7.7%	13.3%	1.8%
To get academic education, learn more about subject	66.7%	57.7%	60.0%	64.3%
To help other people or creatures (planet, etc)	6.7%	5.8%	6.7%	6.3%
To research, develop new technologies, innovate	6.7%	0.0%	3.3%	4.5%
To work with people	1.1%	1.9%	0.0%	1.8%
To make your parents or mentors proud	1.1%	0.0%	0.0%	0.9%
To have prestige, be successful or influential	0.0%	1.9%	0.0%	0.9%
To create art	1.1%	0.0%	0.0%	0.9%
To study or work with math or science	4.4%	9.6%	10.0%	5.4%
To be happy	3.3%	3.8%	0.0%	4.5%
Other	4.4%	1.9%	3.3%	3.6%

Source: Online survey.

Respondents were also asked to rank the importance they assigned to a series of possible reasons for going into a particular program using a five point scale. Table 12 shows the correlation coefficients of this ranking with having a high-earnings or a female-dominated degree. As expected, wanting to earn a high income and to be economically independent are positively associated with the high-earning degrees and negatively associated with female-dominated degrees, although only the first of these correlations is significant. Similarly, wanting an academic education; wanting to make the parents or mentors proud; wanting prestige, success or influence and following a family tradition are all positively associated with choosing a high-earnings degree program (however, wanting to make the parents or mentors proud does not exhibit a significant correlation). These are all aspirations that can be related to a need for rank and prestige within a social group. In contrast, wanting to work with people and helping others are positively associated with studying a female-dominated degree and negatively and significantly correlated with studying a high-earnings degree. These are characteristics associated with a traditional female role: nurturing and, thus, exhibit the

expected signs. Notice also that studying a female-dominated degree could possibly be correlated with an aversion to mathematics and science: whereas having a preference or aversion towards these subjects is not significantly correlated with having a high-earnings degree it is significantly and negatively correlated with having a female-dominated one. Although all the correlations are relatively low, these results suggest that more ambitious women are more likely to end up in high-earnings degrees, while more nurturing and more averse to mathematics and science women choose female-dominated subjects[43].

TABLE 12:

Correlation coefficients between degree choices and possible reasons to study a particular program

	High-earnings degree	Female-dominated degree
To earn a high income, be well off financially.	0.1592*	-0.065
Job security.	0.0263	0.0249
To be economically independent.	0.0238	-0.0456
To get an academic education, learn more.	0.1497*	-0.0572
To help other people or creatures (planet, etc.).	-0.1622*	0.0535
To research, develop new technologies, innovate.	-0.1058	-0.0546
To work with people.	-0.2091**	0.2178***
To make your parents or mentors proud.	0.1091	-0.0305
To have prestige, be successful or influential.	0.1534*	0.0079
To create art.	-0.0761	0.0921
To study or work with math or science.	0.0005	-0.2032**
Not to study or work with math or science.	-0.101	0.1206
To follow a family tradition.	0.1713**	-0.1005
To be happy.	-0.0729	0.0194
Allow time for family and children.	-0.0768	0.0642

Source: Online survey.

* p < 10%, ** p < 5%, *** p<1%

[43] Considering that the academics surveyed might be a more homogenous group than the female population as a whole, these correlations might suggest a stronger relationship among these variables for the female population.

As mentioned earlier, getting an academic education and learning more about a subject stands as the main reason for going into a particular program of study. This suggests two things: for high school students what matters the most is actually getting to university and they identify their initial choice of degree based on tastes for particular subjects. That is, people identify holding a degree as the threshold giving access to more opportunities later in life, but they do not necessarily distinguish between particular degree programs, so that going to university is their final goal at this stage. Access to university also extends the student life and preparation for adulthood, allowing students more time to mature and cultivate themselves both as specialists in a particular subject and other spheres of life. This point is clearer when respondents were allowed to express their particular experiences:

> *"I was able to do it, and was unready to start a job, marry, be grown up..." (id== 1857103394, age 60)*

Going to university is then seen as the next step for a brighter future, but the degree choice does not seem to be a fully rational economic decision, or at least, women do not seem to know or have all the information they need to make the choice. At the time, what is clear is that going to university offers more opportunities than not going:

> *"I knew I needed an academic title, incl. PhD to get to do the job I wanted […] the topic was fairly unimportant: I looked at economics and civil engineering too. [Final degree option] was just a random thing." (id==1857520967, age 44)*

> *"Trying to get to University was infinitely better than the 'choices' otherwise available to me (a not very bright 17 year old); they would have been domestic science college (to be a cook) or teacher training college (to be a primary teacher). I opted for a discipline [name omitted] of which I had never heard until I came to it in the UCCA handbook of degree programmes - it looked interesting and there were no required A level subjects." (id== 1856332413, age 60)*

Attending university can also be the result of peer pressure and expectations to continue education, as for id== 1857501055 (age 33):

"I was only 17 when I chose my degree and I'm not sure that I had much idea about what I was doing, but just did the same thing that my friends were doing."

For others, what is important is the choice of university, i.e. getting admitted into a prestigious institution, but not the program of enrolment to which they finally opt relying on their taste. Although, one would also expect the degree choice to matter to them, choosing a prestigious university signals the labour market a higher ability and is associated with higher wages (Dale and Krueger, 2011), reflecting an underlying concern for both economic and social status, even if this concern is not explicitly expressed, as in the following two cases:

"Chose it rather late in the day. Wanted to go to [prestigious university] more than study a particular degree. However, [the subject chosen] was always a passion." (id==1856914491, age 42)

"[University] was beautiful and I was good at [this subject] at school. My parents had not been to University, so it was an adventure- exciting- my own." (id==1855828208, age 51)

According to the human capital model, peer pressure, postponing adult life and the likes are not relevant economic variables when making investment decisions in education and, when asked, in general, women approach their degree choice, not as an economic investment, but as an opportunity to cultivate their interest in a particular subject. This shows an idealistic view somehow disassociated from the labour market, to which they do not refer to. The primary concern seems to be satisfying a taste for a particular field of knowledge, without questioning whether there would be a job available afterwards or what income or opportunities this degree will offer. As someone puts it:

"When choosing my degree as a teenager, I thought [my choice] offered a combination of science, helping people, taking responsibility and having an intellectual challenge. The spin off benefits of security of employment and salary etc. did not cross my mind." (id== 1855859570, age 46)

Hence, for most women interviewed, the degree choice is driven by their taste or preference for a particular subject. At this point it is worth mentioning two approaches on education: on one hand, a tradition that can be traced back to Ancient Greece tells us that the main objective of education is to facilitate personal flourishing and, on the other hand, the human capital model states that investment in education is dependent on its return, so that it is no different from any other economic decision, where individuals invest in order to maximize their gains. Both of these approaches are right and one would expect people to take both arguments into consideration when making a degree choice, for a person cannot flourish if she is unemployed or forced to work in harsh economic conditions and, at the same time, choosing a degree solely on its economic return could ultimately drive someone to unhappiness if she does not enjoy at all the task associated with her job. However, the data collected clearly shows that women are very concerned about the first approach but not so with the second when they make their degree choice, so that personal fulfilment with no reference to economic conditions seems to be their main concern. From an economic perspective, this suggests that individuals are myopic when choosing their degree. There is evidence suggesting that people who consider financial well-being do, in fact, choose career tracks in high-paying fields of study, like business and engineering (Hilmer and Hilmer, 2012). However, the question is why is not everyone concerned with this as the theory suggests? The literature does not seem to support the hypothesis that individuals are consistently able to plan their career. For example, Croll (2008) finds that, although most teenagers (without distinction of gender) have occupational aspirations, there is a mismatch between them and the effort required, necessary capabilities and possible outcomes attached to them. In fact, only 2 of the respondents mentioned being concerned about their job opportunities later in life and in both cases their economic future was uncertain: in one case, she wanted to escape her poverty background and, in the other, she was going into the labour market during a recession and feared unemployment. For the rest, their personal tastes seem to drive the decision, as illustrated by the following statements:

> *"I also enjoyed the subject and felt that was important when studying intensively for a prolonged period of time." (id==1858446415, age 42)*

"I chose the subject I most enjoyed, and was most interested in" (id==1857712986, age 53)

"It was the most enjoyable topic at school" (id==1857595086, age 50)

"I loved the subject" (id==1857498801, age 34)

It is also interesting to focus on what is not said: being happy was mentioned as being the main reason for choosing a degree in less than 5% of the cases (Table 11) and showed an insignificant correlation with it (Table 12). At the same time, variables associated with income, power and rank were only weakly correlated with choosing a high-earnings degree program; and wanting a high-income and economic independence were not important reasons in choosing a degree for most respondents. All these variables, however, are key in making an economic decision. Further, none of them were mentioned by the respondents when they were given an opportunity to express their opinion. Ambition, it seems, is still taboo for women. For a while now, feminist literature has studied how women learn from an early age that having ambitions and personal projects are considered unfeminine (de Beauvoir, 1999, p. 277 and Friedan, 2010, pp.5, 288). Coria's studies (1986, 1991) unveil how women sublimate the anxiety and guilt that income and wealth give them in their personal relations and argues that such guilt is produced by what she calls, the sexuation of money: generating income, its availability and taking economic decisions are all symbols of male power and sexuality, so that women experience them as a transgression. Since income and economic independence are related to masculinity, women avoid claiming them as their own, not to jeopardize their personal relationships and self-image. The absence of arguments related to personal ambitions in terms of rank, power or wealth when inquiring about degree choices might reflect exactly this: women do not feel entitled to put their personal happiness, economic well-being, prestige or ambition first, since this is considered both selfish and unfeminine. Particularly, they do not frame their degree choice as an action for taking, but as giving: studying a subject because of love for it, wanting "*to put the world to rights*" (id== 1856299532, age 48), helping people or assuming responsibility are more laudable reasons than planning for your own financial well-being.

There are also glimpses of tension in their relation to math and science. As stated earlier, the correlation coefficients reflect some kind of aversion to mathematical and scientific subjects for those women choosing female-dominated degrees. But when commenting about their choices, some women feel the need to clarify that there is neither an aversion nor a split among the different fields and that their personal choice is only driven by their own taste, but not by any gender role imposition or lack of ability on their part:

> *"There seems to be an underlying assumption in this scale that people may choose an Artsy subject in order to stay away from Science or Maths. I am not convinced that is the case. If as a child I had more of an inclination for languages than for science (for whatever reason), then it felt absolutely natural to do languages and it wouldn't have crossed my mind to do science. Staying away from Math or science was clearly not on my list of reasons for wanting a degree and career in [the subject chosen] - it just simply didn't come into it at all." (id==1856282671, age 35)*

Perhaps because sex-typing of subjects has been widely studied (Levy, 1972; Hartmann, Kraut and Tilly, 1986; Reskin and Hartmann, 1986; Walby, 1988; Hanson, Smith and Kapur, 2000; Calabrase Barton and Osborne, 2000; Rosser, 2001; Glover and Kirton, 2006) and some even claim it to be biological (Brizendine, 2007; Fisher, 1992, 2011) it seems reasonable to assume that most of these women are aware about the social association of mathematics and science with masculinity and perceive this sex-typing as politically incorrect. Therefore, when asked, they react with this need to state that such difference does not exist, although, for them is "natural" to choose languages or any other traditional female path. And this is precisely what this study intends to look into, because as Whitehouse notes referring to computer use, women acknowledge a parity in skills and abilities with men, but "*do not apply this belief to themselves*" (Whitehouse, 2002, p.211). They see themselves as an exception or as having an "inclination", so that what "feels natural" to them does not have to be so for other women. But the question remains, why would it feel natural to them? What prior experiences make their decision seem "natural"?

Moreover, the commentaries also reveal a pattern of what some authors refer to as a "leaky pipe" (Rayman and Pearson Stewart, 2000): the process by which women opt-out or drop-out of certain subjects because they seem incompatible with their female roles and,

therefore, challenge their own identity. This pattern has been observed in science (Rayman and Pearson Stewart,2000), engineering (Rosser, 2001) and computer science (Margolis, Fisher and Miller, 2000) and is associated with feeling isolated, not fitting in, losing self-confidence in their performance and ability or questioning their own motivation once they join a particular department. The following two testimonies illustrate this. In the first case, self-confidence in mathematical abilities was lost, while in the second one, fear of isolation and the need to find a new purpose motivated the transfer to a different major:

> *"I initially was pre-med my first year, but discovered that I was not as proficient in the higher maths as my high school grades led me to believe. I soon fell behind and by the beginning of my second year was looking for a new field." (id== 1857791073, age 39)*

> *"I originally went to University to study Pure Maths and Statistcis but I was also interested in people and so wanted to combine these subjects with a social science. [University] offered that possibility. Once there, I realised that I was more interested in the people (ie where the numbers came from), than I was in the numbers per se and was able to change the balance of my degree programme to focus on psychology and drop maths and stats after the first year" (id== 1857089280, age 60)*

The latter testimony also reveals another pattern observed by Rosser (2001) and Margolis, Fisher and Miller (2000), according to which women prefer multidisciplinary programs and have a motivation to help others, so that programs can become more female-friendly if they manage to integrate these two aspects in their curriculum. Parallel to these authors' findings, the following statement illustrates how some women might be driven by a desire to help others and contribute to society, particularly, if their background has taught them about the struggles in life. In some cases, this desire is framed as an abstract ideal; in others it responds to a specific experience in childhood that directly impacted their life and worldview. In none of the cases, however, is the desire to help others explained as innate, but rather, it obeys to a life experience and feelings of empathy for those in need, as illustrated in the following cases:

> *"I'm not sure I ever 'chose a career'. I looked for work (class distinction!) I chose work which 'did no harm' and if possible might enable me to do a bit of good. I had a*

politicised world view probably derived from an inner city migrant upbringing and awareness of my friends and family's histories of poverty." (id==1856299532, age 48)

"Lots of bereavement, illness, bullying, and eating disorders made me more concerned with psychological wellbeing than the average person. I wanted to help others going through hard times." (id==1857427324, age 25)

"Seeing my grandfather lying ill in bed before he died and not knowing what that meant and what to do" (id==1857454926, age 36)

"My entire family (on both mother and father's side) are employed within the public sector in 'caring' professions, including doctors, dentists, nurses, teachers, social work, youth work. I always wanted to work in a profession that supported others who were more disadvantaged than myself, which was undoubtedly influenced by the work ethos of my family" (id== 1856877733, age 30)

Finally, the lack of career advice and admission requirements to university influences the choice of degree. Because in the United Kingdom students are required to take a certain amount of advanced level qualifications (A-levels) in order to move on to university and because students are not well informed about the different degree options offered to them, some students might choose degrees among the subjects they are already acquainted with and feel confident with. If girls are put down in subjects like mathematics and science, they will not choose them later on, either because they fear them or they ignore they could do well in such programs, as illustrated by the following examples:

"When in school I was interested in working in psychology. I spoke to the Educational Psychologist to get a feel for how to go about this, but was discouraged from going into psychology for a career. The reason for this was because the EP felt psychology was 'all numbers'. Disliking maths at that age, I naively believed the EP and subsequently chose not to do psychology for college (choosing instead an arts based course which reflected a 2nd career choice - writing). I continued with this until a first year of University, then dropped out to go back to a [female-dominated] degree, as this was what I wanted to do." (id==1872502808, age 29)

"Studying [female-dominated degree] which had a lots of stats made me realize that I was ok at maths (when I had not been very good at it at school although I did it to A level). There was little by way of subject guidance into university - most people take versions of subjects they took at school. I would actually have been quite happy to go down all manner of routes if I had known enough about them and had been enabled to think I might be good at them. Marine biology, for example, or . . . but there was never any guidance to encourage you to look outside of what you know and this seems to me to be still largely the case." (id== 1856889822, age 54)

Further, because of admission requirements, the A-levels could restrict the university options later in life. Although, there are exceptions to the rule and some students might actually switch to subjects not yet explored in order to try new things, as in the following case:

"I didn't know what to study. I didn't want to do any of my A-levels as a degree, partly because I didn't know what they may lead to. I just wanted to go to uni and in the same year as all my friends. I chose a subject I hadn't studied before. In hindsight it's rather surprising it worked out as well as it did!" (id== 1856228805, age 31)

In general, the comments on how women come to choose a particular degree show that they do so without much information about their options, they are primarily driven by their preference for a subject, their desire to go to university and a lack of concern or ambition regarding their economic well-being later on.

4.3.1.2. Role models and others' influence

The questionnaire also explores whether someone influenced their degree choice and how they influenced it. Less than half of respondents (47.9%) had someone influencing their degree choice and this is weakly but significantly and positively correlated with holding a high-earnings degree (0.27) and insignificantly correlated with holding a female-dominated degree (-0.0223). Among those whose decision was influenced by someone, half of them were influenced by a teacher or counsellor and about the same proportion were influenced by their mother (36.2%) or father (37.7%). At the same time, a lower percentage of them were

influenced by a friend (8.7%) or other relative (2.9%). The above responses are in line with Reskin and Hartmann's (1986, p. 115) argument that it is teachers, and not parents, who play the most influential role model and, thus, suggest that the type of encouragement at school might be crucial in promoting female career options.

It is also interesting to note how easily impressed teenagers are and how malleable their decisions seem to be, given the lack of information they have at the time. Over a fifth of respondents acknowledge that they were influenced by someone who suggested them a degree program or gave them some kind of career advice. In most of these testimonies, the respondent did not have enough information or even certainty about their preferences or options, so that they relied on an adult to guide them and were willing to accept their suggestions as their own decisions. What is striking is that this is the most popular mechanism respondents identified as been influenced by. This guidance goes from introducing them to potential programs and providing them information about them, encouraging them to study something they are good at or discouraging them from studying certain programs, as the following examples illustrate it:

"Simply made suggestions" (id== 1856854756, age 30)

"Discussed options and guided me" (id== 1856268662, age 27)

"Suggested I would be happier (in terms of my personality) following science degree as opposed to English/Arts." (id== 1857488852, age 37)

"Basically, everyone assumed you would do something you were good at. I started out in Physics and after three year realised that I didn't really like it that much. A professor at [University] encouraged me to take more psychology because I was good at it." (id== 1855819332, age 52)

"strongly recommended not studying modern languages (my other main option)" (id== 1859342999, age 49)

Only in a few cases, respondents were actively encouraged to explore the potential field of study with greater depth, either by giving them access to activities beyond their school curriculum or to professionals within the field that could provide them with more background and information to make an informed decision, like the following cases:

> *"My parents influenced my degree choice in that when I showed an interest in my chosen subject they provided resources for me to learn as much as possible about the subject before I entered the University. One of those resources was a family friend who was a psychiatrist, and from whom I learned a lot about psychology and brain biology." (id== 1869210672, age 38)*

> *"My uncle is an engineering fitter and he is pretty cool -- he gave me 5 pounds when I said [what] I was going to become! My teachers were very pleased to have a girl who was good at maths and science in a pretty rough comprehensive school. I was also sent by the school to a free 2 day programme that encouraged girls to become engineers." (id== 1875963742, age 41)*

The latter testimony provides several ways of encouraging a girl into a non-traditional degree: (i) the presence of a role model who is perceived as interesting, (ii) an economic reward mechanism, (iii) teacher's encouragement signalling some type of affirmative action that makes being a path-breaker seem positive, and (iii) enrolment in extracurricular activities that require active involvement and participation in non-traditional female fields of study. All of these support the initial hypothesis that changing the way girls experience and relate to certain fields of study can open up to them a wider range of possibilities. Further, in only 3 of the testimonies gathered, students were advised to think about their economic future, suggesting that the advice they received also neglected the market information. That is, in the same way that respondents did not consider their economic well-being when choosing a degree program, the people advising them on the subject did not consider it either, except for a few exceptions like the following:

> *"They [parents] wanted me to do something that would get me a job later." (id==1856197583, age 42)*

"[Father] Advising me to take a degree on something with future" (id==1856090379, age 31)

"[Parents] talked about high prospects of employment after degree" (id==1855862177, age 39)

It is also interesting to note that, in some cases, the advice received encourages students to enrol in more mathematical or scientific occupations because they are associated with higher status or ranking. This argument shows up as many times as the concern for employment and economic well-being and, in both cases, the concern is rarely expressed, but when it is present, the father is always involved, suggesting that the father is more preoccupied about income, status and rank. Having this type of encouragement from the father to explore non-traditional degree options has a special relevance if it holds that "*the father, rather than the mother, is the major socializer of "sex-appropriate" behaviour for both boys and girls*" (Levy, 1972, p. 12).

"At the time, my mum and brother read a lot of psychology books - although more in the therapy and 'pop' psychology realms. It sounded interesting. I'd thought about zoology (again, not something I'd studied but I'd always wanted to work with animals/wildlife/nature) and my dad said it was the 2nd easier course to get onto (implying a bit of a waste of my predicted AAA maths biology chemistry grades)." (id==1856228805, age 31)

"I was undecided between a degree in Math and a degree in Natural Sciences. He [father] made me reflect on the fact that there were less students willing to study [high-earning degree] and since it was one of my favourite subject I choose that degree" (id==1855958555, age 38)

Hence, the pattern observed throughout the testimonies is a lack of information and real knowledge about the different degree options and a need for more substantial career advice that can allow the potential students to explore with the field of study before university enrolment.

The second most cited way of influencing a degree choice is the presence of a role model, which can take two forms: students either have someone in their life who has a similar degree and they follow their steps (14.5%) or they have someone (usually a teacher) who engages them into a subject by being enthusiastic and passionate about it (12.9%). In both cases, there is an adult figure that makes a positive impression on them. The first case usually refers to parents or people who have made a difference in their lives and whom they relate to outside the school environment and so offer students a particular view of how life within a certain profession can be like, as in the following examples:

> *"He [father] worked all his life as a [medical related professional] and that increased my awareness of the links between poverty, disadvantage, mental health etc. He was also fairly strident politically which also had an influence on me in terms of leaning to the left and as a result developing a social conscience. I was not particularly aware of this influence at the age of 18 but have understood and recognised it more as I have matured." (id== 1857456338, age 45)*

> *"My mother and my step mother both worked in [subject omitted], which I thought I wanted to go into. I also took a personality test administrated by my step-mother to assess my skills and suitability for it as a career." (id== 1856963255, age 27)*

> *"personal experience with serious mental illness from pre-teenage years and meeting an amazingly helpful clinical psychologist helped spark an interest in the area. I knew I wanted to do something that would make a real difference." (id== 1857469946, age 33)*

In the case of teachers, they seem to influence the student differently, not showing them a particular lifestyle or dynamic associated with a subject as the parents or other role models might do, but engaging the students in a particular subject, sharing with them a passion for it and transmitting and building self-esteem and confidence in that subject:

> *"I enjoyed their lessons and their general approach to the subject, and they encouraged me to think that I was good at the subject and could contribute something to it." (id== 1856334167, age 55)*

"Her enthusiasm for her subject & her subject knowledge. Her personality - quiet, assured, interesting" (id== 1856285878, age 45)

Although most girls seem receptive to career advice, this does not mean that they do not filter or question the information they receive and weight it against their own preferences. And evidently, the tone and content of the advice is important as well as the respect the adult has earned from the student. Whereas some advice might be positive and intended to guide students, other can be negative and limit the girl's options:

"Headmaster asked me when I was 10 what my favourite subject was. When I said 'maths' he said 'don't be silly, little girls don't like maths'. I was so incensed that I determined there and then that I would go to University to read [high-earnings subject]. My father would really have liked me to follow in his footsteps as an engineer but accepted it as a second best. I suspect that if I had applied for Psychology in the first place he would have tried to talk me out of it." (id==1857089280, age 60)

As the previous testimony illustrates, some of the advice reveals a gender occupational segregation bias, so that girls are encouraged to go into female professions or to abstain from becoming path-breakers in male-dominated fields. In this particular case, the girl was not discouraged from her chosen degree because she found the support she needed at home and her father highly valued the scientific-oriented disciplines, but this could have discouraged any other girl with less self-esteem or less support at home. Gender occupational segregation can also come in more subtle advice. In the next example, a girl is encouraged to choose a profitable degree option among the female-dominated options; i.e. up to some degree, she is encouraged to enrol in a program that would make her economically better off and that is not as traditional for women, but is still considered appropriate for them:

"In my era, bright girls who were good at science were encouraged to go into medicine" (id==1857441313, age 49)

In synthesis, about half of the respondents claim to have been influenced by someone when making their degree choice and this influence tends to come mainly in the form of career advice or through a particular role model. This advice rarely actively encourages girls to

explore a field before choosing a degree choice; it tends to associate mathematical and scientific degrees with higher rank or status and shows some presence of gender occupational segregation.

4.3.2. School environment

Because teachers seem to play such an important role in the student's decisions later in life and because this information was missing from the 1970 BCS, the questionnaire specifically asked respondents about gender differentiated treatment at school. Most respondents (90%) attended co-educational institutions and 70% of them claim to have received the same treatment as the boys, which reflect a positive perception of the gender-equality among the school system. For those who experienced a different treatment between genders at school, the differentiated treatment can be grouped in three categories: (i) a more lenient treatment towards boys, (ii) active discouragement to girls and encouragement to boys and (iii) subject sex-typing. While all of the above are consistent with school behaviour analysed in feminist literature, it is also worth noting that in some cases, respondents cannot specifically recall the implicit differentiated treatment, although they were aware of it, suggesting that it is subtle, but nonetheless it is there.

Levy (1972) notes that teachers tend to be more lenient with boys because they are afraid of being accused of feminizing them. Also, because gender role stereotypes dictate that boys are more active, rough and independent, teachers tend to discipline them less, while they expect girls to be more obedient and docile, as illustrated by the following examples:

> *"I think they expected the girls to be better - to be better behaved, work harder and produce higher standard work. But in the classroom the boys were louder and dominated the space." (id== 1857456338, age 45)*

> *"Laxer attitude taken to boys work" (id== 1856297344)*

> *"Girls seen to work harder and be more serious" (id== 1856384645, age 50)*

This different attitude toward girls and boys, grounded on the belief of differences in personality by gender, leads teachers to reprimand girls more than boys and to encourage or stimulate boys more than girls, in part because teachers expect more from boys or, at least, figure that they have to be trained for "the real world" (as opposed to girls). While girls receive feedback in the form of negative remarks that directly affects their self-esteem and that is mainly intended to make them conform to social standards, boys receive task-oriented feedback which allows them to work on and improve their skills (Levy, 1972, p.12). At the same time, boys are allowed to call out answers more often than girls and they are heard and praised for them while girls are told off and asked to raise their hands (AAUW, 1992, p.2). This pattern has been observed to be even stronger in math, science and technology classes, which not only signals sex-typing of subjects, but also that boys' careers and interest are more important than the girls' (Hanson, Smith and Kapur, 2000, p. 264-265). The testimonies gathered in the questionnaire seem to confirm these experiences regardless of age, since this differentiated treatment towards girls is still prevalent among the youngest respondents. Not only boys get more attention, their future is deemed more important as well:

> *"While both would be successful, it was assumed that women would be much more interested in having a family. Some of the teachers were very conservative in their approach to morals and religion. However many also encouraged girls to do sports, science and mathematics, so it was not all the teachers in the school. I found generally those who held gender stereotypes tended to be male, while women teachers in subjects ranging from English, History and Science were inspiring." (id== 1856963255, age 27)*

> *"More of an expectation that at some point, a woman would take time off work and stay at home to take care of children. We were encouraged to factor this in into our choice of further education and the cost of our education." (id== 1861944827, age 31)*

The latter clearly illustrates how girls might be discouraged from investing in education, since the expectation is for them to stay at home. Recall that this is consistent with Becker's (1991) sexual division of labour in the household: if sex roles are taken as given, women would specialize in household production and will lack an incentive to invest in human capital. The underlying problem remains: which is that sex roles are taken as given. Not only

boys careers are prioritized over the girls', respondents relate such experience with girls enrolling less in certain subjects during the senior years of high school education; as illustrated by the following testimonies:

> *"I think my subsequent research may bias my answer but just the usual – boys were 'gifted', girls worked hard. Boys tended to 'get away' with behaviour that girls probably wouldn't. But we were encouraged by the (male) physics teacher to take all three sciences at 16 - which many of us did. Only the two with doctors for fathers continued with science into A levels and degrees." (id== 1858912717, age 40)*

> *"Less was expected of the girls. However once in the Sixth form the difference disappeared. (But there were not very many girls in the Sixth form: only two of us doing double maths)" (id== 1857089280, age 60)*

The previous examples reinforce some of the issues already mentioned. In the first case, it seems that the father figure is again present in pushing girls into more scientific areas; and in both examples, respondents clarify that there was no explicit discrimination once girls got to a certain level, i.e. once they had proved their competences, so that the main problem is that of the leaky-pipe mentioned earlier, where women "voluntarily" drop-out or choose not to enrol in certain subjects. It also reflects what Glover (2000, p.12) calls the Marie Curie effect: women do not go into science, because of the perception that it demands huge sacrifices on their part, personally and in terms of effort, in order to succeed in such a competitive and hostile environment. This also relates to the constraints that entry requirements may impose on girls: if the leaky-pipe is present at early stages of the educational process so that it already affects the A-level options, girls would be even more limited in their degree opportunities when they reach university because they have opted out of particular subjects. The previous cases also illustrate how subjects are sex-typed: particularly, mathematics, science, technology and sports are assumed to be male subjects, while arts and humanities are assumed to be female. In fact, sex-typing of subjects comes up in 57% of the testimonies collected, making it the most constant memory respondents recall about differences in treatment at school. The following are a few examples:

"At O level, we were told that girls did biology, history and Latin, whilst boys did physics, chemistry and geography. I did the latter, which irritated the Head, but he could not enforce his directive. We were not allowed to do unsupervised basketball, but the boys were. We had a dragon deputy head for girls, but the boys had a real softy. But it was the 1970s." (id==1857468287, age 53)

"Differences in attention given in various subjects e.g. girls were frequently given more attention than boys in English but less attention in Science/Maths. Sexist and sexual remarks were often made towards female students (by teachers) whereas this was never the case for male students." (id==1861089208, age 34)

"Segregation -- Boys got to do "boys subjects" (metalwork, woodwork); girls got to do "girls subjects" (cookery, needlework)" (id==1857712986, age 53)

"After our senior Maths teacher returned to NZ from a Year teaching in an all boys private school in the UK he decided that Only boys were allowed to enter Maths competitions. - Despite protests from both the Girls and boys in our maths class" (id==1857262693, age 37)

While age could be a factor in exemplifying which subjects were available at school, it is clear from the testimonies that sex-typing is prevalent, regardless of the cohort group, i.e., while metalwork or home economics might not be as available now as they used to be in the 1970s, sex-typing of subjects is still present, although it may take other forms. Other differences in treatment are also evident in these responses, particularly, the case of sexist and sexual remarks aimed at harassing and diminishing girl's self-esteem and confidence; active exclusion of girls in extracurricular activities, such as competitions, and the underlying belief that it is not worth investing extra time on girls, which is exemplified by such exclusion. Hence, whether it is subtle or explicit all these testimonies give account of school environments that do not give the same attention and encouragement to girls, particularly when it comes to the sex-socialization of subjects.

4.3.2.1. Teachers' behaviour towards math, science and technology

Participants were also asked whether they were ever encouraged or discouraged by teachers to learn or explore with mathematics, science or technology. More than two thirds of respondents (68.3%) replied they were encouraged to explore with these subjects by a teacher, while about a fifth (21.8%) were discouraged to do so. As expected, having been encouraged (discouraged) to learn these subjects is positively (negatively) correlated with obtaining high-earning degrees and negatively (positively) correlated with female-dominated degrees, with correlation coefficients equal to 0.1407 (-0.1611) and -0.1401 (0.1218) respectively. Once more, the male figure seems to have a higher relevance in the recollections respondents make about their earlier experiences: 64.9% of those who were encouraged to explore and learn math, science and technology had a male teacher, a slightly higher percentage than those encouraged by female teachers (52.6%), while 83.9% of those who were discouraged to do so had a male teacher; 3.7 times more than those cases discouraged by female teachers (22.6%). Not only male teachers play a more frequent role in cultivating these subjects of study, but their importance is accentuated when discouraging girls.

When asked about how teachers would encourage them to explore math, science and technology, responses vary widely, but three tend to be recurrent and, as in previous answers, the encouragement is not as active or open as one would initially expect. Most of the encouragement is experienced as (i) a shared enthusiasm for a subject, (ii) counselling to take more advanced classes or exams and (iii) support aimed at improving their self-esteem and confidence in the subject. Usually, this comes as a process: students show interest in a subject if the teacher is able to explain it properly, relate it to everyday life, and make it seem easy and interesting, while the teacher's enthusiasm is, as someone said (id==1857791073), "*infectious*". As the teacher makes the subject appear easy to understand and exciting, students build their self-confidence, which is strengthened if the teacher supports them to study the subject further. In particular, suggesting taking advanced examinations on a particular subject represents a vote of confidence on the student's capabilities, since they are advised to present exams on those subjects in which they have a relative advantage.

"He was an inspirational teacher, made maths fun and made me believe I could do it. A different teacher told me to do Chemistry A level because I was good at GCSE" (id==1857787557, age 24)

"Our maths teachers were extremely passionate about their subject, which made it a very enjoyable subject. This was one of the main reasons I took Maths at Alevel" (id==1856877733, age 30)

Although less cited, other forms of open encouragement are also mentioned. Respondents recall being encouraged to learn more when they were being challenged to think by themselves, when they were given harder problems, extra homework or books to read, when they received extra tutoring or through competition and reward systems. All these cases point at building confidence in them and at standing out from the group, that is, at being recognized as competent among their peers. However, despite the teacher's effort, sometimes this does not result in building the confidence needed to feel comfortable with the subject, as in the following examples:

"I was given special extra lessons in mathematics along with a male student who was also aiming for [prestigious university]. I was also sent to the 2-say programme mentioned earlier. Basically the teachers were delighted to find any student who was working hard and had some talent and would pour loads of effort into our education -- I did not have any sense that I could do less due to being a girl, and I was very competitive. This changed later!" (id==1875963742, age 41)

"She (my secondary school Maths teacher) actually had more faith in my knowledge than me, she would send me to various competitions - it didn't really work that well!" (id==1857492588, age 34)

"She thought I had talent (I don't). It was feeling rather insecure in this area." (id==1856315236, age 34)

It is also worth noting that women who attended single-sex schools tend to give positive comments about their school experience and feel that they were supported and encouraged to study subjects that are traditionally viewed as male. This is consistent with

some of the previous literature, according to which students attending single-sex schools are more likely to take qualifications in non-stereotypical subjects (Sullivan, Joshi and Leonard, 2008 and Schoon, 2001) and that co-education actually reinforces occupational gender stereotyping (Sullivan, Joshi and Leonard, 2011), although single-sex schooling has no effect in explaining mathematical confidence (Sullivan, 2006). Further, they feel this experience strengthen their own self-confidence and opened wider opportunities for them, as in the following examples:

> *"I went to a state grammar school, i.e. it was free but it was for those passing the 11 plus. This was a single-sex school and a great place to learn (if you did well). My memory is of that the overwhelming majority of teachers being motivational - it was a really feminist place where all the girls were seen as having important futures. I can still remember that my science teacher from years 7-9 wrote in my school report that I was 'a born scientist' - I guess the teachers knew how to motivate us because praise worked for me! My GCSE biology teacher was also full of praise. The a-level biology teacher also knew how to motivate – she commented at parents' evening that she'd heard great things about me and was yet to see them. So I made more effort and her coursework comments reflected that. So, at our institution, it was very much about praise and disappointment!" (id== 1856228805, age 31)*

> *"Being at an all girls comprehensive school was very good for me as I was not very confident in my teenage years and I could easily have been put off science if there had been a culture of favouring boys in the school." (id== 1858496175, age 45)*

Finally, other forms of encouragement involved enrolment in extracurricular activities, such as math competitions and science clubs. These provide additional space for the students to feel empowered and improve their understanding of a subject by providing an approach that makes the subject more appealing and available to the student, like in the following cases:

> *"I was asked if I wanted to join the Maths club, in order to improve my maths. I was not very good at science but my female biology teacher in particular made the class interesting and interactive, doing dissections. I always enjoyed getting involved." (id==1856963255, age 27)*

"after school clubs and individual work and freedom to experiment with scientific concepts and methodology" (id==1856394729, age 60)

In contrast, for those students who were discouraged in mathematical or scientific subjects, such discouragement came in the form of gender discrimination, inappropriate course taking, violent or ill treatment, jokes and name calling, bullying, poor teaching, refusal to help them, comparisons to siblings, patronizing behaviour, mathematics as punishment and, particularly, being told that they could not do or understand certain activities or subjects. According to the testimonies, some women experienced less attention or felt neglected in class because of their gender; others were excluded from extracurricular activities because of it and others felt they were intruding in a 'boys club', as in the following cases:

"By constantly ridiculing the female students and refusing to allow them to enter maths competitions (even when they had equal top of the class marks as the top boys)" (id==1857262693, age 37)

"Not personally. Physics: I struggled with this more than with any other subject at school. Simultaneously class felt very much like a 'boys' club' - I was one of only two girls in advanced class. Similar with advanced maths. Gave up physics, and took less advanced maths. Don't regret the physics, but do wish I'd managed to get on top of the maths, as had always loved it up till then." (id==1855858904)

All of the above constitute alienating experiences for women. In particular, as Hanson, Smith and Kapur (2000, p. 262) point out, most girls avoid being path-breakers, because this implies a higher cost to them, in terms of isolation, not having girlfriends, having to fit into the 'boys club' and, in general, having to negotiate their gender identity. So, even if the discouragement does not come specifically directed at them, girls will eventually drop-out or stop enrolling in such classes simply to avoid these feelings. In other cases, such as that of girls being excluded from math clubs and extracurricular activities, the exclusion is more obvious and even violent and is intended to tell the girls that they are not good enough, or capable enough to study the subject, as in the following examples:

"Threw a book at me once, and generally not a very encouraging teacher to either girls or boys, only encouraging to those girls and boys who had an aptitude for it." (id==1861901434, age 39)

"He would make jokes about my 'lower' mathematical ability (and achievement) and would explicitly prioritise helping other students ahead of me as a result. He expressed negative views about my academic ability more generally; my seeming lacking talent in mathematics was taken as indicative of my lacking talent overall. Ironically I went on to study higher mathematics at A-level and achieved much higher marks than I had done at GCSE Maths (but was taught by a different, and very encouraging, teacher at A-level)." (id==1861089208, age 34)

"called me an "illiterate scientist"" (id==1857712986, age 53)

"He said that it would be too difficult as 'my' brain wasn't wired right for science" (id==1857815848, age 49)

"I was very good at technical drawing when we did it within our craft/practical skills work during years 7 to 9 (aged 11 to 14). I really loved it and my mother worked in an architect's office so I toyed with doing it at O level. The teacher told me in no uncertain terms that this was a stupid thing for a girl to do and I should do art instead (which I did). I have always regretted it - not that I think I would have ended up as an architect but I just loved the subject." (id==1857456338, age 45)

All of the above reinforce a feeling of inadequacy and the idea that one has to be especially smart to enjoy mathematics or science while undermining the student's self-esteem. In other cases, students do not suffer insults, but are given the same message by comparing them to a more skilful sibling and thus, learn to lower their expectations on their own performance in the subject, like in the following case:

"There was a lot of comparison between me and my older brother, with myself being compared negatively. A couple of teachers, both male and female, were surprised when I did well in assessments but didn't perform well in class." (id== 1857501055, age 33)

Although most of the testimonies refer to active discouragement from the teachers, some of them were discouraged by poor teaching, which came in two forms: (i) either the teachers were unenthusiastic, insecure or did not dominate the subject properly, or (ii) they signalled that the subject was difficult and tedious by giving homework as punishment, as illustrated by the following cases:

> *"I was never discouraged verbally, but I had a very poor male maths teacher and as a result my interest and ability in maths decreased. I also had a very poor female science teacher for some lessons (1 of the 2 teachers that taught me science) who also affected my interest and ability in this area." (id==1857437149, age 25)*

> *"I had a really dull female physics teacher at secondary school whcih put me off physics for life, and a fairly dull chemistry teacher at sixth form which put me off that too." (id==1856271625, age 28)*

> *"Maths was set as a punishment in my primary school...." (id==1855828208, age 51)*

In synthesis, the school experiences indicate that students can engage in a subject through a process in which they need stimulating and enthusiastic teachers. They are further encouraged to learn and explore with mathematics, science and technology when they receive special attention that makes them feel confident about their own abilities, such as participating in clubs, extracurricular activities and given additional homework. In contrast, they are put off when teachers are dull and actively discourage them from a subject by undermining their confidence. For the respondents, such discouragement was linked to the association of these subjects with men, so that they are not considered as capable and they suffer isolation, are the target of jokes and bullying and are excluded from class or clubs because of their gender.

4.3.2.2. Participation in extracurricular activities

Some of the previous experiences point at participation in extracurricular activities as a way to engage girls in less traditional subjects. In order to further explore this, respondents were asked about the kind of extracurricular activities they engaged in during their school years. The responses, along with its correlation coefficients, are presented in Table 13. The most popular extracurricular activities are stage arts and sport clubs or teams as well as community or volunteering work. In contrast, activities related to music, mathematics, science or technology are less popular, with less than 10% of the respondents participating in each of them. More interestingly, participating in robotics, computer, math or science clubs are positively related to both degree choices, probably reflecting a common characteristic among the population, since one would expect the best students to engage in these types of activities. However, only the correlation coefficient between participating in math clubs or fairs and choosing a high-earnings degree is significant. In turn, playing a musical instrument, which is another form of relating to mathematics, not only is significant and positively correlated with studying a high-earnings degree, but is negatively correlated with female-dominated degree choices, suggesting that music may be another effective approach in engaging girls in less traditional female activities. For example, studying music has been associated with enhancing spatial-temporal reasoning both in the short and long run (Rauscher, Shaw, Levine, Wright, Dennis and Newcomb, 1997 and Rauscher and Zupan, 2000), so that the same neural activity is required for music and mathematics. If the traditionally male subjects are associated with mathematical abilities, then playing an instrument might encourage girls towards these subjects. In contrast, engaging in stage arts or community and volunteering work is negatively associated with choosing a high-earnings degree and positively and significantly associated with choosing a female-dominated degree. This relation is also expected, since they are both traditionally viewed as female activities.

TABLE 13:

Participation in extracurricular activities and its correlation with degree choice

	Responses		Correlation coefficients	
	Observation	Percentage	High-earnings degree	Female-dominated degree
Total responses	142			
Robotics or computer clubs or camps.	3	2.1%	0.0903	0.078
Math or science clubs or fairs.	13	9.2%	0.2118**	0.0518
Stage arts (theater, dancing, singing, etc.).	64	45.1%	-0.103	0.1419*
Sport clubs or teams.	62	43.7%	-0.0238	0.0262
School magazines or newspapers.	29	20.4%	-0.0242	-0.0231
Community or volunteering work.	51	35.9%	-0.0834	0.1513*
I never engaged in extracurricular activities.	26	18.3%	-0.0588	-0.0965
Debate, librarian or languages societies	6	4.2%	0.057	0.0279
Music, instrument playing	12	8.5%	0.2388***	-0.0806
Political or religious groups	3	2.1%	-0.0105	-0.039

Source: Online survey.

* p < 10%, ** p < 5%, *** p<1%

In particular, taking part in extracurricular activities can offer more informal spaces for the students to explore new areas of interest, as well as their own motivations and goals in life. In this regard, these activities can serve as a chance to try out possible career options, as in the following examples:

> *"Summer school for academically gifted teenagers. Excellent experience socially, as we were all 'nerds', and also intellectually. Studied psychology at one of these and really enjoyed it." (id==1855858904)*

> *"Volunteered in the local primary school and realised I didn't want to be a primary teacher! We were given an opportunity in sixth form to go up to the local University to take part in biology labs as 'taster' sessions for University and this made biology seem like an accessible subject, i.e. I could see the similarities and continuities with what we were doing at school so it didn't seem as uncertain/scary as choosing another subject like, for example, English - which I had no idea how they taught at University level." (id==1857720121, age 30)*

"Voluntary work in an older person's ward made me realise I wanted to be a nurse - I didn't think any further than that at the time." (id==1856312403, age 47)

Beyond school, girls are also exposed to media culture and this might also shape their attitudes towards certain subjects. In general, the literature argues that girls exposed to media culture are more likely to reproduce gender stereotypes; are more prone to depression, more fixated with their image and have more self-esteem problems (Orenstein, 2011). However, some media products might also engage girls into more scientific topics, as illustrated in the following case:

"I was very into Star Trek which made me very interested in science and I considered majoring in astronomy." (id== 1855819332, age 52)

4.3.2.3. Remarks on school environment

As you recall, the questionnaire was aimed at an academic population and, therefore, it targets a particular profile of women, presumably, those who were more successful at school. In fact, when asked about their academic performance, most of them (85.5%) claim to have been at the top 15% of their class[44], excelled in at least one subject (81.9%) and two thirds of them excelled in math, science or technology. Although weak, having any of these characteristics is positively correlated with choosing a high-earnings degree and negatively correlated with choosing a female-dominated one, as shown in Table 14. These results and the experiences documented earlier support the hypothesis that being positively exposed and

[44] Correlation coefficients were estimated to check whether self-reporting being at the top 15% of the class was affected by the school type, but none of the correlation coefficients were significant at the standard confidence levels. This is consistent with Sullivan's (2006) finding that school sector has no effect on academic self-concept.

encouraged to learn math, science and technology is associated with women choosing less traditional female degrees later in life[45].

TABLE 14:

Correlation coefficients between academic ability and degree choice

Correlation coefficients	High-earnings degree	Female-dominated degree
Was at top 15% of the class in high school	0.2404***	-0.1774**
Excelled in at least one subject	0.2085**	-0.0338
Excelled in math, science or technology	0.0222	-0.0917

Source: Online survey.

* p < 10%, ** p < 5%, *** p<1%

While most respondents did not experience a different treatment at school because of their gender, about one out of five of them did. In particular, this differentiated treatment is associated with sex-typing of certain subjects, where girls experience less attention from their teacher and sometimes even bullying or exclusion from certain activities, such as sports, woodwork, math, science and computer. In general, the testimonies suggest that, for girls to feel confident and excited about a particular subject, they require a constant process of enthusiastic teaching, which requires challenges and building confidence and self-esteem in the girl's abilities; whereas discouragement takes a more active form on part of the teacher. And as it is easier to destroy than to build, a particular event can put off a girl from certain areas or subjects, while building the taste and confidence might take longer. At the same time, having the opportunity to participate in other school activities offers a different space for girls to try out possible career options. In particular, playing an instrument and participating in robotics, computer, math or science clubs and fairs are positively correlated with studying a high-earnings degree, while volunteering and stage arts are so with studying a female-dominated degree.

[45] As mentioned earlier, one has to keep in mind that this particular sample is more homogenous than the female graduate population in general, so that it has an overrepresentation of the best students.

4.3.3. Household environment

This section explores the environment and experiences regarding gender, math, science and technology in the household. In particular, this section explores how children were stimulated to play and relate to math, science and technology, whether they grew up with siblings and what their parents' attitudes and aspirations were towards them. Information about their household reveals that, while most fathers (98.5%) worked when the respondent was in school age, only 69.3% of the mothers did so. At the same time, a higher percentage of fathers (47.8%) than mothers (33.6%) were university graduates. Although mothers exhibit lower employment and education than fathers, these numbers suggest that a considerable size of the population surveyed grew up with working female role models and highly educated households. While respondents come from different backgrounds, most of them had parents with professional (61.2%) or managerial-technical (12.7%) occupations; only 18.7% of the parents worked in skilled-occupations and 7.5%, in partly-skilled or unskilled occupations. However, when respondents are asked about their social class, they tend to assign themselves to a lower group, probably giving the impression of a higher social mobility than the one observed when measured by parental occupations. According to the self-reported social class, 25% of respondents come from a working class family, 18.1% come from the lower middle class, 39.6% come from the middle class, 10.4% come from the upper middle class and only 6.9% belonged to the upper class as a child. This suggests a mismatch between the parental occupations reported and self-perceived social class. This is consistent with literature in social ranking: while people are good at identifying social classes, they tend to rank social status according to their own position and, therefore, experience inequality differently according to their social location (Wegener, 1992, p. 268 and Irwin, 2005, p. 135, 160-166). Despite this, it seems appropriate to conclude that, while there is some social mobility, most respondents have a background of educated parents and middle class backgrounds.

4.3.3.1. Toys

Respondents were asked about the type of toys they played with as children. Table 15 summarizes the different toys girls played with as well as their sisters' and brothers'. It also presents the correlation coefficient of the different type of toys the respondent owned with their degree choice later in life. Most of the respondents for this question (92.4%) grew up with siblings in the household: 76.4% of them had sisters and 53.6% had brothers. The results show that a majority of girls had access to traditional toys, such as balls, bicycles, swings, table games, crafts, building blocks, music instruments, radios and dolls. In contrast, access to scientific toys is much more reduced: only between 20% and 30% of the respondents owned chemistry or science sets, telescopes, microscopes, electric trains or remote control cars or planes; and less than 5% owned robots, rockets or gear sets. Similarly, only a small percentage of them owned toolboxes or workbenches (16.1%) and citizen's band radios, computers or electronic games (11.2%). The smaller availability of these toys can have two possible reasons: these toys are not often marketed as neutral; instead, they are marketed for boys, so that when parents buy gender-specific toys, girls receive less of these items (Orenstein, 2011, p. 38; Jacobs *et al*, 2005; and Karbownik and Myck, 2011); or they could be more expensive, so that not all parents can afford to buy them. For examples, robots, telescopes and electric cars are much more expensive than dolls or balls. And, in fact, results show that some of the girlie toys, such as easy-bake ovens or beauty salons are less available, indicating that there might be an economic constraint to the toys children play with.

In order to test for the latest, respondents were also asked about the toys their siblings owned. Beforehand, one would expect the sisters to own similar toys as the respondents. However, if parents do, in fact, give children different toys subject to a gender socialization process, one would expect brothers to own toys that are more scientific-oriented or require more physical activity and girls to own more feminine and passive toys, such as dolls and crafts. When asked about the type of toys their sisters played with, results reveal three patterns: (i) for most items (except four), respondents remember their sisters' having less toys than they, (ii) they report owning considerably more scientific and mechanic-oriented toys than their sisters (building blocks, chemistry or science sets, electric trains, remote control cars or planes, telescopes, microscopes, toolboxes and workbenches), i.e., they remember

themselves being more interested in these type of toys; and (iii) they recall their sisters more interested in the most feminine toys, such as the different types of dolls, easy-bake ovens, vacuum cleaners, make-up sets and beauty salons. Recreating memories is always tricky, so that these answers could be accurate or they could suggest that respondents do, in fact, remember better their own toys than their sisters, which wouldn't be a surprise, since in one case they are being asked about their own experience and subjectivity and, in the other, they are being asked about a third person. The results can also suggest that the memory is recalled in such a way that they remember themselves as conforming less to the gender-stereotypes that could be invoked by the different toys. Or, it could also be that academics are, in fact, more inclined than other girls to play with scientific-oriented toys and less feminine ones.

TABLE 15:

Toys frequently played with during childhood and its correlation with degree choices

	Responses			Correlation coefficients for own toys	
	Own toys	Sisters'	Brothers'	High-earnings degree	Female-dominated degree
Building blocks (Lego, Meccano, etc.).	73.4%	55.6%	89.6%	0.0115	-0.1002
Toolboxes, workbenches.	16.1%	6.2%	38.8%	-0.0183	-0.0405
Electric trains, remote control cars or planes.	22.4%	13.6%	74.6%	0.077	0.0045
Puzzles or table games.	85.3%	70.4%	64.2%	0.124	-0.1341
Chemistry or science sets (magnets, electronics)	28.0%	14.8%	35.8%	-0.1518*	0.0331
Telescopes, microscopes.	26.6%	9.9%	29.9%	-0.0649	-0.0211
Robots, rockets, gear sets.	3.5%	1.2%	22.4%	-0.0661	0.1014
Balls, bikes, swings.	90.9%	81.5%	94.0%	0.0074	-0.0063
Music instruments and radios.	67.1%	60.5%	37.3%	0.0509	0.0118
Citizens' band radio, computer/electronic games	11.2%	7.4%	34.3%	-0.0407	-0.0236
Crafts, painting, sewing, knitting, etc.	76.9%	63.0%	20.9%	0.0852	-0.2185***
Barbie dolls or similar adult dolls.	42.7%	50.6%	4.5%	0.0743	-0.015
Other dolls and doll houses.	51.7%	60.5%	6.0%	-0.0068	0.0817
Make-up sets, beauty salon.	15.4%	23.5%	0.0%	0.0361	0.1341
Easy-bake ovens, vacuum cleaners, shopping baskets, etc.	22.4%	28.4%	4.5%	0.0077	0.2054**

Source: Online survey.

* p < 10%, ** p < 5%, *** p<1%

When compared to their brother's toys, the results provide supporting evidence for the gender-socialization process hypothesis. According to Orenstein (2011, pp. 21-22), playing and toys help socialize and prepare children for their roles as adults and more and more the sex-differentiation of toys is teaching children from an early age the different gender roles. Around age four, children become rigid around gender roles because before age seven they are not fully aware that people cannot change sex, so they try to fit into their gender as a mean to reaffirm their identity, precisely at the time when the brain exhibits its highest neoplasticity (Orenstein, pp. 59-64). Hence, if children are taught that deep gender differences exist, this belief will be ingrained in their minds, which is why at around this age sex-typing of occupation begins to be observed. For example, Hanson, Smith and Kapur (2000, p. 254) argue that, between ages six and eight, children eliminate careers based on gender. Toys, therefore, might become a tool with which children can explore or limit their future career options.

Results from the questionnaire exhibit a pattern of neutral and sex-differentiated toys but, even when it comes to neutral toys, boys seem to receive them in higher percentages. For example, balls, bikes and swings are the most popular toys for both girls and boys; and, among the different categories, these seem to be the most neutral toys, since girls and boys had similar availability to them. Other toys can also be considered somewhat neutral. These include: chemistry and science sets, building blocks, telescopes, microscopes and puzzles and game tables. However, in all these cases except for the puzzles and table games, boys received them in slightly higher percentages. As with the sister's case, this could signal that parents are slightly more likely to buy these toys for boys or that respondents are recreating this difference when asked to remember so far back into their childhood. However, it is interesting to note that boys receive more of these neutral toys that are more science-oriented or imply more activity, while girls only receive a higher percentage of those toys that suppose less physical activity (puzzles and table games), which is also consistent with the agency-passiveness ascribed to the male-female dichotomy.

On the other hand, toolboxes, workbenches, citizen's band radios, computer or electronic games, electric trains, remote control cars or planes, robots, rockets and gear sets are considered male toys, since their brothers owned these toys with, at least, twice more

frequency than the girls did. For example, the respondents' brothers owned robots, rockets and gear sets 6.4 times more than the respondents. In contrast, the girlie toys include: music instruments and radios, crafts, painting, sewing, knitting, easy-bake ovens, vacuum cleaners, shopping baskets, all types of dolls, make-up sets and beauty salons. In order to exemplify how this toy differentiation signals different roles to girls and boys, it is interesting to note that respondents report receiving music instruments and radios 1.8 times more than their brothers, whereas their brothers received citizens' band radios, computer or electronic games 3.1 times more than they did. While girls are given the radio to use and listen to music, boys are given the citizens' band radios to assemble and produce the communication. Similarly, boys are given more toys that allow them to build, understand mechanics, develop spatial and mathematical abilities and learn the technological know-how. Girls, in contrast, are given toys related to arts, housekeeping, motherhood and image. No wonder why different studies have found that girls develop technological reticence to computers (Hanson, Smith and Kapur, 2000), do not expect to assemble technological devices or learn the know-how behind them (Jenson and de Castell, 2011) and become technology users and consumers but not producers or programmers (Orenstein, 2011, pp.161-177).

Finally, Table 15 also reports the correlation coefficients between the different type of toys and the degree choices. At first hand, having access to scientific-oriented toys during childhood does not seem to be associated with studying a high-earnings degree program or to discourage going into a female-dominated one. In fact, some of these coefficients present the opposite sign as expected. For example, having chemistry or science sets is negatively and significantly correlated with having a high-earnings degree, while having citizen's band radio, computer or electronic games, robots, rockets and gear sets are insignificantly correlated with choosing a high-earnings degree, which is contrary to the hypothesis in hand. Similarly, owning rockets, robots and gear sets is positively but insignificantly correlated with choosing a female-dominated degree and having crafts and artistic games is positively correlated with high-earnings degree choices and negatively and significantly correlated with the female-dominated degree, which is also inconsistent with the initial hypothesis. The correlation coefficients do exhibit the expected sign for owning puzzles, table games and building blocks. And the most feminine toys (make-up sets, beauty salons, easy-bake ovens, shopping baskets, etc.) are more positively related to choosing a female-dominated degree. So, it is worth asking

if it is the most girlie toys the ones that reinforce the gender role but more neutral toys are not as effective in encouraging girls to explore beyond these gender roles.

4.3.3.2. Technological confidence

As mentioned earlier, women tend to reveal traits of technological reticence. This has been associated with some play technics and access to technology at an early age. For example, Jenson and de Castell (2011) found that none of the girls between ages 12 and 13 that they observed had consistent access to technology and, therefore, were not able to set up consoles and were not as familiarized with console games as boys were. But, once they were given access to such games and the field was levelled up, they developed the same playing behaviour as their male peers, suggesting that it is the restricted access to technology what puts girls in a disadvantage with boys. Likewise, Walkerdine (2006) does not find any evidence suggesting that girls play any differently from boys, but they struggle negotiating their gender identity when playing electronic games. Further, Margolis, Fisher and Miller (2000) find that, while male undergraduates in computer science are fascinated with computers and how they work, female students lack their previous experience with computers and become less confident about their motivations and skills as they advance further into the program.

In order to test for evidence about the technological reticence influencing degree choices, respondents were asked whether they felt confident using electronic devices and their ability to use and program computers. Four out of five respondents claimed to feel confident using electronic devices and this variable is insignificantly correlated with studying a high-earnings degree (0.0887) and significantly and negatively correlated with the female-dominated degree choice (-0.162) at the standard confidence level. While the age in which respondents first used a computer varies widely (from 5 to 45 years), all the respondents have used a computer; but only a quarter of them actually knows how to program and only 8.4% of them knew how to program computers before entering university. However, this variable is not significantly correlated with studying a high-earnings degree program (0.0825), neither with a female-dominated one (-0.255).

4.3.3.3. Parents' behaviour towards math, science and technology

The questionnaire asked participants about parental behaviour towards math, science and technology in order to assess the stimulus they received at home regarding these subjects. Two thirds of respondents felt encouraged by their parents to explore with math, science and technology; 68.4% of which received such encouragement from their mother and 78.9%, from their father. Once more, the data suggests that it is the father who plays a more active role in encouraging girls to learn these subjects. However, this changes when they are asked whether any of their parents ever discourage them to learn or explore with the subjects in hand. Although, parental discouragement is rarely reported (only 7.7% of the cases reported it), it is more likely to come from the mother (63.6%) than the father (45.5%).

Parental encouragement is perceived in many different ways, which include supervising and helping out with homework; engaging their daughter in conversations and asking them questions for them to figure out a solution to an everyday problem or a scientific puzzle; taking them to museums; doing outdoor activities where they can explore and observe nature; supporting them in their studies and degree aspirations; praising their school progress and their good grades; assembling machines or electronic devices and fixing things around the house; enrolling them in extracurricular activities, driving them to activities; sharing their hobbies with their children; and buying toys, books, experiments and electronic devices for them. Although there are exceptions, there seems to be a pattern in the way mothers and fathers relate to the child. Mothers tend to be more in charge of supervising their daughter's school performance and progress and to be more involved in doing homework or supporting their academic ability, so that their encouragement is more constant, while the fathers tend to engage in moments that respondents associate more with leisure time in more ludic ways, such as sharing their career and hobbies with the child, assembling or building things, or exploring new activities, such as botany, photography or programming. The following testimonies illustrate this:

"Mum bought me lots and lots of books, read them to me/worked through them with me. We made regular trips to the library and science museums. Hands on play with dad when he was making things." (id== 1869022351, age 34)

"Mum believed in learning about everything - provided books, learning environment at home and didn't mind helping with experiments etc. even when we made a mess. Dad was a civil engineer and was always inventing, building and making things and we were allowed to join in and help." (id== 1870708915, age 54)

In the first example, the mother's behaviour is more constant and structured, while the father appears as a playmate ("*hands on play with dad*"). Similarly in the second case, whereas the mother was academically supportive and "*didn't mind helping with experiments*", the activities with the father are portrayed as being more playful. This could be due to the fact that mothers tend to dedicate more hours to childrearing and, therefore, are more involved in their child's life. It is also likely that the father spends less time with his daughter, so that his attention is more valuable for the child, since it is relatively scarcer than the mother's. But when daughters engage in activities with the father, they are invited into their father's world. The father does not play with the child's toys or engages in her responsibilities, like the mother does; instead it is the child that gets to play with 'daddy's toys' and they remember this as being funnier. They can go to the father's workplace and play at his office, or share his hobbies and learn from him:

"My dad is a keen gardener and enjoys wildlife in the garden. He encouraged me to be interested in the science of how things grow, why different birds are different etc. We often watched Nature documentaries together on TV" (id== 1860688264)

"I'd help out in the workshop (my dad's a horologist), using the lathes etc., counting wheels, doing the maths. My dad was doing maths A levels and he'd help me with my algebra and maths homework when I didn't understand it. We would watch him fix the car, problem solve, talk through practical problems." (id==1861901434, age 39)

"He took me to his lab and brought me home a microscope" (id==1856455718, age 36)

Both parents buy toys, books and experiments for their children and, in fact, respondents identify this as one of the main forms of encouragement. However, it is the father who most of the time introduces the technological gadgets. Following Coria (1991), this could be related to the dynamics of power within the household. While women have access to the daily budget and struggle to stretch it for the family (balancing the budget, paying bills, doing the grocery shopping, etc.), men tend to take control over the long-term planning and savings. As women administer what Coria calls "small money", men administer the "big money", that is, the budget used to make investments (buy new houses, televisions, computers, etc.) and plan vacations[46]. While the mother may buy new colour pencils at the supermarket, it is the father who brings home the microscope. The following examples illustrate this point:

> *"[Parents] Took us to science museums, bought us books about science, my dad brought home an old computer from his work so we probably had one in the house before a lot of kids did in those days - and he brought us computer games to play on it. Bought me a 'fieldbug' kit for my birthday one year to look at/collect insects. Encouraged me to collect, press and classify flowers." (id==1857720121, age 30)*

> *"[Father] Brought computers into the house, encouraged me to use them, bought me books on the way things work." (id==1856866914, age 32)*

Notice also that it is the father who gets more involved in teaching the technological know-hows and who engages their daughter in more technological and scientific-related activities. He does so by fixing things around the house, assembling new devices, teaching them to use and program computers and even teaching them about photography:

> *"My dad used to be an inventor and had some very early computers which we played on (e.g. POD), and he wrote programmes for us to play with. He taught me to programme a Micro but I've forgotten it all now! He also bought us science books,*

[46] Pahl's (1989, p.100) findings in the management and control of household income for British households parallels some of the patterns described by Coria: women in the UK also tend to be responsible for small purchases, while men have more decision-making in the large issues.

although my mother may have bought some of these as she is a physiotherapist so also interested in science." (id==1856271625, age 28)

"Both my parents were teachers, they encouraged me in general. I used to do quite a lot of photography with my dad, including developing and printing the pictures, not just taking them." (id== 1856197583, age 42)

"Dad built things at home - such as hi-fi speakers and we assisted. When any decorating was happening - we were encouraged to help work out how much of the different items were needed (and we got to choose colours etc.) Always had science books around and had discussions and try to come up with explanations as a family about things we'd seen on T.V. science programmes - such as Arther C. Clarke's Mysterious World and Tomorrow's World etc. My parents helped me with maths a lot at home as I struggled with times-tables for many years." (id==1857481656, age 41)

"[Father] built electric circuits with me, show my magnets, test water quality, show me how to develop photos, show me how to use a computer, modem ect" (id==1856463533, age 36)

Evidently, relating the father figure with access, use and understanding of technology plants or reinforces the idea that technology is masculine. Likewise, although mothers help out with all homework and are involved in all school activities, fathers do seem to help out with the math homework, which probably also contributes to designating this subject as a masculine one. Hence, these testimonies support the hypothesis that gender socialization at home does tend to identify technology and agency with masculinity.

"My father taught me basic maths before I started school and used to set me maths puzzles and sums to do. He encouraged me to develop my knowledge of money and business." (id== 1857437149, age 25)

"My Dad was very good with Physics and Maths, he would like to build all sorts of electronic/electric gadgets and he would talk me through what he was doing; he would also be the one to help me with my Maths homework if I needed help" (id== 1857492588, age 34)

This does not mean that mothers are not active or involved in encouraging their daughter to explore certain subjects. As mentioned earlier, mothers tend to be more involved in their daughter's academic progress and are supportive of it; but the household dynamics do reproduce the identification of math, science and technology with masculinity. Some mothers, aware of this, even try hard to teach their daughters otherwise; usually advising them not to repeat their mistakes, so that their daughters would be more successful than they were. In a way, although realistic, this reflects maternal frustration and presents daughters with the threat of a heteronomous life, as in the following two cases:

> *"My mother very actively - she was keen that we were brought up [with] positive and non-stereotypical role models and encouraged me to play traditionally male games and my brother was not discouraged from playing with dolls (the difference between discouraged and encouraged is intentional). She bought me a chemistry set etc. She was an artist my training but had gone in that direction in rebellion against her pushy parents. She was (is) a strong feminist and keen that my brother and I would have the same opportunities. In many ways she pushed me to be successful in non-traditionally female ways because she felt she had given up and 'just' become a mother. My father was around less due to work but he was an aircraft pilot and I think his general engineer-type background set the tone to an extent." (id==1856574867, age 33)*

> *"My father provided me with a lot of support with homework. My mother always mentioned that we wouldn't fail maths like she did in secondary school." (id==1855967889, age 35)*

Only a few respondents report having been discouraged to explore with or learn math, science and technology by any of their parents so that, in general, students are not put off these subjects at home as much as they are at school. At the same time, while teachers tend to discourage them in very aggressive ways (throwing books at them, excluding them from competitions, making jokes, etc.), parental discouragement is not as aggressive, although some of it entails forms of passive aggressiveness. In general, respondents perceived parental discouragement towards mathematical, scientific and technological activities in three ways: (i) by showing lack of interest or not knowing how to encourage the study of these subjects, (ii)

reflecting their own fear and reticence toward these subjects, and (iii) expecting girls to perform worse in these subjects because of their gender. The first two cases are related and explain why mothers played a bigger role in discouraging girls away from these subjects of study: if the mother has interiorized the belief that mathematics, science and technology are masculine, she will have some reticence toward these subjects. Her lack of interest in the subjects implies that, sometimes, she will not be able to help out with homework or answer questions to her daughter, reinforcing her own belief that these are difficult subjects. She will then wait for the father to step in and help with the homework, thus reinforcing the prejudice further, which also explains why respondents recall their father helping out with math homework.

> *"Only in the sense that she is petrified of all computers etc. so for a long time it rubbed off on me - she didn't explicitly discourage me." (id==1857720121, age 30)*

> *"My mother struggled with A-level Maths and questioned whether I'd find it difficult" (id==1857552136, age 34)*

> *"discourage is probably too strong a word, but not encouraged - as she didn't have a knowledge or interest in the workshop etc. it was just an area that we didn't discuss with her." (id==1861901434, age 39)*

Because the underlying belief is that these are subjects difficult for women, the expectations regarding the daughter's performance will be lowered. At the same time, girls will learn to develop an aversion or fear to these subjects. This could be even more evident when there are brothers in the house, since they will be expected to perform better. The difference will also be more evident when very conservative views are held, so that investing in women's education (especially investing in subjects that are not considered feminine enough) will conflict with the traditional expectation of women wanting to become housewives. Notice that active encouragement through discourse seems to be more evident in older respondents, while implied discouragement is more frequent in the younger ones, as illustrated in the following examples:

"Comments along the lines of it was a more suitable field for my brother. Also conveyed the idea that this was a functional rather than a creative area." (id==1856285878, age 45)

"My parents - not untypical for their generation - thought that girls were less likely to be good at maths and science than boys so it was 'ok' for them if one didn't do well in those subjects (this has to be seen in a context where we were sort of expected to get straight As for everything - so not doing well was dropping into the B range! - we were also told that 'you are not too stupid, you're just lazy' if we failed to do well, i.e. get As)." (id==1856889822, age 54)

In synthesis, the household environment seems to be more supportive of girls learning and exploring with math, science and technology than the school environment. And, although both parents play important roles in encouraging interest in these subjects, daughters seem to be more impressed when the father engages them in these subjects, whereas the mother is perceived as a constant support. But mothers also make a bigger impression when they discourage their daughters away from these subjects.

4.3.3.4. Parental aspirations

Respondents were also asked about their parents' aspirations for them. Table 16 presents the summary results for those respondents who gave a concrete answer. In a considerable amount of cases, respondents did not give a specific answer, since they felt their parents would support them on any decision they took and simply wanted them to be happy. Once again, the results in Table 16 reveal a slightly stronger concern on part of the father to push their daughters into professional careers, particularly, into high-earnings degree programs. In contrast, a slightly higher per cent of mothers expected their daughters to enter traditional female-dominated programs. Further, twice as many mothers than fathers expected their daughters to follow more traditional gender roles and grow to become wives and mothers, although in general, this is a small percentage of all responses.

TABLE 16:

Parental aspirations

	Mother	Father
Total responses	**133**	**133**
Wanted you to have a professional career	35.3%	39.1%
Wanted you to study a high-earnings degree subject	17.3%	21.8%
Wanted you to study a female-dominated degree subject	14.3%	12.8%
Wanted you to work in a non-professional traditional female occupation	2.3%	2.3%
Wanted you to get married or have children	7.5%	3.8%

Source: Online survey.

Respondents were also asked whether they felt their parents treated them differently because of their gender. Only a minority of the respondents (14.3%) answered positively, so that the vast majority did not experienced this differentiated treatment. Among those who were treated differently, in 85% of the cases it was the mother who treated them differently, while the father did so in 45% of the cases. When asked to explain how the treatment would vary, there seems to be two distinct approaches. On the one hand, in more conservative environments, girls were given more domestic chores; they were expected to behave better than their brothers; suffered stricter rules and enjoyed less freedom. In such conservative environments, parents, but particularly the father, were not supportive of female careers, since girls were expected to either marry and have children or stay and help the family financially. This parental attitude also seems to be stronger for older cohort members, which could suggest a generational change. On the other hand, in a second group of cases, parents, but particularly the mother, seemed to have had higher aspirations for their daughters and pushed them academically more than they did with their brothers. The following cases illustrate some of the experiences in the more conservative households:

> *"The expectation was that I would work in a clean working environment as possibly a secretary but mainly there was not encouragement or structure for a career which was identified for my brothers. I was expected to assist my mother in cleaning the house and cook meals whereas this was not necessarily expected of my brothers, although my mother encouraged them to learn to cook, iron and clean (Father not impressed)" (id== 1863390362, age 48)*

"Made to do more around the house than my brother; careers not so important for girls" (id==1858464605, age 49)

"My father didn't feel education was important for girls as he believed they were destined to be housewives and mothers. But 'well done son' was often heard in relation to my older brother. My mother didn't exactly encourage me but my mother was proud of my academic achievements, always congratulated me." (id== 1856321665, age 60)

"My father wanted me to get a job and get married as soon as possible so that I would be financially secure and have someone to look after me." (id==1858496175, age 45)

Clearly, in all these cases, girls are signalled that their career is not as valuable as a man's. At the same time, this also explains why simply going to university (but not the particulars of what that implies) might become the main reason for enrolling in a program of study, since going to university is already far beyond any aspiration for them. In contrast, mothers may also have higher aspirations for their daughters as a way to revindicate a young girl's future.

"I answered yes because I think that my mother wanted more keenly for me to do well than she did my brother. But I don't think she consciously thought that, it was more of an underlying need to see a daughter succeed having grown up being 'just' a girl in her family." (id==1856574867, age 33)

"Mother encouraged university and a career because she wanted us to be more financially independent than she had been" (id== 1856455718, age 36)

"[Mother] Encouraged more educationally." (id==1860376643, age 45)

In synthesis, results derived from this section suggest that, while a majority of girls feel they are encouraged to explore with math, science and technology both in the school (68.3%) and the household environment (66.4%), there is an important percentage of them that are being discouraged from these subjects. Particularly, girls seem to be more likely to be put off these subjects because of experiences at school. The household seems to be a more

supportive environment than the school, although a minority of respondents does identify differences in treatment because of their gender and more traditional parents (associated with older respondents) do not have career aspirations for their daughters, since they are expected to become housewives and mothers. Parallel to this, mothers and fathers play different roles in encouraging interest in certain subjects or in reinforcing gender roles. The different testimonies seem to support the argument that fathers are more important as gender role socializers than mothers (Levy, 1972): in the results, women tend to recall fathers as being more ludic and engaging them in more interesting ways in non-traditional activities or subjects than mothers. But at the same time, fathers may also reinforce traditional gender roles and have lower aspirations for their daughters. Mothers, in turn, encourage children through a more constant and structured process and sometimes put more pressure on their daughters to stimulate them into having aspirations and wanting a career instead of settling for the traditional role as mothers and wives.

4.3.4. Beliefs and personal views

The questionnaire also inquired about the participant's view on some gender beliefs as well as their self-perception and potential worries related to gender stereotypes. Respondents were asked to rank on a five-point scale whether they agree with 14 statements regarding gender roles. Thirteen of those statements reflect conservative views on gender roles, while the last statement reflects the belief in gender equality in the labour market. Some of the items reproduce questions from the 1970 British Cohort Study in order to have similar variables as those from the previous chapter. The distribution of agreement with the statements and their respective correlation coefficients with the degree choices are summarized in Table 17.

TABLE 17:

Distribution of level of agreement with gender stereotype statements and its correlation with degree choice

	Responses						Correlation coefficients	
	Total	Strongly disagree	Disagree	Neither	Agree	Strongly agree	High-earnings degree	Female-dominated degree
Scientists and mathematicians are boring and unattractive.	138	50.0%	32.6%	14.5%	2.2%	0.7%	-0.0626	-0.0259
Girls don't like getting dirty, working with machines or in a lab.	138	54.3%	31.2%	10.9%	3.6%	0.0%	-0.0348	0.0717
Boys are better at mathematics than girls.	138	55.8%	28.3%	9.4%	6.5%	0.0%	-0.1235	0.0831
Engineering is for boys, not girls.	138	63.8%	28.3%	5.8%	2.2%	0.0%	-0.1112	0.1425*
A female mechanic is a tomboy.	138	52.9%	29.0%	8.7%	9.4%	0.0%	-0.0832	0.0692
Male nurses are usually gay.	138	60.1%	29.7%	7.2%	2.2%	0.7%	-0.0349	0.1792**
Women are better teachers because of their mother instinct.	137	55.5%	32.8%	10.9%	0.7%	0.0%	-0.0192	0.0779
A woman can be beautiful or smart, but not both.	138	83.3%	15.9%	0.7%	0.0%	0.0%	0.0115	0.0244
A mother should stay at home looking after her children.	137	62.8%	22.6%	12.4%	1.5%	0.7%	0.0033	0.1794**
Women should not prioritize their career over having a family.	138	46.4%	23.2%	27.5%	1.4%	1.4%	-0.0505	0.0232
Men are not attracted to smart women.	138	47.1%	34.8%	12.3%	4.3%	1.4%	-0.0021	0.038
It's better for a relationship if the man earns more money than the woman.	136	46.3%	29.4%	15.4%	8.8%	0.0%	-0.0081	0.1734**
When jobs are scarce, men should have more right to a job than a woman.	138	84.1%	12.3%	2.9%	0.7%	0.0%	0.0545	0.1169
Women can do the same job as men.	137	4.4%	3.6%	9.5%	30.7%	51.8%	0.0329	-0.0327

Source: Online survey.

* p < 10%, ** p < 5%, *** p<1%

** Correlation coefficient between the level of agreement with the statement and holding a high-earnings degree.

** Correlation coefficient between the level of agreement with the statement and holding a female-dominated degree.

In general, results reveal that respondents reply consistently to all statements, i.e., they show similar distributions. For example, an individual who disagrees with one of the negative statements is likely to also disagree with the other 12 and agree with the statement "women can do the same job as men". And, except in two cases, over 80% of the respondents disagree or strongly disagree with the statement claiming gender inequality. This profiles respondents as holding, for the most part, egalitarian views. However, less than 80% of the participants disagree with the statements "it's better for a relationship if the man earns more

money than the woman" and "women should not prioritize their career over having a family", both of which reflect the traditional female role as the main supporter of the household dynamics. In the first case and in line with Coria's arguments discussed earlier, a higher percentage of women seem to support the association of money with masculinity, so that it is better for the relationship not to threaten the man's masculinity or power in it. The second case emphasizes the women's role as a mother, putting this role before any other aspect by which she can define herself. This could suggest that it is more difficult for women to disassociate themselves from those roles that are more primal to femininity, such as reinforcing men's ego by allowing them to be the main providers and a woman's role as mother. This will also be consistent with Gottfredson's (1981) thesis that people are the least likely to compromise their gender identity. The homogenous responses on this subject might correspond to the sample surveyed, so that academics might reflect more homogenous beliefs and gender equality than the one observed in the whole population.

Table 17 also presents the correlation coefficients for all these statements with the degree choices. The correlation coefficients associated with choosing a high-earnings degree are not significantly different from zero; while believing that "engineering is for boys, not girls"; that "male nurses are usually gay"; that "a mother should stay at home looking after her children" and that "it's better for a relationship if the man earns more money than the woman" are positively and significantly associated with choosing a female-dominated degree. That is, the stronger women agree with any of these statements, the more likely they are to hold a female-dominated degree. This relationship seems consistent with the initial hypothesis: women with more conservative views are more likely to remain in those fields of study considered female, where their femininity cannot be called into question[47]. Although not significant, it is worth noticing that the correlation coefficient with studying a high-earnings degree is smaller (either in size or because of a negative sign) than the one associated with studying a female-dominated degree in all of the conservative statements. As for the

[47] As for the positive and significant sign for the statement "male nurses are usually gay", it is worth mentioning that some respondents explained they believed this to be true, not out of homophobia, but their own experiences with the gay population: they own experiences studying gender and homosexuality has confirmed to them that nursing is an occupation where gay men are overrepresented.

egalitarian statement (women can do the same job as men), the correlation coefficient is positively associated with studying a high-earnings degree and negatively associated with studying a female-dominated degree but it is not significant. The latter suggests that holding more conservative views might be weakly related to not choosing a high-earnings degree (but this is a loose interpretation, since the coefficients are not significant at the standard confidence level).

Respondents were also asked whether their parents would agree with three statements: "it's better if the husband earns more money than his wife", "when jobs are scarce, men should have more right to a job than a woman" and "women can do the same job as men"[48]. As expected, respondents think their fathers exhibit more conservative views than the mothers, reflecting some consistency with the pattern discussed earlier, where it was the father who would treat girls differently in terms of reinforcing more traditional gender roles, while the mother would exhibit a different treatment in order to push them away from such roles.

TABLE 18:

Distribution of parental beliefs

Mother	N.A.	Strongly disagree	Disagree	Neither	Agree	Strongly agree
It's better if the husband earns more money than his wife.	0.0%	26.7%	20.0%	19.3%	24.4%	9.6%
When jobs are scarce, men should have more right to a job than a woman.	0.0%	40.7%	19.3%	16.3%	18.5%	5.2%
Women can do the same job as men.	0.0%	3.8%	20.5%	13.6%	28.8%	33.3%
Father						
It's better if the husband earns more money than his wife.	5.9%	18.5%	14.8%	20.0%	23.7%	17.0%
When jobs are scarce, men should have more right to a job than a woman.	5.9%	27.4%	16.3%	21.5%	17.8%	11.1%
Women can do the same job as men.	6.0%	8.3%	21.1%	14.3%	28.6%	21.8%

Source: Online survey.

[48] This items were reproduced from the 1970 British Cohort Study, in order to collect data for similar questions as those in the previous chapter.

Table 19 presents the correlation coefficients between the respondent's agreement with the previous three statements and what she believes would be her parent's responses to the same statements. In general, the results provide a positive and significant correlation between the parents' and daughter's beliefs, so that some intergenerational transmission of beliefs might take place. At the same time, the coefficients between daughter and mother are slightly higher in two of the cases ("it's better if the husband earns more money than his wife" and "women can do the same job as men"). The latter could suggest that girls are more likely to feel empathy and reproduce the mother's belief system slightly more than the father's.

TABLE 19:

Correlation coefficients for respondent's and parental beliefs

	Mother	**Father**
It's better if the husband earns more money than his wife.	0.3245***	0.2657***
When jobs are scarce, men should have more right to a job than women.	0.235***	0.2663***
Women can do the same job as men.	0.4107***	0.3900***

Source: Online survey.

* p < 10%, ** p < 5%, *** p<1%

Finally, respondents were also asked whether they worried about their career choices affecting their personal life and self-perception. In general, most respondents did not think at the time that their degree choice would affect them in such ways: only 0.7% of the cases worried that their career choice would make them less attractive or beautiful; 4.4% of them worried it would make them feel threatened or not accepted by male co-workers; 7.3% worried it would make them feel insecure; 10.3% worried they would feel lonely and 12.4% worried their degree choice might keep them away from their family projects. But in none of the cases any of these were particularly important in choosing a degree choice; if anything, they were seen as part of the challenge of obtaining a professional career:

> *"I *knew* that I might not be accepted by some male co-workers. I didn't worry about this. It was an annoying fact, but not one that I weighed against others in deciding my*

career. My only worry about my career choice was that it didn't obviously contribute to alleviating suffering from injustice or natural disaster." (id== 1855812792, age 36)

For the respondents, what mattered the most at the time was to be able to get a degree and cease the opportunity to study a subject they like and feel passionate about; which actually might strengthen their self-esteem by allowing them to become the person they want to be, so that social stigmas do not seem to be affecting their degree choices:

"I actually thought that to study physics would make me more interesting" (id==1877575615, age 41)

In fact, some of the respondents admit not having considered the working environment until they actually had to go into the labour market. The same way respondents were not concerned about the labour market opportunities when choosing a degree, thinking that a job would be available for them after university, they only seemed to have started worrying about the working environment once they entered the labour market. In particular, they now worry about acquiring a work-life balance, but they do not let potential gender stereotypes or gender discrimination interfere with their decisions, which reflects a positive attitude towards taking control of their life and acting according to their self-interest:

"When doing my degree I didn't think much beyond achieving the degree and getting work experience related to my degree so that I would be employable" (id==1856455718, age 36)

"In hindsight, I do understand that gender does matter especially when reaching a more managerial level, especially for women who have children and sometimes have to compromise career choices between family and relations. However these choices are likely quite independent on whether in a 'male dominated ' work sphere (as in engineering for example or science research). At the time of choosing degree this was not an issue, and I possibly naively thought gender did not matter." (id==1857520967, age 44)

"I did not feel any worry about choosing a degree. It was only when I left university that I began to think about my degree choices. Especially for my female friends who did choose scientific fields, I think that the world is still unequal when it comes to scientists who choose to have children. It is very difficult trying to balance family commitments with a scientific career. While there is now plenty of choice to do what you love and you are encouraged either by your family or at school to take up sciences, you are still paid less than men, working times are inflexible for those with families and paying for childcare is a huge problem. This is forcing many women I know to seek employment or careers in fields that are more female friendly and flexible." (id==1857420297, age 33)

The last comment exemplifies Glover's arguments about the low female participation in scientific occupations, which is that these occupations are not well integrated vertically, lack family friendly environments, have a history of exclusionary practices, give less opportunities to women for doing research and places them in teaching and have a glass ceiling, so that women in science are more conservative in order to accept the work ethos of the scientific environment (Glover, 2000). Similarly, Connolly and Long (2008) argue that scientific occupations offer women less stable jobs (temporary or post-doctoral positions) with an average pay gap of 20% and have a glass ceiling. All of the above illustrate the difficulties of women not only studying but staying in scientific environments.

Besides a concern for being able to have an appropriate balance between their career and their personal life, some women also comment on how their degree choice is not as appreciated as they would expect, since it is considered inferior to other degrees. This becomes evident in two ways: either they face less job opportunities than expected, thus realizing that their degree choice is not as profitable as they might have imagined, or they feel they are not taken as seriously as professionals compared to other disciplines. In both cases, the experience can be frustrating, since after investing so much in their university education, they feel unappreciated or undervalued.

"I feel that maybe my degree is sometimes considered inferior by those with a hard science degree, or that it was somehow 'easier' than science degrees." […] "I made a

mistake by moving to a science department with a social science degree. I am not taken seriously." (id==1856533218, age 53)

"I never considered that it would be any of these things, but since working in a [scientific] school have found that clinicians definitely look down on non-clinicians and place social scientists lower than life scientists. But it had never occurred to me that it would be the case." (id==1855819332, age 52)

4.3.5. Satisfaction

Respondents were also questioned about their degree of satisfaction with their career, their degree choice and their life. Results are presented in Table 20. In all cases, a vast majority reports satisfaction with their decisions. Whereas the same percentage (89.1%) reports being satisfied or very satisfied with their degree choice and life, a slightly lower percentage (84.8%) reports these levels of satisfaction regarding their job. Further, the degree choice reports the highest percentage of respondents who are very satisfied and the lowest of those who are very dissatisfied, suggesting that despite not having enough information, respondents seem to be acting rationally when it comes to their degree choice. This needs to be highlighted, since it suggests that if female degree choices appear, at first glance, not to be consistent with the theory, it is because the model fails to incorporate other factors in female preferences, but that women are, in fact, acting rationally. Further, the correlation coefficients are not significantly different from zero in any of the cases, suggesting that utility does not directly depend on the type of degree chosen.

TABLE 20:

Satisfaction and its correlation with degree choice

Satisfaction with:	Responses					Correlation coefficients	
	Very dissatisfied	Dissatisfied	Neither	Satisfied	Very satisfied	High-earnings degree	Female-dominated degree
Job	2.2%	5.8%	7.2%	47.1%	37.7%	0.0137	0.1099
Degree choice	0.7%	3.6%	6.5%	33.3%	55.8%	-0.0905	0.0367
Life	1.4%	5.1%	4.3%	47.8%	41.3%	0.031	0.1036

Source: Online survey.

* p < 10%, ** p < 5%, *** p<1%

In particular, women seem to be concerned about balancing their personal life with their career (40% of respondents are mothers), so that keeping a job that would allow this is one of their main concerns; and they highly value flexible or reduced work schedules. At the same time, some of them recognize not being as preoccupied with acquiring a higher standard of living than the one they already have or wanting higher positions or ranks in the organization, since this is not part of their preferences and comes at a high cost[49].

> *"My job is very flexible which is very helpful when raising a family and working at the same time. The university is a very good employer in that sense." (id==1858496175, age 45)*

> *"[…] Just to note, I do not allow people to discriminate against me because I am a woman. I do make choices that men might see as compromising my career, but who cares? I have a nice family, and enough money, and that has been true for a long time now. I enjoy my work, and I don't care much about male-oriented ambition. […]" (id==1857468287, age 53)*

> *"Working across secondary school and university sector gives me a lot of flexibility and chance to be creative which I enjoy" (id==1856914491, age 42)*

[49] This could also be a characteristic associated with the academic profile, since one would not expect people oriented towards earning high incomes to stay in academia.

The dilemma between progressing in their career and having a family only becomes a problem when the women enter the labour market, but not when they are choosing a degree. However, once they start thinking about planning a family, it becomes a huge issue and the main cause of work dissatisfaction or interference. Some women decide to prioritize the family, so they cut back hours and are willing to accept not getting promotions or even lower positions in order to have both a family and a job, while others decide to postpone having a family in order to build their career up to the point they want to. In both cases, some level of frustration or distress is expressed, since they are faced with the decision to neglect or give up projects in one area of their lives. If they choose to have a family, they feel overwhelmed with work and underappreciated; while, if they postpone their family plans, they might feel they are missing out on something they planned on having, as illustrated by the following examples:

> *"I make the choice to limit the number of hours I work because I want to have weekends and evenings with family. This means I don't do as much research as colleagues who don't make this choice. In fact, I feel that my ability to do research (which is supposed to be part of my job) is severely hampered by not working overtime." (id== 1857596338, age 43)*

> *"I struggle to consolidate (to myself) the conflict between the pressure to succeed in my career (publish heavily, get big grants in, get promoted etc.) and that to have children and be a 'good' mother. Until my 30s I had not realised that I would feel this conflict." (id== 1856574867, age 33)*

> *" […] The pressures of working F/T and having a family are immense at times and there feels to be a culture of having no children or only 1 child in my department, although this may be a false perception of course. You get your PhD in your mid to late 20's, you enter your academic career, and it's very difficult to fit in time for children in this career trajectory and especially when you have fixed term contracts. I might want a second child for instance, but feel very stressed wondering when I might fit this into my contract ending and new ones starting. This is incredibly stressful for me and other females who may be do not want to be having children at a later age" (id== 1860153878)*

The distress about not balancing both aspects of life is also related to other sources of dissatisfaction, particularly not having a stable job, since this interferes in family planning.

> *"Short term contracts are a big deal for university staff, we'd like to start a family but neither my husband (who also works at the University) are on permanent (they don't call them that anymore) contracts, so I'm waiting until I get an open contract and better maternity rights before we think about children." (id==1856271625, age 28)*

According to the testimonies, lack of job stability and work-life balance are two of the main causes of work dissatisfaction, along with an excessive overload of work and long hours; lack of promotion opportunities and lack of recognition for previous work experience outside academia. However, all of these are perceived as part of the working environment and respondents do not relate it with any kind of bad policy or discrimination against them. They acknowledge all of these as a result of the highly competitive environment in academia and thus, accept it as part of their career choice. In fact, most respondents feel they earn about the same or more than other members of their department (63.9%) and other women in their department (74.8%); and have the same or more power to bargain changes to their working contract (65.2%). So, while most women do not feel discriminated against, they accept having fewer promotions, working part-time, publishing less and doing less research. They accept the working rules, which are clear to them, but recognize that these rules are incompatible with their life plans.

> *"Benefit of academic science is the privilege of making new discoveries and being at the 'cutting edge' whilst surrounded by fascinating colleagues and research projects. Job dissatisfaction mainly arises from competitive nature of research environment (feelings of inadequacy), lack of job security and jobs in general after the end of fixed contract also make working in academic science more competitive and work-life balance more difficult." (id==1857502374, age 26)*

> *"Job Dissatisfaction is mainly due to the lack of any permanency, always being on part time funding and the stress of always having to produce at such a high level to be competitive for the next contract. In addition, lack of stability and or job security over a long time has made both my husband's and my life choices very difficult and delayed*

our attempting to have a family until we were in our first post doc position which for us has turned out to be too late causing much heartache and distress. All of which is compounded by the constant need to publish and the stress of the general ultra competitive and short term environment that we work in." (id==1857262693, age 37)

"No promotion prospects - there are 100-300 applicants for each lectureship position - fixed term contracts means I can't get a mortgage - anxiety over future - lack of security means choosing not to have children - am regularly told there are no prospects and that I should consider another career after 8 years of study and 11 years of work - but I don't know what else I can do" (id== 1856455718, age 36)

Although a huge majority does not feel hostility towards them, some do feel they are being looked down on, either because they work-part time and thus do not meet the same production standard as full-timers, or because their degree is not appreciated. In the first case, the respondent seems distressed about people expecting her to work full-time (despite her part-time job) and managing having children up to the point in which she says:

"Maybe I deserve the situation I'm in" (id==1858912717, age 40)

In the second case, the respondent describes a hostile environment against her, both for being a woman as well as for having a degree in a discipline that is not as appreciated in that environment:

"I worked in [non-scientific] departments for a while before being hired in a [scientific] school. I thought my skills in [my area of study] would be very valued and applicable, but I have found it to be the most misogynistic environment I have ever encountered. Also, clinicians are paid 2-3 times what I am for the same work. I have been lumbered with admin jobs to the point where I feel completely deskilled as a scientist at this point." (id==1855819332, age 52)

In synthesis, even though most respondents (77.3%) work in a department that matches their education and report satisfaction with their life, degree choice and career, it is clear that, in one way or another, women in academia deal with some distress in trying to

balance their personal life with their career aspirations, particularly, younger women who also struggle with less stable jobs.

4.4. A model of degree choice

4.4.1. Model

This section presents some estimation results for a model on degree choice, following the model described in section 3.2. As before, the first model estimates the probability of completing a high-earnings degree. A degree is classified as having high-earnings depending on the historical data provided by the Labour Force Survey, so that the dependent variable takes a value of 1 if the degree is associated with high-earnings in the labour market and 0 otherwise. Similarly, a second model estimates the probability of completing a female-dominated degree, so that the dependent variable takes a value of 1 if, traditionally, female employment has dominated that subject[50]. Degree decisions (d_i) are estimated using binary response models: both probit and logit models. The first model estimates the probability of *i* studying a high-earnings degree, while the second model estimates the probability of studying a female-dominated degree depending on a set of individual characteristics *x*, so that the latent variable model is given by:

$$(30) \qquad d_i^* = \gamma x_i + \xi_i \,,$$

where γ is the coefficient vector and ξ is the error term. The independent variables for the model were chosen considering those significant correlations observed in the whole sample. This time the vector of individual characteristics includes eight dummy variables indicating whether (i) *i* thought it was important to earn high income when choosing a degree; (ii) *i* thought it was unimportant to work with people when choosing a degree; (iii) *i* thought it was important to work with math and science when choosing a degree; (iv) someone else positively influenced the degree choice; (v) *i* was ever discouraged to learn or explore with

[50] See section 3.5.1 for details on the construction of these variables.

mathematics, science or technology; (vi) *i* was at the top 15% of her class in high school; (vii) *i* ever engaged in robotics, computer, math or science clubs, camps or fairs and (vi) *i* strongly disagrees with the statement "engineering is for boys, not girls", since this best reflects the belief in sex-typing of subjects. Having economically ambitious goals reveals a concern on economic well-being and, therefore, one would expect it to be positively related to choosing a degree program associated with high-earnings. Having someone influencing their degree choice might reveal the effect of either a role model or how expectations from others might drive women to pick one type of degree over other. Having been discouraged to learn or explore with mathematics, science or technology as well as not disagreeing with statements regarding sex-typing of subjects might reflect the level up to which *i* might have learned to identify these subjects with masculinity. In contrast, being at the top of the class and taking part in extracurricular activities that stimulate these subjects might reflect a level of confidence or taste for these subjects. Finally, age is also included as a control variable, since different generations might have experienced different ideals about gender roles.

Table 21 presents some descriptive statistics for the balanced sample used in the estimations, which consists of 123 observations.[51] Slightly more than a third of respondents have high-earnings degrees and three quarters hold female-dominated degrees, which are similar to the proportions observed for the whole sample. As discussed earlier, only a minority of women expressed thinking about their economic wellbeing when deciding their degree choice, which is also reflected in the balanced sample, where only about a fifth of them claim to have thought it was important to earn a high income when choosing a degree. The proportion of women who do not think it is important to work with people and those who thought it was important to study with mathematics and science when choosing a degree is also small. Likewise, only a small group engaged in extracurricular activities that promote skills in mathematics, science or technology as children, despite the fact that most of the respondents were good students. And about one of every four was discouraged by either a teacher or a parent to engage in these subjects. Also, about half of them decided their degree influenced by someone. As in the whole sample, the average age of the participants is close to 40 years of age.

[51] The limited number of observations restricts the amount of variables that can be tested in the model.

TABLE 21:

Descriptive statistics for the balanced sample, by age group

	Total	<40	40-49	50+
Observations	123	63	34	26
High-earnings subject field	35.0%	33.3%	44.1%	26.9%
Female-dominated subject field	74.8%	71.4%	82.4%	73.1%
Important to earn a high income	22.0%	28.6%	20.6%	7.7%
Unimportant to work with people	20.3%	20.6%	17.6%	23.1%
Important to study or work with math and science	35.8%	36.5%	32.4%	38.5%
Someone influenced their degree choice	49.6%	52.4%	50.0%	42.3%
Discouraged to learn science, math or technology	27.6%	28.6%	26.5%	26.9%
At the top 15% of the class in high school	86.2%	93.7%	76.5%	80.8%
Robotics, computer, math or science clubs, camps or fairs	8.9%	14.3%	0.0%	7.7%
Strongly disagree with "engineering is for boys, not girls"	65.0%	68.3%	52.9%	73.1%
Age				
Average	40.6			
Standard deviation	9.9			
Minimum	24			
Maximum	60			

Source: Online survey.

The table also presents the descriptive statistics by age group and shows some differences in their responses. The youngest (less than forty years old) and oldest (50 years old or older) groups are more alike among their responses and differ more from the cohort between ages 40 and 49. In the latter the percentage of respondents with high-earnings degrees is higher than in the other two groups. At the same time, this group is less likely to consider unimportant to work with people or consider important to work with math and science, fewer of these respondents were at the top of their class and are more likely to express traditional gender beliefs, at the same time that are more likely to hold female-dominated degrees than the younger and older groups. In turn, the youngest group is at the same time more likely to have participated in scientific-related extracurricular activities and to be discouraged from these subjects of study. Finally women in the older group were less influenced by a third party in their degree choice.

4.4.2. Findings

Table 22 reports the average marginal effects of the estimated models. Columns (1) and (2) present the average marginal effects of studying a high-earnings degree according to the probit and logit models, respectively. Contrary to what it was expected, considering it important to earn a high income is not significantly related to choosing a high-earnings degree*, ceteris paribus*, although the observed sign is positive, as expected (p-values are close but above 10% in both cases). This suggests that girls do not have access to enough market information and might not be fully aware of the economic opportunities offered by the different degree options. This is consistent with previous testimonies in which they recognized not having enough information about the degree they were enrolling in and not worrying about future career options until they had to join the labour market. It could also suggest that academics are not that concerned about earning a high income and, thus, this variable is not significant for the population in hand, which is only a particular subset of the whole female professional population. In contrast, having someone influencing the degree choice significantly increases the probability of choosing a high-earnings degree in about 24 percentage points*, ceteris paribus*. Even though the testimonies do not indicate that the advice received or the influence these people had was oriented towards achieving a high standard of living, it might be that the information given by other people does signal women to enrol in more profitable degrees.

Having a sense of community, wanting to work with people or help others is usually associated with the construction of femininity. In fact, women are usually taught to put others first or to highly value social traits and interactions. In this sense, the degree in which women do not identify with this trait could serve as a proxy for not interiorizing or conforming to that social standard, reflecting instead the prioritization of their own lives. The results seem to support this, since those women who do not think it is important to choose a degree based on the possibility to work with people are more likely to complete a high-earnings degree.

Consistent with the initial hypothesis, results indicate that girls who engage in activities that promote mathematical, scientific or technological skills and those girls that excel in school and, thus are aware –and probably more confident- about their own capabilities, are

more likely to enrol in high-earnings degrees. Attending robotics, computer, math or science clubs or fairs as a child increases the probability of holding a high-earnings degree in about 23 p.p. in both the probit and logit model, while being at the top of the class has even a higher effect (above 30 p.p.)*, ceteris paribus*. While engaging in extracurricular activities that promote the development of mathematical, scientific and technological capabilities might influence choosing a high-earnings degree, considering it important to work or study these subjects is not significantly associated with holding a high-earnings degree. In contrast, those who are stirred away from these subjects are more than 25 p.p. less likely to enrol in high-earnings degrees[52]*, ceteris paribus*. The latter suggests that having confidence and developing capabilities in these areas might be more important than developing an explicit taste for these subjects, since girls stop enrolling in these degrees if they have been discouraged from such subjects but they do not enrol more if they share a taste for them[53]. Contrary to what was expected, expressing disagreement with sex-typing of subjects (engineering is for boys, not girls) is not significantly related to choosing high-earnings degrees*, ceteris paribus*. Finally, age is not significantly associated with studying high-earnings degrees: being younger or growing up as part of the information technology generation is not linked with pursuing higher economic opportunities and no cohort effect is observed, so that entrance into the labour market under different circumstances does not seem to affect the degree choice.

Columns (3) and (4) present the average marginal effects for studying a female-dominated degree. Although it has the expected sign, considering important to earn a high income is not significantly associated with holding a female-dominated degree, suggesting that women that go into this type of degrees have other goals or priorities in life. These goals might be reflected by the significant association between choosing a female-dominated degree and considering it important to work with people: *ceteris paribus,* women who do not

[52] Estimations were calculated considering the source of this discouragement (whether it came from the household environment or the school), however, given the sample size and the restriction on the number of variables that can be tested, it was preferred to keep one single variable to capture this effect.

[53] As before, it should be noted that this hold for the sample surveyed, which might correspond to the best students and the girls with the highest capabilities, so that one could expect these effects to be stronger in the whole female population.

consider this to be an important characteristic in a job are around 21 p.p. less likely to have a female-dominated degree and more likely to have a high-earnings degree (as previously discussed from columns (1) and (2)).

While having a taste for mathematics and science did not increase the probability of studying a high-earnings degree, it does decrease the probability of studying a female-dominated degree in around 17 p.p*., ceteris paribus*. Thus, developing a taste for these subjects might incentivize women to explore less traditional degree options[54]. In contrast, being discouraged to learn or explore with mathematics, science or technology increases the probability of studying a female-dominated degree in more than 20 p.p*., ceteris paribus.* As discussed in previous sections, this discouragement takes several forms, some of which include discrimination, name-calling, jokes and other experiences that undermine a person's self-esteem and self-confidence. Hence, it is expected that those who have gone through such experiences will pull away from the subjects they associate them with. Since degrees associated with mathematics, science and technology tend to be male-dominated, it is understandable that these women are more likely to stay in the female-dominated degrees. At the same time, women who are not at the top of their class in high school also tend to enrol in these more traditional degrees. None of the other variables, however, explain the decision to enrol in female-dominated degrees: in particular, participating in extracurricular activities that develop mathematical and scientific capabilities and having gender equal beliefs that do not reflect sex-typing of subjects do not encourage women to choose male-dominated degree options. All of these provides supporting evidence for an argument already derived from the testimonies: being put down and losing self-confidence seem to have a stronger effect in keeping women in more traditional degrees and roles than the positive encouragement they get, so that the investment required to counterbalance the effect of a bad experience that makes them lose their confidence or creates reticence towards certain subjects is high compared to the initial negative shock that created such reticence.

[54] Again, if this holds for the students with the highest academic profile, it would be expected that this effect should be stronger for the whole female population.

TABLE 22:

Average marginal effects of the binary response models on degree choice

	High-earnings		Female-dominated	
	Probit (1)	**Logit (2)**	**Probit (3)**	**Logit (4)**
Important to earn a high income	0.1499	0.1476	-0.1264	-0.1266
	(0.09)	(0.09)	*(0.09)*	*(0.09)*
Unimportant to work with people	0.2372***	0.2388***	-0.2104**	-0.2074***
	(0.09)	(0.08)	*(0.08)*	*(0.08)*
Important to study or work with math and science	-0.0295	-0.0258	-0.178**	-0.1771***
	(0.08)	(0.08)	*(0.07)*	*(0.07)*
Someone influenced their degree choice	0.2483***	0.2383***	0.0115	0.017
	(0.06)	(0.06)	*(0.07)*	*(0.07)*
Discouraged to learn science, math or technology	-0.2506***	-0.2573***	0.2223**	0.228**
	(0.09)	(0.09)	*(0.09)*	*(0.09)*
At the top 15% of the class in high school	0.3419**	0.3504**	-0.2653**	-0.3116*
	(0.15)	(0.17)	*(0.13)*	*(0.16)*
Robotics, computer, math or science clubs, camps or fairs	0.2345*	0.2279*	0.113	0.1063
	(0.12)	(0.12)	*(0.13)*	*(0.13)*
Strongly disagree with "engineering is for boys, not girls"	0.104	0.1017	-0.0874	-0.0867
	(0.08)	(0.08)	*(0.08)*	*(0.08)*
Age	0.0061	0.0061	-0.0043	-0.0047
	(0)	(0)	*(0)*	*(0)*

Source: Online survey.

* p < 10%, ** p < 5%, *** p<1%; standard errors in parenthesis.

4.5. Conclusions

An online survey addressed to female academics at the University of York was conducted in order to further explore the motivations and the process leading to a degree choice. Consequently, even though the results derived from such survey refer to a specific profile of women (presumably, those with highest academic ability) they help illustrate how the relationship between gender, science, mathematics and technology might be constructed and how these women experienced such relationship earlier in their lives. Figure 2 illustrates the most relevant relations identified as influencing the choice to study a high-earnings degree

based on the results derived from the survey. According to the different testimonies, degree decisions obey more to a taste or interest in certain subjects as well as a desire to attend university rather than to an economic decision. In fact, only a small percentage of women recognize that earning a high income was an important reason when making their degree choice and this variable is not significantly related to their degree choice in the regression estimations. The latter suggests there is an information problem, so that girls do not have enough information about the labour market when they enrol in a degree program. However, when someone influences the degree choice (whether as a role model or by giving advice), women are more likely to choose a high-earnings degree, suggesting that this influence conveys some market information and that they might be signalling women the degree options that offer better economic opportunities. The information transmitted by this person also tends to associate mathematical and scientific degrees with higher rank or status, thus encouraging some girls to enrol in this type of programs. However, for other girls, the advice received reinforces gender occupational segregation, as shown by some of the testimonies collected. The age of respondents also shows that sex-typing of occupations is still persistent, although the discourse that discourages girls from certain subjects is more subtle than the one faced by older respondents.

Although most women do not feel they were treated differently because of their gender by their parents or teachers, those who did and, particularly, those who were discouraged from studying mathematics, science or technology, are less likely to complete a high-earnings degrees and more likely to choose a female-dominated degree. Whereas being encouraged and developing confidence in a particular subject requires constant support from teachers and parents, particular incidents or experiences can keep women away from certain subjects. Also having the opportunity to further study and develop mathematical, scientific and technological capabilities in extracurricular activities and excelling in school can also encourage girls to later complete high-earnings degrees. Although there is evidence that girls receive different types of toys than boys and an argument has been made that these gender-typed toys might limit the career options of women later in life, the correlations observed in this sample do not support this. The lack of evidence supporting this hypothesis, however, demands special care, since respondents seem to recall their toys as being more gender-

neutral than their sisters, suggesting that they could be recalling their experiences with toys with a certain bias.

The data also indicates that, in general, girls experienced a more supportive environment at home than at school in terms of developing mathematical, technological and scientific capabilities, with parents taking on different roles. While mothers stimulate their children more constantly, supervise and help with their school work, fathers are perceived as being more engaging and playful in regards to these subjects. Mothers are also more likely to discourage girls from these subjects, since they transmit to them their own fears and reticence, while fathers are more likely to hold more conservative aspirations for their daughters, thus being less supportive than the mothers in opting for a professional degree.

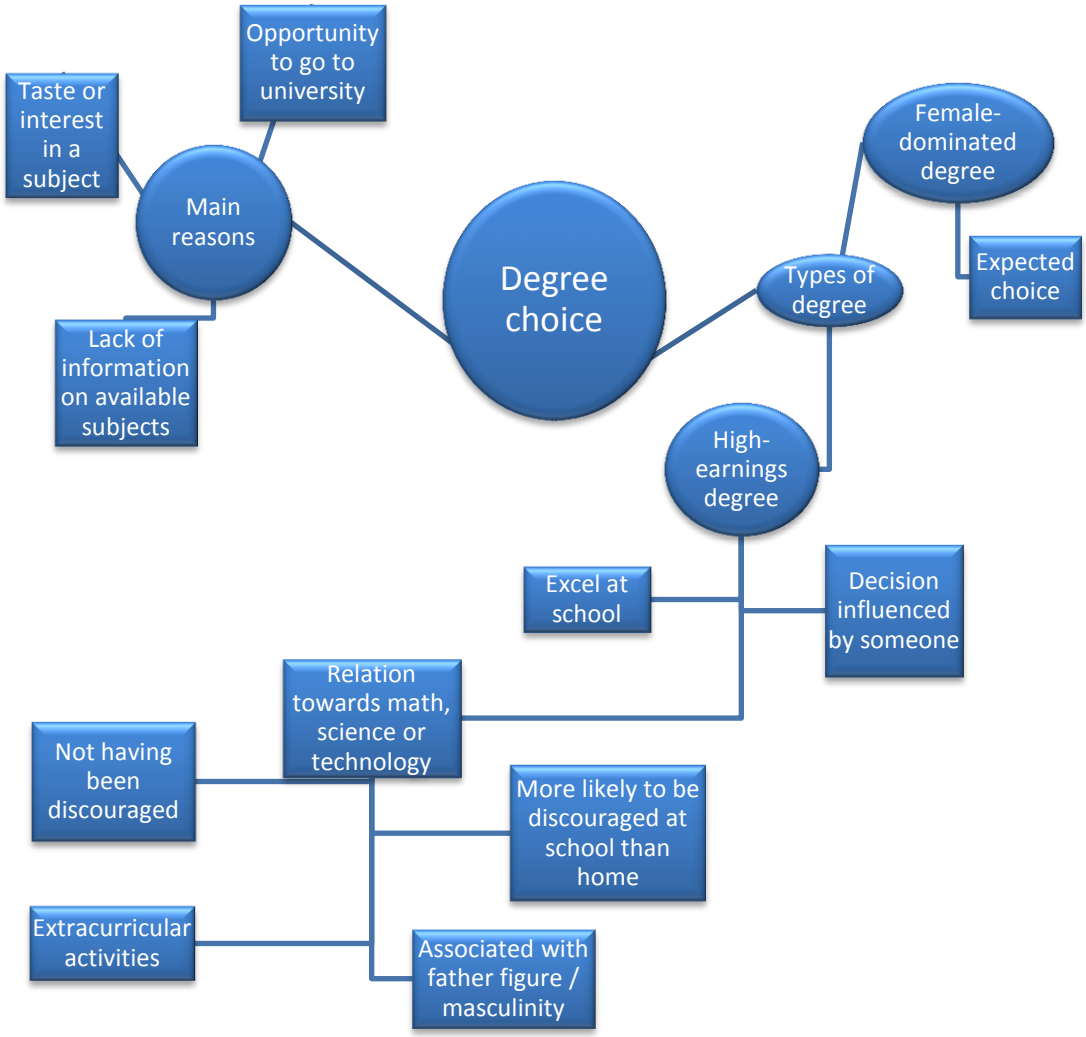
Results provide conflicting evidence regarding the relationship between gender-equal beliefs and degree choices. While the testimonies suggest that experience teaches girls to associate mathematics, science and technology with masculinity, the regression estimations do not find a significant relationship between holding conservative beliefs and the type of degree chosen. The regression results seem to suggest that this relationship is more subtle: while most women would express gender-equal beliefs; argue in favour of having equal capabilities and access to degree programs; and girls also have access to mathematical, scientific and technological devices, toys, classes and activities (although their access might be restricted in some ways), it is the constant signalling and association of these subjects with masculinity and the experiences that undermine their confidence in these subjects what might be keeping them away from the most profitable degree choices. Tackling this problem has no easy solution since, in both the household and school environment, children are socialized into associating these subjects with masculinity. This contributes to women remaining in the female-dominated degrees, most of which are not in the top of the wage distribution.

Finally and despite the lack of career information and the gender roles that permeate women's degree choices, the female academics surveyed tend to report satisfaction with their degree choice, their career and their life. While they report to be satisfied with these, however, their testimonies reflect a struggle to balance their career and their personal life.

What is interesting is that they accept this struggle as part of the challenge of having an academic career and not as something associated with their gender.

FIGURE 2:

Concept map for degree choice



5. Exploring the correlation between degree and occupational choice with the earnings function and gender wage gap decomposition

"At the thought of all those women working year after year and finding it hard to get two thousand pounds together, and as much as they could do to get thirty thousand pounds, we burst out in scorn at the reprehensible poverty of our sex. What had our mothers been doing then that they had no wealth to leave us? Powdering their noses? Looking in at shop windows? Flaunting in the sun at Monte Carlo?" (Virginia Woolf, 1928, p. 576)

5.1. Introduction

The previous chapters explored whether studying a high-paying degree is associated with the construction of gender-equal beliefs and the level of exposure to mathematics and technology at an early age, with the underlying assumption that the type of degree is associated with gaining access to certain type of jobs and earning opportunities. That is to say, it is expected that graduate women with high-paying degrees will have access to higher wages when entering the labour market, since they would have developed highly-valued marketable skills. However, this need not be true. It could well be that women entering high-paying degrees and occupations suffer a higher level of discrimination within these fields than those women choosing female-dominated degrees and occupations or that having a degree, not the degree choice, is what is relevant in gaining access to better paid jobs. In order to test whether the degree and occupational choice are, in fact, associated with a higher wage, earnings functions are estimated for both graduate women and men using data from the 1970 British Cohort Study. The results from these earnings functions are later used to decompose the gender wage gap.

The human capital model, developed by Becker (1993, first published in 1962) and Mincer (1970), provides the basic framework for estimating earnings functions[55]. According to this model, the level of schooling or training, as well as ability, explain the differences in productivity between workers, thus, explaining the differences observed in wages. However, observed differences in wages between groups can also contain a discrimination component that does not respond to productivity, but to preferences benefiting a particular group over another (Becker, 1971). Among genders, occupational segregation has been signalled out as the major barrier in closing the gender wage gap (Becker, 1971 and Oaxaca, 1973): women have traditionally been employed in lower-paying occupations and face entry barriers as well as discrimination and coercion when they try to move into higher paid occupations (Power, 1975 and Goldin, 2002). Thus, it is worth investigating whether women who have crossed over to the high-paying degrees and occupations benefit from higher earnings or if, on the contrary, their degree and occupational decisions leave them worse-off than those women in more traditional female-dominated work environments. Women may also avoid entering high-earnings occupations due to higher atrophy rates that will result in higher penalties in case of intermittency in the labour market participation (Polachek, 1981). Training and labour force participation may both be endogenous to the human capital model (Gronau, 1988), and associated with childbearing decisions for women (Dolton and Makepeace, 1987), so that women choose those occupations with lower investment requirements, lower atrophy rates and lower wage rates and this also contributes to widening the gender wage gap.

Oaxaca (1973) developed an econometric estimation that decomposes wage differential in two: the explained differential due to differences between the group characteristics and a discrimination coefficient that captures the unexplained differential. Similarly, Blinder (1973) proposed decomposing the wage differential in three: a differential in endowments, a differential on how the group characteristics are valued (difference in coefficients) and an unexplained component. More recently, Oaxaca and Ransom (1994) decompose the wage differential into the overpayment received by the favoured group, the underpayment of the group discriminated against and a productivity differential. Because of its applicability, this technique, known as the Blinder-Oaxaca decomposition, is widely used when studying wage gaps. For instance, in the United Kingdom, more than three quarters of

[55] For a more detail review of the literature, see section 2.

the gender wage gap of full-time workers observed in the 2004 Workplace Employment Relations Survey is not explained by differences in characteristics, suggesting the persistence of discrimination (Mumford and Smith, 2009). Other studies show that, over time, occupational choice is not significant in understanding the wage growth gap, but rather constraints on job shopping, part-time and intermittent employment explain why men's wages grow faster (Manning and Swaffield, 2008, using data from the British Household Panel Survey and New Earnings Survey 1975-2001). The gender wage gap in the United Kingdom also increases over time due to lower returns on promotion for women than men, according to data from the British Household Panel Survey (Booth, Francesconi and Frank, 2003); and has been consistently estimated above 10% (Lanning *et al*., 2013, p.14).

When the degree subject is considered in the earnings function of graduates, results tend to suggest that the degree choice does, in fact, influence earnings, although this finding is not consistent across studies. For example, Machin and Puhani (2002 and 2005, using data from the 1996 British, German and French Labour Force Surveys) and Chevalier (2011, using data from the Longitudinal Destination of Leavers of Higher Education survey) find a higher premium for degree subjects that are typically dominated by men and related to technology and mathematics. However, the biggest wage gaps are observed within (not among) the degree subjects (Chevalier, 2011), showing a highly unequal wage distribution for certain subjects. The latter might suggest that women with a male-dominated and high-paying degree (such as engineering or Economics) might not be as well-off as someone in a more traditional degree, such as education simply because of this wider wage inequality in the field.

Further, interquantile analysis of the gender gap can reveal the existence of a glass ceiling effect, so that the narrowing of the gender wage gap slows down at the top of the wage distribution (Blau and Kahn, 2006). Findings of Chzhen and Mumford (2011, using the 2005 British Household Panel Survey), Connolly and Long (2008, using data from the 2003-2004 Athena Survey of Science Engineering and Technology) and Arulampalam, Booth and Bryan (2004, using data from the 1995-2001 European Union Household Panel) support the existence of a glass ceiling effect for British workers; while those of Blackaby, Booth and Frank (2005) and Neuburger (2010, using data for full-time workers in the 1970 British Cohort Study) do not. A glass ceiling effect is consistent with Chevalier's finding, thus suggesting that women in high-

paying occupations might not enjoy the same opportunities as men. In contrast, Walker and Zhu (2011, using the 1994-2009 Labour Force Surveys) do not find the existence of a higher premium for graduates in science, technology, engineering and mathematics in England and Wales, suggesting that the degree choice does not contribute in explaining differences in earnings. While contrary to Chevalier's, Walker and Zhu's findings are consistent with Glover's (2000) argument that the United Kingdom does not experience a shortage of labour supply in the sciences.

Studies using data from the 1970 British Cohort Study show an increasing gender wage gap over time for this cohort: the ratio of a median female wage was 90% of a man's at age 26%, 86% at 30 and 80% at 34 (Neuburger, Kuh and Joshi, 2011). Other studies report a gross gender wage differential of 0.082 log points (Makepeace, Dolton and Joshi, 2004 and Joshi, Makepeace and Dolton, 2007) and 0.17 at age thirty for full-time workers (Neuburger, 2010); and 0.22 at age 34 (Neuburger, 2010). Further, this gap is estimated to be around 25% for female graduates in their late thirties and 29% for all workers (Lanning *et al*., 2013).The present chapter adds to the literature by considering whether opting for a high-earnings degree contributes to women gaining access to higher paid jobs. The next section presents the specification for the different estimation models. Section 5.3 offers a brief discussion on the balanced sample used, which refers to graduates in the 29 and 34-years follow-up of the 1970 British Cohort Study. Section 5.4 analyses the results and section 5.5 concludes.

5.2. Methodology

This section outlines the estimation equations used to calculate the earnings and gender wage decomposition for the 29 and 34-year old follow-ups of the 1970 BCS. Initially, a version of the basic human capital model is estimated in order to provide a benchmark for subsequent models. In a second step, an augmented version of this model is estimated to discuss the inclusion of control variables exogenous to the model. Later, earnings functions are estimated including each of the four interest variables[56]: having a high-earnings degree

[56] These variables are defined as in section 3.5, when degree choices were analyzed.

(d^H), having a female-dominated degree (d^f), working in a high-earnings occupation (o^H) and working in a female-dominated occupation (o^f). Finally, an earnings function is estimated including all the control and variables of interest. Once the preferred earnings function is estimated, the wage gap decomposition is calculated following Oaxaca and Ransom (1994).

5.2.1. Human capital model

As discussed earlier, the human capital model (Becker, 1993 and Mincer, 1970) provides the baseline for estimating earnings functions. Earnings (*Y*) for individual *i* are measured as the natural logarithm of the real gross hourly pay (in pounds of 2005) for employed graduates as reported in the 29 and 34 year follow-ups. They are estimated for both waves separately using ordinary least squares and they are assumed to be dependent on the highest educational level attained (i.e., a dummy variable indicating whether the cohort member has a postgraduate degree or not), the years of working experience and the years of working experience squared. Since earnings are estimated for both women and men, a variable indicating whether individual *i* is female is also included in the pooled model. If *X* denotes the vector of independent variables mentioned above (i.e., having a postgraduate degree, years of working experience, years of working experience squared and being female), ε_i is an error term, and β_j are the coefficient values, earnings will then be given by:

$$(31) \quad Y_i = \beta X_i + \varepsilon_i$$

Because women participate less in the labour market than men, there is a risk that working women are self-selected into the sample, which will produce biased estimators. In order to correct for this self-selection bias, Heckman (1976, 1979) proposes a two-step model: in the first step, a probit function is estimated to determine the probability of a woman working. In turn, this allows calculating the inverse of the Mills ratio (λ_i), which can be interpreted as an estimate for the omitted variable, so that λ_i is then included as a regressor in the earnings equation to correct for self-selection. When significant, results are reported with the Heckman correction, as discussed below. In such case, the probability that a woman works (*W*) is estimated as being dependent on her educational level, the years of working

experience, the years of working experience squared, binary variables indicating whether she is legally married, exhibits gender-equal beliefs, there are any preschool children in the household and whether she is British, Irish or white, as well as an interactive variable indicating whether she has preschool children and gender-equal beliefs. If *Z* is the vector of independent variables specified above and ξ is the error term, then the latent model for the probability of working is given by:

$$(32) \quad W_i^* = \alpha Z_i + \xi_i$$

Notice that the educational level, the years of working experience and the years of working experience squared are shared variables with the earnings function, while the remaining permit the identification. A binary variable to capture ethnicity is included. Women may participate less in the labour market due to their household responsibilities, particularly those associated with childbearing. Being married and having preschool children may capture these characteristics[57]. At the same time, one would expect that having gender-equal beliefs will be associated with a higher likelihood of working, particularly for those women who have children, which is why this variable is also interacted with having preschool children. The attitudinal variable was constructed from four attitude variables in the 29-year follow-up. Respondents were asked to rate their level of agreement in a five-point Likert scale with the statements: (i) preschool children suffer if the mother works, (ii) dad's job is to earn money, mom's to stay at home, (iii) a mother and family are happier if she goes out to work and (iv) kids benefit if mom has a job outside home. The first two statements were recoded backwards to measure agreement with gender equal beliefs. Respondents were given a value of 1 if the average score of the replies given was above 2, that is, agreement or strong agreement with positive statements regarding gender equality; and this same value was imputed to the data from the 34-year follow-up. It is presumed that beliefs precede the decision of working: the conceptual framework and ethos of a woman, as well as her reproductive decisions, are assumed to be prior to the decision of working. This assumption is based on the argument that individuals shape their identity early in life and because this is such a central issue in defining identity, it is unlikely it will change. So, it is not assumed that

[57] Dolton and Makepeace (1987) argue that children should be accounted for in the human capital model in order to avoid misspecification.

respondents would accommodate their beliefs to their decision of working but rather that their decisions respond to their beliefs and preferences. However, because the variables used to measure agreement with gender identity are drawn from the 29-year follow-up, there is a risk that these variables could be endogenous to the decision of working iff individuals did accommodate their beliefs and preferences to their actions, which would lead to inconsistent estimators. Alternatively, the gender-equality index score[58] at age 16 could be used instead to avoid this risk of endogeneity. However, using data from the 16-year follow-up does not change the significance levels of the Heckman adjustment when estimating the human capital model in section 5.4.2 but costs losing more than 40% of the observations in the sample, which is why it was decided to keep the score constructed from data at age 29.

Once the probability of working for women is estimated, the inverse of the Mills ratio is calculated, so that women's earnings in the second step are now given by:

$$(33) \quad Y_i = \beta X_i + \beta_\lambda \lambda_i + \varepsilon_i$$

5.2.2. Augmented human capital model

A second set of estimations includes control variables that are usually included in earnings functions. These are: binary variables indicating (i) whether the respondent is currently working part-time, (ii) is married and (iii) is British, Irish or white. Part-time work is usually associated with lower wages and a higher preference for leisure, so that controlling for it may measure particular characteristics of part-time workers. Likewise, being married has been associated with higher wages for men, but not women (Ribar, 2004), which represents a particular cultural trait: while married men receive a premium in the form of higher promotions or raises, married women do not. Lastly, ethnicity is included as a measure for racial discrimination, since minorities in certain segments of the labour force might face less training and working opportunities, although this may not be the case for those minority members that have been privileged enough to receive a university education.

[58] See section 3.4.1 for a description of this variable.

A second version of this augmented model is also estimated including industry as a control variable. This is a categorical variable with 14 categories: (i) agriculture, hunting, forestry and fishing; (ii) mining and quarrying; (iii) manufacturing; (iv) electricity, gas and water supply; (v) construction; (vi) wholesale and retail trade; (vii) hotels and restaurants; (viii) transport, storage and communication; (ix) financial intermediation; (x) real estate, renting and business activities; (xi) public administration, defence and social security; (xii) education; (xiii) health and social work and (xiv) others. However, as it will be discussed later on, it was not considered appropriate to include industry as a control for later estimates, since it is related to occupational choice. Despite being often included as controls in earnings functions, public employment and region could not be included in the estimations due to unavailability of such variables in the dataset at hand. If c_i is the vector of control variables, then the earnings function with the Heckman correction is given by:

$$(34) \quad Y_i = \beta X_i + \beta_c c_i + \beta_\lambda \lambda_i + \varepsilon_i$$

5.2.3. Variable inclusion model

The main hypothesis to be tested is whether those women who have a high-earnings degree (d^H) have, in fact, access to higher earnings due to this decision. Hence, one would expect for this variable to be positively associated with earnings. In contrast, because high-earning degrees are predominantly dominated by men, one would expect women with female-dominated degree (d^f) to enjoy lower earnings. Similarly, one would expect to find the same relationship when considering occupational choices. Because degree and occupational choices could be related, the effect of each of these variables is first analysed individually. For consistency, degrees and occupations in this chapter were classified using the same criteria discussed in sections 2.3 and 3.5.1, which consists of two binary variables identifying (i) high-paying fields of study at the top 20% of the wage distribution vs. the ones at the bottom 80% and (ii) female-dominated vs. male-dominated fields of study[59]. If q_i denotes either d^H, d^f, o^H or o^f, earnings are then given by:

[59] Section 2.3 discusses the definition of female-dominated occupations and why Power's (1975) binary classification was chosen over other possible classifications, including using more than two categories.

$$(35) \quad Y_i = \beta X_i + \beta_q q_i + \beta_c c_i + \beta_\lambda \lambda_i + \varepsilon_i$$

5.2.4. Full model

The final version of the model includes all the variables of interest in the earnings function, so that earnings are given by:

$$(36) \quad Y_i = \beta X_i + \beta_{d^H} d_i^H + \beta_{d^f} d_i^f + \beta_{o^H} o_i^H + \beta_{o^f} o_i^f + \beta_c c_i + \beta_\lambda \lambda_i + \varepsilon_i$$

This allows to test whether the different degree and occupational choices are associated with the graduate's earnings.

5.2.5. Wage decomposition

Once the preferred earnings model is estimated, the gender wage gap is measured using the wage decomposition proposed by Oaxaca and Ransom (1994), as discussed in section 2.2 of the literature review. This is a three-fold decomposition that allows identifying the differences in group characteristics, the discrimination in favour of men and the discrimination coefficient against women. Equation (37) above can be expressed as: $Y_i = \beta X_i + \varepsilon_i$; so that the gross wage decomposition *(ln(G_{mf}+1))* between women (*f*) and men (*m*) can be estimated by :

$$(37) \quad ln\left(G_{mf} + 1\right) = \bar{X}_m'\left(\hat{\beta}_m - \beta^*\right) + \bar{X}_f'\left(\beta^* - \hat{\beta}_f\right) + (\bar{X}_m - \bar{X}_f)'\beta^* \ ,$$

where:

$\bar{X}_j'$: vector of mean values of the regressors,

$\hat{\beta}_j$: vector of estimated coefficients,

Section 3.5.1 details how the classifications were made using data from the Labour Force Surveys. Appendices 2 and 3 (6 and 7) show the classification of degrees (occupations), as discussed in chapter 3.

$\beta^* = \Omega\hat{\beta}_m + (I - \Omega)\hat{\beta}_f$: vector of coefficients when there is no discrimination, assuming weighting Ω.

Estimations for the gender wage gap are calculated using the oaxaca Stata command developed by Jann (2008) and contemplating three possible scenarios regarding the value of Ω. Oaxaca and Ransom (1994) propose that the best weighting matrix for estimating the scenario with no discrimination is given by $\Omega = (X'X)^{-1}X'_mX_m$, which includes information for the pooled sample (X) and the group favoured by discrimination (X_m). Jann (2008) argues that this weighting might overstate the explained differential if a group variable is not included in the regressors. In this case, this implies that a binary variable identifying female cohort members is included when estimating the pooled earnings functions[60]. The second scenario assumes that the current female wage structure is the correct one, so that Ω=0, while in the third scenario, the male wage structure is assumed to be the correct one, Ω=1.

5.3. Data discussion

The hypothesis is tested using data from the 1970 BCS[61]. As discussed in section 3.3, attrition problems may arise both because cohort members may not participate in some waves or because of missing values for specific questions. Appendix 5 presents how nonresponse affects each of the variables of interest in the 29 (panel 1) and 34 (panel 2) year

[60] An alternative to the Oaxaca-Blinder decomposition is the quantile regression analysis, which examines how the wage responds to changes in the trait distribution (Machado and Mata, 2005). However, in this case, the Oaxaca-Blinder decomposition seems adequate: in the first place, the research focuses on graduates and whether certain types of degree choices are associated with higher earnings for the typical graduate. That is, the research question was established with the intention to examine the mean, not its variability, so that using an instrument that focuses on the mean and not its distribution is consistent with the question in hand. Secondly, the Stata command used allows for estimations using the preferred weights for the pooled matrix as suggested by both Jann (2008) and Oaxaca and Ransom (1994). Thirdly, when using a Heckman correction this command also adjusts for the selection bias in the decomposition as suggested by Neuman and Oaxaca (2004).

[61] For a more detailed description of this dataset see section 3.3.

follow-ups relative to the original population, the total of responses in that particular wave and total graduates. It also shows the percentage of female responses per item. As expected in a longitudinal study, it becomes more difficult to trace the cohort members as time goes by: only 65.5% (11 261) of the initial (17 196) cohort members participated in the 29-year follow-up and this number decreased to 56.2% (9 665) in the 2004 follow-up. Additionally, the target population, those with university degrees, consists only of about 12% of the initial population. Although some variables can be retraced from previous waves, the sample size drops further due to missing values. This leaves a sample size of 1528 graduate workers at age 29 and 1377 at age 34. In both waves, graduates are slightly more likely to report their wage, occupation and industry relative to the whole cohort. In contrast, women are less likely to report these same variables, but women are, in general, overrepresented in the surveys. Hence, it is worth noting that, while missing observations were treated as random, this may not be the case, so that there might be a selection bias and results cannot be generalized to the population.

Table 23 provides some descriptive statistics for the variables of interest for the 29 and 34-year follow-ups. Results for each wave are presented and analysed separately, since they provide information at a very particular period in a graduate's career: particularly for women, the period observed provides information associated with a tipping point in their careers, which is their reproductive decision and the consequences that stem from it (less years of experience, accepting lower wages, working part-time, etc.).

In total, information is available regarding 2905 working graduates, 52.6% of whom belong to the 29-year follow-up, and 48.4% are women. As discussed above, because observations were dropped when data was missing, these graduates include only those cohort members who have a university degree and reported their subject field of study, which is necessary to classify the degree. It also includes only those graduates who were working and reported a wage, but excludes self-employed graduates. There is also information for 398 non-workers, a majority (71.4%) of whom are women. Although the percentage of graduates who are not working might seem high (13.7% of total observations), only one out of five of non-working graduates is actually unemployed or seeking work (2.2% of total). The rest are still in education (15.1%), sick (8.5%) or looking after their family (46.7%), so that the main reason for graduates not participating in the labour market is their role as caretakers at home;

a role that particularly affects women. Among those graduates out of the labour market, the proportion of women increases from 63.8% at age 29 to 77.4% at age 34, which is accompanied by an increase of the proportion of non-working women with preschool children: at 29, 61.1% of women out of the labour market have children, but by age 34, this percentage increases to 70.8%. The increase in the proportion of women with children between 29 and 34 is more dramatic for working women: at age 34, working women are 2.4 times more likely to have preschool children at home than when they were 29, especially 34 years old part-timers, who are 3.6 times more likely to have preschool children than full-time working, graduate women. Therefore, if graduate women are self-selected into the labour market, this phenomenon should be more visible in their early thirties than in their twenties, since British graduate women postpone motherhood into their thirties[62].

As expected, women earn less on average than men. As defined in section 5.2.1, if wages are measured as the natural logarithm of the real gross hourly pay, the gender log wage differential for full-time graduates is around 17.7% for both waves, thus showing some stability over time. This estimate is between the gross log wage differential of 0.17 and 0.22 estimated by Neuburger (2010) for all full-time workers for the 1999 and 2004 waves, respectively. It is also higher than the 0.082 log point differential in 1999 estimated by Makepeace, Dolton and Joshi (2004) and Joshi, Makepeace and Dolton (2007), but lower than the 25% gap for graduates at age 38 estimated by Lanning *et al*. (2013). This suggests that, either graduates, who tend to be located at the top of the wage distribution, face a higher wage gap than all workers, which would be consistent with the evidence of the glass ceiling effect in the United Kingdom (Mumford and Smith, 2009; Chzhen and Mumford, 2011; Connolly and Long, 2008; and Arulampalam, Booth and Bryan) or that the sample may be

[62] In 2011, the standardized average age of first birth in England and Wales was 27.9 (Office of National Statistics, 2013). At the same time, Ní Bhrolcháin, M. and Beaujouan, E. (2012) estimate that, for the 1995-1999 period in Britain, women with the highest educational (who finish their study at ages 21 or higher) postponed their first birth by 8.6 years after finishing education, that is, into their early thirties. Similarly, highly qualified women have also been estimated to defer motherhood in about 5 years on average (Jenkins, 2011, p. 203).

biased[63], in which case the findings of this study can only illustrate the behaviour of the sample discussed. Part-time graduate women do not earn less than male part-timers. In fact, they earn about 12.9% more when they are 29 years old, but this female advantage decreases over time and, part-time working graduate women and men earn about the same by the time they are 34 years old. Table 23 also shows estimates for the net hourly wage. In this case, the gender wage gap slightly increases over time, from 15.9% to 16.9% between 1999 and 2004 for full-timers, while the female advantage in part-time work disappears by age 34, thus showing a similar behaviour as the gross wage[64].

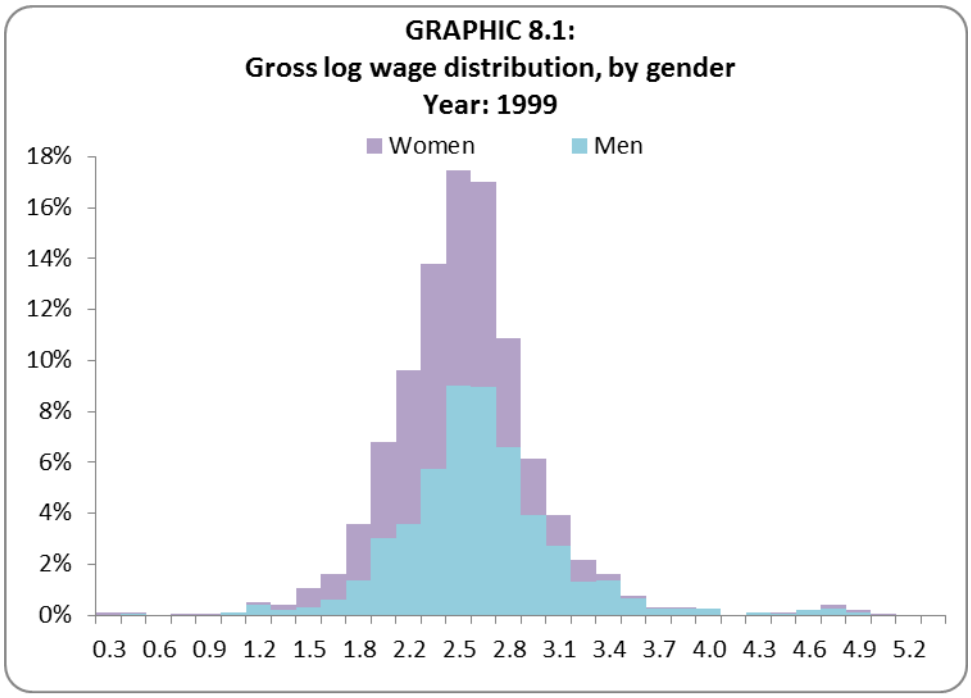
Graphic 8 plots the gender composition for the gross wage distribution of working graduates in the balanced sample: in 1999, 56.6% of the graduates in the bottom decile of the gross wage distribution were women, compared to only 27% of those in the top decile of the distribution. Further, 25% of women earned a wage located in the bottom quartile of the log wage distribution and a similar percentage of women were located in the top quartile. In contrast, only 16.1% of men were located in the bottom quartile but 41.7% of them were located in the top quartile of the log wage distribution[65]. By 2004, some changes are observed among the distribution: 28.1% of women earned a wage located in the bottom quartile of the log wage distribution but only 17.4% of men did. At the same time, only 15.7% of women were located in the top quartile (9.3 p.p. less than in 1999) while 28.9% of men did. Women also represent a higher percentage of those in the bottom decile of the log wage distribution (63%) than they did in 1999 (56.6%). However, they represent 9.2 p.p. more of those located in the top decile (36.2%) relative to 1999 (27%). Hence, the distribution for men seems to flatten relative to the one observed in 1999 and to women[66].

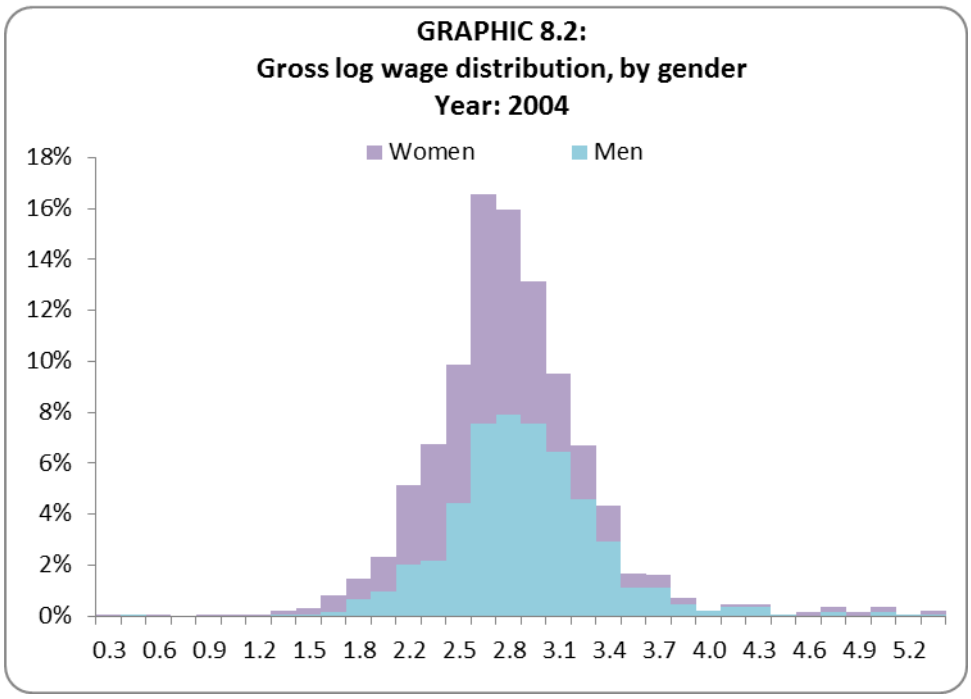
[63] Recall that observations were dropped from the sample for those graduates with no known degree or other missing data.

[64] Because the net hourly wage is affected by taxes and benefits, which are outside the scope of this research, estimates will be based on the gross hourly wage, which better reflects the market value of a specific degree or occupational choice.

[65] Because the sample does not have equal number of women than men, the proportion of men in these quartiles differs from that of women.

[66] Data does not exhibit enough movement to carry on an interquantile analysis.





It is not expected for the gender wage gap to be associated with differences in education, since British women are part of the world trend of reversing the gender gap in education: according to this trend, women now attain higher levels of education than men, enrol more in college and university education and graduate faster than men (Goldin, Katz and

Kuziemko, 2006; Lanning *et al*., 2013; Gregory and Connolly, 2008; Schoon and Polek, 2011; Glover, 2000, and Joshi, Makepeace and Dolton, 2007). By age 29, 30% of graduate working women have a higher professional degree, compared to only 26.5% of graduate working men and this gap is higher among part-timers (a difference of 8.6 p.p.). However, by age 34, this percentage is similar among female and male graduate workers. At the same time, there is a considerable increase of the proportion of female non-workers with higher professional degrees. These changes can be explained by flows in and out of the labour market, training decisions and cohort members moving in and out of the survey. Firstly, workers were more likely to get a higher professional degree than non-workers: 13% of women and 19% of men who were working in 1999 decided to get a higher professional degree and stayed working, contrasted with 6% of both women and men who were not working and remained out of the labour force. Secondly, the proportion of male graduates with higher degrees joining the labour force was higher (42.9%) than that of female graduates (34.2%). Thirdly, a higher proportion of the female graduates who stopped working had higher professional degrees (32.6%) than that of male graduates (25%). And finally, a higher proportion of women, for whom information was available in 1999 but not in 2004, had professional higher degrees (31.5%) than that of men's (26.4%). Hence, during this period women with higher qualifications were more likely to move out of the labour force or the survey than their male counterparts.

Full-time working graduate women exhibit similar, albeit slightly lower, average working experience as their male counterparts in both waves. However, this is not the case for part-timers and non-working graduates. On both cases, female working experience surpasses the men's over 10% at age 29; however, this is inverted by age 34, when men in these groups have accumulated almost a whole year of more working experience than women. Among workers, men are 1.6 times more likely to hold a high-earnings degree than women, which is consistent with the hypothesis that high-earnings degrees are predominantly dominated by men. This ratio holds for full-timers both at 29 and 34 years old. However, there is a higher proportion of women with high-earning degrees working part-time than men at 29, but this is reversed in the 34-years follow-up. In all cases women are more likely to hold a female-dominated degree and this does not change much over time: full-time working women are 2.6 times more likely than men to hold this type of degree, while men with this

type of degree are more likely to work part-time or to be out of the labour force. At the same time, the proportion of non-working women with this type of degree is higher when they are 29 years old, suggesting that women with more traditional degrees might leave the labour force earlier than women with male-dominated degrees.

Women are also more likely to enter high-earnings occupations than to have high-earnings degrees, which could suggest that the type of degree does not restrict them as much from entering the most profitable occupations. In fact, since occupations cover the whole spectrum of workers, not just the segment for graduates, the high levels of graduates in high-earnings occupations could be implying the existence of a threshold: it might well be that holding a degree, irrespective of its type, is crucial in gaining access to the highest paying occupations. Notice also that the percentage of women and men in high-earnings occupations is higher among full-timers than part-timers in both waves, which could be interpreted as people in these occupations having higher opportunity cost to go part-time. As expected, women are more likely to go into female-dominated occupations: in fact, full-time graduate women are 2.6 times more likely than men to work in these occupations. At the same time, working in a female-dominated occupation is overrepresented for part-timers, especially for men. The majority of male part-timers work in a female-dominated occupation, which could signal either a different profile for these men (i.e., they enjoy working part-time, prioritize family life, etc.) or a more restricted access to full-time employment in such occupations. It is also important to notice that the percentage of men working part-time represented in the data is almost trivial, just over 1% of all working male graduates. In contrast, this percentage is considerable for women and it increases over time, going from over 10% when they are 29 years old to over 20% by age 34.

Regarding socio-demographic variables, it is clear that legal marriage is associated with women working part-time or staying out of the labour market and the percentage of married women in these groups increases with time, whereas married men are more likely to work full-time. Most of the cohort members are British, Irish or white, so that ethnic minorities represent only about 5% of the sample; and non-British, Irish or white women are more likely to be out of the labour force. Female full-timers are more likely to have gender equal beliefs than female part-timers and the latter are more likely to do so than those non-working

women, while part-timer men are more likely than full-timers or non-workers to express gender equal beliefs, which again could signal that this group of men has a different profile and set of preferences. Finally, women with preschool children are more likely to work part-time or be out of the labour force, while men with preschool children are more likely to work full-time. Also, women are more likely to have preschool children at age 34 than at age 29. This is consistent with the literature, according to which women in this cohort experience their first birth around age 28 (Kneale and Joshi, 2008, p. 1943) and 40% of them are childless at age 30 (Jenkins, 2011, p. 202). If highly qualified women defer motherhood in about 5 years (Jenkins, 2011), then one would expect graduate women from this sample to have their children after turning thirty. That women with children work part-time or move out of the labour force is also consistent with literature according to which women downgrade jobs after having a child (Lanning *et al*., 2013, pp.3, 26 and Gregory and Connolly, 2008, F2), see an increase in their pay gap around 30 when they have children; and are more likely to be childless if they work in professional and managerial occupations (Lanning et *al*., 2013, p.24 and Hakim, 2006, p. 283).

TABLE 23:

Descriptive statistics for graduates in the 1970 BCS, by wave

29-year follow-up	Pooled sample				Women				Men			
Variable	Workers	Full-timers	Part-timers	Not working	Workers	Full-timers	Part-timers	Not working	Workers	Full-timers	Part-timers	Not working
Average natural logarithm of net hourly wage*	2.103	2.113	1.934	0.000	2.023	2.033	1.941	0.000	2.177	2.181	1.872	0.000
Average natural logarithm of gross hourly wage*	2.427	2.444	2.159	0.000	2.335	2.356	2.171	0.000	2.513	2.518	2.049	0.000
Professional higher degrees	28.2%	28.1%	30.0%	26.0%	30.0%	29.9%	30.9%	26.5%	26.5%	26.5%	22.2%	25.0%
Average years of working experience	7.33	7.42	5.82	5.44	7.16	7.31	5.90	5.69	7.48	7.51	5.10	5.00
Average years of working experience squared	59.17	60.37	39.89	36.08	55.99	57.96	40.01	37.08	62.14	62.41	38.78	34.33
High-earnings degree	42.1%	43.0%	27.8%	29.4%	32.5%	33.0%	28.4%	20.4%	51.1%	51.4%	22.2%	45.3%
Female-dominated degree	35.2%	33.8%	57.8%	53.1%	51.8%	50.8%	60.5%	61.1%	19.6%	19.5%	33.3%	39.1%
High-earnings occupation	41.6%	42.2%	31.1%	0.0%	39.5%	40.3%	33.3%	0.0%	43.5%	43.8%	11.1%	0.0%
Female-dominated occupation	39.3%	37.1%	75.6%	0.0%	58.3%	55.9%	77.8%	0.0%	21.5%	21.2%	55.6%	0.0%
Currently working part-time	5.9%	0.0%	100.0%	0.0%	11.0%	0.0%	100.0%	0.0%	1.1%	0.0%	100.0%	0.0%
Female	48.4%	45.8%	90.0%	63.8%	100.0%	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Currently working	100.0%	100.0%	100.0%	0.0%	100.0%	100.0%	100.0%	0.0%	100.0%	100.0%	100.0%	0.0%
Married	38.2%	36.3%	68.9%	46.9%	38.6%	33.9%	76.5%	62.8%	37.9%	38.3%	0.0%	18.8%
Has preschool children	15.4%	12.4%	63.3%	42.9%	14.1%	7.3%	69.1%	61.1%	16.7%	16.8%	11.1%	10.9%
British, Irish or white	95.4%	95.4%	95.6%	93.2%	96.2%	96.0%	97.5%	91.2%	94.7%	94.9%	77.8%	96.9%
Gender equal beliefs in labor market	69.4%	68.8%	77.8%	58.8%	79.4%	79.6%	77.8%	61.9%	59.9%	59.7%	77.8%	53.1%
Observations	1 528	1 438	90	177	739	658	81	113	789	780	9	64

… table 23 (continued)…

34-year follow-up	Pooled sample				Women				Men			
Variable	Workers	Full-timers	Part-timers	Not working	Workers	Full-timers	Part-timers	Not working	Workers	Full-timers	Part-timers	Not working
Average natural logarithm of net hourly wage*	2.343	2.346	2.320	0.000	2.271	2.257	2.319	0.000	2.411	2.412	2.324	0.000
Average natural logarithm of gross hourly wage*	2.707	2.728	2.542	0.000	2.613	2.634	2.542	0.000	2.794	2.798	2.531	0.000
Professional higher degrees	34.1%	34.9%	27.8%	29.0%	34.1%	36.0%	27.5%	32.2%	34.2%	34.2%	33.3%	18.0%
Average years of working experience	11.72	11.94	10.04	9.00	11.42	11.84	9.99	8.80	12.00	12.01	10.86	9.72
Average years of working experience squared	145.03	149.49	110.57	95.93	138.24	146.55	109.43	89.96	151.38	151.66	129.43	116.37
High-earnings degree	42.7%	44.6%	27.8%	25.3%	31.8%	33.3%	26.8%	22.2%	52.9%	53.0%	44.4%	36.0%
Female-dominated degree	34.9%	32.0%	57.0%	45.2%	51.8%	49.9%	58.4%	50.3%	19.0%	18.8%	33.3%	28.0%
High-earnings occupation	45.0%	45.7%	39.2%	0.0%	40.7%	41.2%	38.9%	0.0%	48.9%	49.0%	44.4%	0.0%
Female-dominated occupation	38.9%	34.9%	69.6%	0.0%	57.7%	54.4%	69.1%	0.0%	21.4%	20.7%	77.8%	0.0%
Currently working part-time	11.5%	0.0%	100.0%	0.0%	22.4%	0.0%	100.0%	0.0%	1.3%	0.0%	100.0%	0.0%
Female	48.4%	42.4%	94.3%	77.4%	100.0%	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Currently working	100.0%	100.0%	100.0%	0.0%	100.0%	100.0%	100.0%	0.0%	100.0%	100.0%	100.0%	0.0%
Married	57.3%	54.7%	77.2%	62.4%	51.8%	43.9%	79.2%	74.3%	62.4%	62.7%	44.4%	22.0%
Has preschool children	38.9%	34.0%	75.9%	58.4%	34.4%	21.9%	77.9%	70.8%	43.0%	43.0%	44.4%	16.0%
British, Irish or white	94.8%	94.7%	96.2%	92.8%	95.9%	95.9%	96.0%	91.2%	93.8%	93.7%	100.0%	98.0%
Gender equal beliefs in labor market	68.7%	68.5%	70.3%	61.5%	79.6%	82.2%	70.5%	62.6%	58.5%	58.4%	66.7%	58.0%
Observations	1 377	1 219	158	221	666	517	149	171	711	702	9	50

Source: 1970 BCS, 29 and 34-year follow-ups.

* 2005 prices

5.4. Results

This section presents and discusses the results obtained from estimating the equations specified in section 5.2 using the 29 and 34-year old follow-ups of the 1970 BCS.

5.4.1. Probability of working for women

Before discussing the earnings estimations, it is worth presenting the probit estimations for the probability of working for women, from which the inverse Mills ratio is derived. These results are presented in Table 24 for each wave. In none of the cases is having a professional higher degree associated with the probability of working for graduate women. That is, women who further invest in obtaining masters or PhDs do not have a higher probability of working at ages 29 and 34 than those women with a bachelor degree, *ceteris paribus*. This supports the hypothesis that having a university degree is the threshold for explaining certain phenomena in the labour market, but investing in education beyond this point does not contribute much more in explaining decisions such as participation in the labour market or access to certain jobs once this threshold is passed. The years of working experience and its squared value are not found to be significantly associated with the probability of working when graduates are 29 years old, but work experience is positively and significantly associated with such probability at age 34, *ceteris paribus*. Similarly, its squared value is negatively associated with such probability at this age, *ceteris paribus*. Hence, both variables exhibit the expected signs. It may be that previous experience in the labour market becomes significant for graduate women when they are in their most fertile years, but it is not as important at the early stage of their career, because as some women start to move in and out of the labour market, the variation in experience increases (i.e., the standard deviation increased from 2.4 to 2.8 between ages 29 and 34), making the variable significant.

TABLE 24:

Probit results for working graduate women

	29-years	**34-years**
Educational level		
Professional degrees(omitted category)		
Professional higher degrees	0.1525	0.0911
	(0.1399)	*(0.1189)*
Years of working experience	0.1557	0.3489***
	(0.1071)	*(0.0749)*
Years of working experience squared	-0.0001	-0.0104***
	(0.0088)	*(0.0037)*
Married	0.0158	-0.2537*
	(0.1505)	*(0.1343)*
Gender equal beliefs in the labor market	0.0673	-0.0918
	(0.187)	*(0.2092)*
Preschool children	-1.8532***	-1.2588***
	(0.2705)	*(0.2386)*
Having gender equal beliefs and preschool children	0.8534***	0.6832***
	(0.2951)	*(0.2615)*
British, Irish or white	0.4928*	0.1832
	(0.2555)	*(0.2384)*
Constant	-0.0534	-1.1385***
	(0.4222)	*(0.4093)*
Observations	852	837

Source: 1970 BCS, 29 and 34-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%; standard errors in parenthesis.

As expected, being married is negatively associated (at a 90% confidence level) with working when women are 34 years old, *ceteris paribus*. Contrary to what was expected, having gender equal beliefs in the labour market is not associated with a higher probability of working. However, having these beliefs is positively and significantly associated with a higher probability of working for those women with preschool children in the household, *ceteris paribus*. The latter suggests that, while gender beliefs might not be a determinant in a woman's decision to work (women nowadays may expect to work irrespectively of whether they are conservative or not), they become relevant in the presence of children, so that more conservative women will give up their jobs to look after their children while more liberal ones

will try to balance their motherhood decisions with their jobs[67]. Even after controlling for this effect, having preschool children in the household is the variable with the highest weight in determining a woman's decision to work, so that women with preschool children are much less likely to work. Finally, ethnicity is relevant in determining a women's decision to work at a 90% confidence level for the 29 years old sample. In this case, being British, Irish or white is positively associated with working for graduate women.

5.4.2. Human capital model

This section presents the results for the simplest representation of the human capital model, both with and without the Heckman correction for sample selection bias. These results are depicted in Table 25. The model is different from a model with no regressors but has an extremely low explanatory power. Contrary to what was expected and all things equal, having a higher graduate degree is not significantly related to earnings. This variable is only significant at a 90% confidence level for the 34 year old pooled sample with the Heckman correction (column 4 of panel 2)[68]. As discussed in previous chapters, there seems to be a threshold in the labour market, so that having a degree, irrespective of its type, places workers at the top of the distribution[69]. However, what the data now seems to suggest is that once that threshold is crossed, gaining further degrees does not significantly increase earnings. One possibility is that the on the job training that a graduate worker receives could be equivalent to the training of a higher degree program, making this variable not significant.

[67] This variable shows similar significance levels when the gender equality score at age 16 is used instead of the score at age 29. However, the latter is used in order to avoid losing a significant number of observations in the sample.

[68] This result is consistent with Blackaby, Booth and Frank's (2005, p. F85) finding that holding a PhD has no significant effect on earnings for UK academics.

[69] Recall that respondents of the online questionnaire repeatedly argued that having a university degree, not their chosen program, was the relevant decision in being able to join the labour market later on in more favourable conditions than the rest of the population.

TABLE 25:

Earnings functions according to the human capital model,

with and without Heckman sample selection correction

Panel 1: Without Heckman adjustment	**29-year follow-up**			**34-year follow-up**		
	Pooled (1)	**Female (2)**	**Male (3)**	**Pooled (4)**	**Female (5)**	**Male (6)**
Educational level						
Professional degrees (omitted)						
Professional higher degrees	-0.0177	-0.0341	-0.0002	0.0489	0.0484	0.0542
	(0.0282)	*(0.036)*	*(0.044)*	*(0.0298)*	*(0.0442)*	*(0.0408)*
Years of working experience	0.1394***	0.1356***	0.1416***	0.1441***	0.1274***	0.1699***
	(0.0213)	*(0.029)*	*(0.0316)*	*(0.0265)*	*(0.037)*	*(0.0409)*
Years of working experience squared	-0.0077***	-0.0072***	-0.008***	-0.0054***	-0.0047***	-0.0064***
	(0.0013)	*(0.0019)*	*(0.0019)*	*(0.0011)*	*(0.0016)*	*(0.0016)*
Female	-0.1792***			-0.1689***		
	(0.0244)			*(0.0277)*		
Constant	1.9551***	1.7801***	1.9508***	1.8677***	1.7953***	1.7044***
	(0.086)	*(0.1121)*	*(0.1306)*	*(0.1616)*	*(0.2126)*	*(0.258)*
Observations	1 528	739	789	1 377	666	711
F	26.07	10.48	7.32	19.29	5.60	5.99
Prob > F	0.0000	0.0000	0.0001	0.0000	0.0009	0.0005
R^2	0.0641	0.0410	0.0272	0.0533	0.0247	0.0248
Adjusted R^2	0.0616	0.0371	0.0235	0.0505	0.0203	0.0207
Panel 2: With Heckman adjustment	**29-year follow-up**			**34-year follow-up**		
	Pooled (1)	**Female (2)**	**Male (3)**	**Pooled (4)**	**Female (5)**	**Male (6)**
Educational level						
Professional degrees (omitted)						
Professional higher degrees	-0.0175	-0.0326	-0.0002	0.0587*	0.0627	0.0542
	(0.0285)	*(0.0365)*	*(0.044)*	*(0.0301)*	*(0.0445)*	*(0.0408)*
Years of working experience	0.1397***	0.1383***	0.1416***	0.1748***	0.1769***	0.1699***
	(0.022)	*(0.0307)*	*(0.0316)*	*(0.0295)*	*(0.0429)*	*(0.0409)*
Years of working experience squared	-0.0077***	-0.0073***	-0.008***	-0.0064***	-0.0063***	-0.0064***
	(0.0013)	*(0.0019)*	*(0.0019)*	*(0.0012)*	*(0.0017)*	*(0.0016)*
Mills lambda	0.005	0.0253		0.2305**	0.2634**	
	(0.0936)	*(0.0942)*		*(0.098)*	*(0.1167)*	
Female	-0.1801***			-0.2284***		
	(0.0298)			*(0.0375)*		
Constant	1.9536***	1.7614***	1.9508***	1.6525***	1.3711***	1.7044***
	(0.0905)	*(0.1319)*	*(0.1306)*	*(0.1854)*	*(0.2833)*	*(0.258)*
Observations	1 528	739	789	1 377	666	711
F	20.85	7.87	7.32	16.59	5.50	5.99
Prob > F	0.0000	0.0000	0.0001	0.0000	0.0002	0.0005
R^2	0.0641	0.0411	0.0272	0.0571	0.0322	0.0248
Adjusted R^2	0.0610	0.0359	0.0235	0.0536	0.0263	0.0207

Source: 1970 BCS, 29 and 34-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%; standard errors in parenthesis.

In contrast, work experience is significantly and positively associated with earnings in all cases, *ceteris paribus.* Further, the rate of return on working experience does not significantly change over time for both women and men at the standard confidence levels[70]. For example, for a woman with 7.16 years of experience at 29 and 11.42, at 34, an additional year of work experience increases her wage rate by approximately 3.3%. For a man with average experience (i.e.,7.48 years of experience at 29 and 12 years at 34), an additional year of working experience increases his wage rate by 2.2% when he is 29 and the premium seems to decrease to 1.6% at age 34[71]. Although at first these numbers might suggest different returns on work experience between women and men, these coefficients are not significantly different from one another at the standard confidence levels. Thus, working experience may have a similar rate of return among graduate women and men. Similarly, the coefficients for the squared value of working experience is negative and significant in all cases, supporting the theory according to which, the rates of return for work experience are increasing but at a decreasing rate.

When women and men are pooled together, a control variable for being female is introduced. This variable is negative and significant in all cases. In the models without the Heckman adjustment (panel 1), the female average wage rate is lower than the male average wage rate by 17 to 18%[72], *ceteris paribus*. But if the estimations are corrected for female self-selection, the estimated coefficient is apparently higher, not only among the genders, but also across time: while, on average, women earn 18% less than men at age 29 (column 1 of panel 2), they earn 22.8% less when they reach 34 years of age (column 4 of panel 2), *ceteris paribus*. However, these coefficients are not significantly different from one another at standard confidence levels, so that it cannot be concluded that the gap is actually increasing over time. Nonetheless, a gender wage gap ranging between 17 to 23% is significant in itself, even if it remains stable over time. These results are consistent with Joshi, Makepeace and Dolton

[70] Comparison of coefficients is done using the t-test that $\beta_f = \beta_m$, so that $t = (\beta_f - \beta_m) \Big/ \sqrt{se_f^2 + se_m^2}$ at a 95% confidence level (i.e., critical t=1.984).

[71] The examples are based on the average experience for workers in Table 25 and the return is calculated as $\beta_{experience} + 2 * experience * \beta_{experience^2}$.

[72] Recall that this is a binary variable, so that the return is given by $e^{\beta} - 1$.

(2007) and Neuburger (2010) who also find women in this cohort to be more highly qualified than men.

As discussed earlier, a vast majority of non-working graduates are women; and this behaviour is highly related to motherhood, particularly in the 2004 wave when professional women are more likely to reproduce. In order to test for female self-selection, the Mills lambda is introduced as a regressor in the estimation equation. This coefficient turns out to be significant for the 34-year follow-up, but not for the 29-year follow-up. Given the results for the probability of working, it is expected that female graduates who remain in the labour market by age 34 are mostly single or don't have children yet, which is the case for 72% of the cases. Recall that Jenkins (2011, p. 202) estimated that 40% of women in this cohort were childless at age 30, so that childless women are overrepresented in the group of female working graduates. This clearly contrasts with the 37.4% of non-working, 34-years old, graduate women that are single or don't have children. Since graduate women postpone having children until their thirties, the Mills lambda is not significant at age 29. At this age, the percentage of non-working, graduate women who are single or don't have children is 46.9%, only slightly lower than those who are married with children. Because the Heckman adjustment[73] is not significant for the 1999 sample, from now onwards, results for this wave will be presented without such adjustment, while the results for the pooled and 2004 samples will include such correction when significant[74].

[73] The inclusion of the Mills lambda in this case will generate inefficient results since it does not seem to be a self-selection bias in this particular sample.

[74] As discussed in section 5.2.1, the variable measuring gender-equal beliefs in the labour market when estimating the probability of working for women was constructed using data from the 29-year follow-up. It could be argued that this could cause endogeneity problems when estimating the Mills lambda at age 29, since the measure is taken at the same point in time as when the person decided to work or not. In order to avoid this, the probability of working was also estimated using the gender-equality index score at age 16. However, doing so reduces the total sample of workers from 2905 to 1682, which represents a loss of 42.1% of the observations. The results, however, do not vary much: when gender-equality beliefs at age 16 are included, the Mills lambda is still not significant for the female human capital model at age 29 but it is significant at age 34. Since the Heckman adjustment is not significant at

5.4.3. Augmented human capital model

Table 26 presents the results for the augmented human capital model. In this augmented version, controls for part-time employment, age, being married and ethnicity are included. A second set of estimations including industry are also reported in columns 7 to 12. As before, the model is different from a model with no regressors and has an extremely low explanatory power, although it increases when industry is included. Also as before, having a higher graduate degree is not consistently significant: it is only significant for the pooled sample at 34 years of age (column 4) and for the 34-year follow up when industry is included (columns 10 to 12), so that by age 34, those graduates with a higher degree earn about 8% more than those graduates with just a bachelor degree*, ceteris paribus*.

Experience is still highly significant in all cases. If industry is not included, an additional year of working experience raises the wage rate by more than 2.6% for women with average experience and more than 1.3% for men with average experience. Data does not provide evidence that one gender is more rewarded than the other for their work experience or that the rate of return for experience increases over time, since these coefficients are not significantly different from one another at the standard confidence levels. Results also provide evidence that the rate of return on work experience exhibits a positive but decreasing pace.

As for the control variables, part-time employment is significant for the pooled (columns 1 and 4) and female (columns 2 and 5) samples when industry is not included; for men in the 29-year follow-up when industry is not included (column 3) and for the pooled (column 7) and female (column 8) samples at 29 when industry is included as a control*, ceteris paribus*. As expected, part-timers enjoy lower wages than full-timers: for instance, part-timers make, on average, 75% of an average full-timer's wage when they are 29 years old and 83% of a full-timer's average wage when they are 34.

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age 29 and, therefore, estimates for this wave do not report it, it was decided to keep the Mills lambda estimated with the gender-equal belief variable at age 29, in order to avoid the loss of observations.

Being married is positively and significantly associated with earnings for the pooled and male samples, but it is only significant for women at a 90% confidence level when they are 29 years old and industry is not included as a control (column 2)*, ceteris paribus*. While the literature argues that married men are rewarded with higher wages, this need not be the case for married women (Ribar, 2004 and Reskin and Hartmann, 1986, p.70). In this regard, the estimated results suggest that the market also rewards women for marrying, although their premium disappears over time: for instance, while married, 29 years old men earn, on average, 11.7% more than single men (column 3) and this gap increases to 14.3% at age 34, the average gap between married and single women at 29 is only 6% (column 2) and is not different from zero by the time they are 34, all else equal. Notice also that, although the coefficients are different for women (0.0588) and men (0.1104) for the 29-year follow-up, these are not significantly different at the standard confidence levels, so that it cannot be concluded that married men earn a higher premium than married women. Regarding ethnicity, results do not indicate any difference between British, Irish or white people and minorities. This is expected, since the group of interest refers to a selected and highly educated segment of society, so that the data does not provide any evidence on discrimination against ethnic minorities among graduates. The results could also be a consequence of the small weight minorities have in the sample, so that in this case, no discrimination is observed. Finally, being a woman is again significantly and negatively associated with the average wage rate, although the coefficients in the augmented model are slightly lower than those observed in the basic human capital model: *ceteris paribus,* women earn, on average, between 7% (column 10) and 17% (column 4) less than men, with the coefficients estimated in the different scenarios not being significantly different from one another.

The inclusion of industry as a control variable affects some of the results of other variables of interest, the more obvious one being the significant coefficients for having a professional higher degree discussed earlier; or smaller coefficient values for years of work experience (although these difference are not statistically significant). Despite these small variations, the trends observed remain the same, so that the inclusion of industry as a control does not significantly alter the main results observed for the basic model. In general, most of the industry categories are not consistently significant across the estimations. In the 29-year follow-up, women seem to earn higher wages if they work in industries predominantly

dominated by men (mining and quarrying; manufacturing; electricity; construction; financial intermediation; and real estate, renting and business activities) or if they work in industries highly dominated by women (wholesale and retail trade; education; and health and social work). Hence, women seem to be worse off in those industries in which the participation of women and men is more equal. An explanation to this might be that women entering highly male-dominated industries might have very specific and competitive characteristics, i.e., they are outliers, whereas, on average, women will be offered better economic opportunities within the more traditional, female-dominated industries.

It could be argued that industry is not an appropriate control variable. Given the initial hypothesis, according to which degree and occupational choices might be related to earnings, including industry as a control could turn out to be problematic, since some occupations are highly related to industry. While a computer engineer could work in any industry, a teacher or a doctor would most likely be employed in a specific industry, so that industry could not be considered exogenous for these groups. For example, 88% of the doctors and dentists in the sample (1990 SOC codes 220-224) are clustered in the health and social work industry; the same as 97.4% of nurses and midwives (1990 SOC codes 220-224), while 97.6% of teachers (1990 SOC codes 230-239) work in education. Thus, results are expected to be sensitive to the inclusion of industry, given that the latter is related to occupational choice. Because of this, it was decided to drop industry as a control for subsequent estimations.

TABLE 26:

Earnings functions according to the augmented human capital model

	Without industry						With industry					
	29-year follow-up			34-year follow-up			29-year follow-up			34-year follow-up		
	Pooled (1)	Female (2)	Male (3)	Pooled (4)	Female (5)	Male (6)	Pooled (7)	Female (8)	Male (9)	Pooled (10)	Female (11)	Male (12)
Educational level												
Professional degrees (omitted category)												
Professional higher degrees	-0.0253	-0.0409	-0.0064	0.0497*	0.0546	0.0446	0.0093	-0.0259	0.0415	0.073**	0.0768*	0.0786*
	(0.0281)	*(0.036)*	*(0.0439)*	*(0.03)*	*(0.0445)*	*(0.0405)*	*(0.0288)*	*(0.0373)*	*(0.0447)*	*(0.0301)*	*(0.0453)*	*(0.0405)*
Years of working experience	0.1217***	0.1179***	0.1225***	0.1548***	0.1603***	0.1541***	0.1165***	0.1269***	0.1062***	0.1218***	0.1484***	0.1245***
	(0.0216)	*(0.0295)*	*(0.0323)*	*(0.0301)*	*(0.0459)*	*(0.0409)*	*(0.021)*	*(0.0294)*	*(0.0308)*	*(0.0266)*	*(0.046)*	*(0.0394)*
Years of working experience squared	-0.0069***	-0.0064***	-0.0071***	-0.0058***	-0.0058***	-0.0059***	-0.0067***	-0.0072***	-0.0064***	-0.0047***	-0.0053***	-0.0049***
	(0.0013)	*(0.0019)*	*(0.0019)*	*(0.0012)*	*(0.0018)*	*(0.0016)*	*(0.0013)*	*(0.0019)*	*(0.0018)*	*(0.0011)*	*(0.0018)*	*(0.0015)*
Currently working part-time	-0.1891***	-0.1592***	-0.3072*	-0.132**	-0.1252**	-0.1929	-0.1406***	-0.1383**	-0.1454	-0.0544	-0.0808	-0.0411
	(0.0545)	*(0.0553)*	*(0.1734)*	*(0.0547)*	*(0.0608)*	*(0.1641)*	*(0.0532)*	*(0.0551)*	*(0.167)*	*(0.0476)*	*(0.0603)*	*(0.1602)*
Married	0.0885***	0.0588*	0.1104***	0.1114***	0.0762	0.134***	0.0782***	0.0524	0.0961***	0.1103***	0.0595	0.1259***
	(0.0254)	*(0.0345)*	*(0.0376)*	*(0.0301)*	*(0.0494)*	*(0.0382)*	*(0.0248)*	*(0.0345)*	*(0.0362)*	*(0.028)*	*(0.0487)*	*(0.0368)*
British, Irish or white	-0.0141	0.0373	-0.0502	-0.0217	-0.0018	-0.0297	0.0195	0.0759	-0.0342	-0.0061	0.0849	-0.0315
	(0.0582)	*(0.0844)*	*(0.0811)*	*(0.0625)*	*(0.1064)*	*(0.0762)*	*(0.0565)*	*(0.0839)*	*(0.0776)*	*(0.061)*	*(0.1065)*	*(0.0733)*
Industry												
Agriculture, hunting, forestry and fishing												
Mining and quarrying							0.5894*	1.5669**	0.2862	0.5373	0.5508	0.4863
							(0.3068)	*(0.611)*	*(0.366)*	*(0.3434)*	*(0.7533)*	*(0.3813)*
Manufacturing							0.3287	0.9181**	0.1555	0.4911*	0.6367	0.3982
							(0.2309)	*(0.4319)*	*(0.2806)*	*(0.2905)*	*(0.5507)*	*(0.334)*
Electricity, gas and water supply							0.5549**	1.3046***	0.2798	0.793**	1.0323*	0.6367*
							(0.2592)	*(0.4635)*	*(0.325)*	*(0.3146)*	*(0.5811)*	*(0.3663)*
Construction							0.2939	0.9638**	0.078	0.4275	0.4556	0.3785
							(0.2413)	*(0.4637)*	*(0.2913)*	*(0.2972)*	*(0.5739)*	*(0.3397)*
Wholesale and retail trade							0.2131	0.9227**	-0.0515	0.2497	0.2115	0.3068
							(0.2345)	*(0.4336)*	*(0.2899)*	*(0.2937)*	*(0.5508)*	*(0.3414)*
Hotels and restaurants							-0.1476	0.7787*	-0.5984*	0.0393	0.0375	0.1506
							(0.2573)	*(0.4583)*	*(0.3248)*	*(0.3148)*	*(0.568)*	*(0.4044)*

… table 26 (continued)…

	Without industry						With industry					
	29-year follow-up			34-year follow-up			29-year follow-up			34-year follow-up		
	Pooled (1)	Female (2)	Male (3)	Pooled (4)	Female (5)	Male (6)	Pooled (7)	Female (8)	Male (9)	Pooled (10)	Female (11)	Male (12)
Transport, storage and communication							0.2162	0.9175**	-0.0157	0.4793	0.3301	0.5163
							(0.2353)	*(0.4379)*	*(0.2869)*	*(0.2937)*	*(0.5554)*	*(0.3381)*
Financial intermediation							0.5821**	1.1352***	0.4451	0.686**	0.5384	0.7421**
							(0.2328)	*(0.4343)*	*(0.2835)*	*(0.2923)*	*(0.5518)*	*(0.336)*
Real estate, renting and business activities							0.393*	1.0525**	0.18	0.5856**	0.6962	0.5009
							(0.2298)	*(0.4305)*	*(0.279)*	*(0.2887)*	*(0.5454)*	*(0.3321)*
Public administration and defense; social security							0.1906	0.8743**	-0.0348	0.3234	0.4173	0.2334
							(0.2322)	*(0.432)*	*(0.2845)*	*(0.2906)*	*(0.548)*	*(0.3358)*
Education							0.1669	0.8906**	-0.1354	0.3354	0.4222	0.2269
							(0.231)	*(0.4306)*	*(0.2838)*	*(0.2892)*	*(0.5459)*	*(0.3348)*
Health and social work							0.2299	0.9579**	-0.1056	0.3616	0.4478	0.2439
							(0.2318)	*(0.431)*	*(0.2862)*	*(0.2894)*	*(0.5454)*	*(0.3363)*
Other							0.1378	0.8116*	-0.0819	0.2911	0.3964	0.2008
							(0.2346)	*(0.4343)*	*(0.2884)*	*(0.293)*	*(0.549)*	*(0.3404)*
Mills lambda				0.2181*	0.2844*						0.2527*	
				(0.1189)	*(0.154)*						*(0.1514)*	
Female	-0.1613***			-0.1875***			-0.1204***			-0.0807***		
	(0.0248)			*(0.0398)*			*(0.025)*			*(0.03)*		
Constant	2.0197***	1.8223***	2.0467***	1.7479***	1.4717***	1.7674***	1.6998***	0.812*	2.0128***	1.4902***	0.9891*	1.5644***
	(0.0989)	*(0.1358)*	*(0.1472)*	*(0.1915)*	*(0.3112)*	*(0.2633)*	*(0.2498)*	*(0.4513)*	*(0.3146)*	*(0.3138)*	*(0.5596)*	*(0.4187)*
Observations	1 528	739	789	1 377	666	711	1 528	739	789	1 377	666	711
F	17.99	6.83	5.86	12.91	4.07	5.44	12.63	4.19	7.33	10.31	4.00	5.96
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R^2	0.0765	0.0530	0.0430	0.0702	0.0415	0.0443	0.1435	0.0996	0.1533	0.1320	0.1104	0.1409
Adjusted R^2	0.0723	0.0452	0.0357	0.0648	0.0313	0.0361	0.1322	0.0758	0.1324	0.1192	0.0828	0.1172

Source: 1970 BCS, 29 and 34-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%; standard errors in parenthesis.

5.4.4. Results for high-earnings degrees

Table 27 presents the estimation results when the dummy variable for holding a high-earnings degree is introduced in the earnings function when cohort members are 29 and 34 years old. As before, the model has a low explanatory power, although its adjusted R^2 is slightly higher than the one reported for the augmented human capital model. The coefficient for having a professional higher qualification is again not significantly different from zero; and the rate of return on years of working experience is positive, but increases at a decreasing rate and is stable over time*, ceteris paribus*. For women (men) with average experience, an additional year of working experience increases the wage rate in more than 2.5% (1.4%). These coefficients are not significantly different from one another between women and men, nor between the 29 and 34-year follow-ups, thus, indicating that the premium is somewhat stable over time (although the coefficients estimated are higher for the 34 year sample). This behaviour is consistent with previous results.

The coefficient associated with holding a high-earnings degree, which is the main variable of interest, is highly significant in all cases and particularly substantial for men*, ceteris paribus*. For women, holding a high-earnings degree is associated with an increase in the average wage rate of about 10% in both waves. In contrast, men with a high-earnings degree earn, on average, over 20% more than those men with a different type of degree. That is, men receive a premium about twice the size of women for studying this type of degrees. The latter provides supporting evidence for the hypothesis in two ways: (i) women entering high-earnings degree programs do, in fact, have access to higher wages, which is the starting hypothesis of the present research; and (ii) although this type of programs are more profitable, they are not as profitable for women as they are for men, suggesting that entering such programs implies certain type of discrimination against women. For example, women might not have access to the top positions in their field; they might go into teaching instead of taking research or managerial positions or face a glass ceiling (Glover, 2000). For both women and men, the premium seems to be stable over time, since the coefficients from the 29 and 34 years old samples are not significantly different from each other.

TABLE 27:

Earnings functions, including holding a high-earnings degree into the model

	29-year follow-up			34-year follow-up		
	Pooled (1)	Female (2)	Male (3)	Pooled (4)	Female (5)	Male (6)
Educational level						
Professional degrees (omitted)						
Professional higher degrees	-0.0313	-0.0427	-0.0191	0.0383	0.0504	0.0386
	(0.0278)	*(0.0359)*	*(0.0431)*	*(0.0294)*	*(0.0445)*	*(0.0395)*
Years of working experience	0.1128***	0.1133***	0.11***	0.1167***	0.1508***	0.1315***
	(0.0214)	*(0.0294)*	*(0.0317)*	*(0.0269)*	*(0.046)*	*(0.04)*
Years of working experience squared	-0.0063***	-0.0061***	-0.0062***	-0.0044***	-0.0054***	-0.0049***
	(0.0013)	*(0.0019)*	*(0.0019)*	*(0.0011)*	*(0.0018)*	*(0.0016)*
High-earnings degree	*0.1524****	*0.0904****	*0.2007****	*0.1687****	*0.0943***	*0.2249****
	(0.0247)	*(0.0342)*	*(0.0356)*	*(0.0282)*	*(0.0443)*	*(0.036)*
Currently working part-time	-0.1796***	-0.1568***	-0.2557	-0.0786	-0.1175*	-0.1789
	(0.0539)	*(0.055)*	*(0.1704)*	*(0.0479)*	*(0.0608)*	*(0.1598)*
Married	0.0862***	0.0599*	0.104***	0.1316***	0.0812	0.1374***
	(0.0251)	*(0.0344)*	*(0.0369)*	*(0.0282)*	*(0.0494)*	*(0.0372)*
British, Irish or white	0.0037	0.0408	-0.015	-0.0091	0.0012	0.0011
	(0.0576)	*(0.0841)*	*(0.0798)*	*(0.0618)*	*(0.1061)*	*(0.0743)*
Mills lambda					0.2607*	
					(0.154)	
Female	-0.1332***			-0.1045***		
	(0.025)			*(0.0297)*		
Constant	1.9569***	1.8058***	1.9569***	1.8785***	1.5011***	1.7391***
	(0.0983)	*(0.1354)*	*(0.1453)*	*(0.1682)*	*(0.3106)*	*(0.2565)*
Observations	1 528	739	789	1 377	666	711
F	20.87	6.90	9.76	17.27	4.15	10.49
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
R^2	0.0990	0.0620	0.0804	0.0917	0.0481	0.0946
Adjusted R^2	0.0943	0.0530	0.0722	0.0864	0.0365	0.0856

Source: 1970 BCS, 29 and 34-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%; standard errors in parenthesis.

As for the control variables, part-time employment is only significant for the pooled sample at 29 and the female samples. In these cases, the coefficients associated with it are negative, so that part-time working women earn 11% (16.5%) less than full-timers at age 29 (34)*, ceteris paribus*. This is consistent with the literature and might imply that women are either willing to accept a lower wage in exchange of flexible working schedules or that the lower ability women move into part-time employment. Consistent with the previous section, being married is positively associated with earnings, except for women aged 34; and this premium is not significantly different between the genders or across time, although the estimated coefficients for men are higher than those observed for women*, ceteris paribus*.

The coefficients associated with ethnicity are still not significant, showing also consistency with previous results. Once again, for the pooled sample, being female is associated with a cut in the average wage rate over 10%, *ceteris paribus*.

In synthesis, the results do provide supporting evidence in favour of the initial hypothesis, according to which women with high-earnings degrees have access to higher wages in the labour market. Therefore, increasing female enrolment in degree programs with a high market value might contribute to increase women's wages. However, data also suggests that the barriers women face in such degrees might be structural and more difficult to contest than just increasing women's training in certain fields of study, since men are benefiting from higher premiums than women.

5.4.5. Results for female-dominated degrees

Table 28 provides the results for the earnings function with the inclusion of a binary variable indicating whether the cohort member has a female-dominated degree. . The model is different from a model with no regressors and its adjusted R^2 is lower than those reported for the models in section 5.4.4. With minor changes in the coefficient values, the results for all the other variables do not vary much, all else equal: (i) having a professional higher degree is still not significant at a 5% level (although it is now significant at a 10% for the pooled 34-year old sample); (ii) working experience is highly significant and positive (iii) with a negative and significant slope; (iv) as before, working part-time is significantly different than working full-time for the pooled and female samples; (v) marriage is positively associated with earnings, except for 34 years old women; (vi) ethnicity is not significant and (vii) women earn significantly less than men and estimates suggest that this gap might be increasing over time, although the coefficients are not significantly different from one another at the standard confidence level.

TABLE 28:

Earnings functions, including holding a female-dominated degree into the model

	29-year follow-up			34-year follow-up		
	Pooled (1)	**Female (2)**	**Male (3)**	**Pooled (4)**	**Female (5)**	**Male (6)**
Educational level						
Professional degrees (omitted)						
Professional higher degrees	-0.0191	-0.0394	0.0068	0.0566*	0.0581	0.0568
	(0.028)	*(0.036)*	*(0.0432)*	*(0.03)*	*(0.0446)*	*(0.0405)*
Years of working experience	0.1234***	0.1193***	0.1205***	0.1576***	0.1633***	0.1561***
	(0.0215)	*(0.0296)*	*(0.0317)*	*(0.0301)*	*(0.0459)*	*(0.0406)*
Years of working experience squared	-0.0071***	-0.0065***	-0.0071***	-0.006***	-0.0059***	-0.006***
	(0.0013)	*(0.0019)*	*(0.0019)*	*(0.0012)*	*(0.0018)*	*(0.0016)*
Female-dominated degree	*-0.1127****	*-0.0287*	*-0.2369****	*-0.0903****	*-0.0514*	*-0.1468****
	(0.0269)	*(0.0324)*	*(0.0447)*	*(0.031)*	*(0.042)*	*(0.0469)*
Currently working part-time	-0.1787***	-0.1563***	-0.2773	-0.1215**	-0.1188*	-0.1732
	(0.0543)	*(0.0554)*	*(0.1706)*	*(0.0547)*	*(0.061)*	*(0.1632)*
Married	0.0886***	0.0579*	0.1172***	0.1084***	0.0738	0.1311***
	(0.0253)	*(0.0346)*	*(0.037)*	*(0.0301)*	*(0.0495)*	*(0.0379)*
British, Irish or white	-0.0181	0.036	-0.0558	-0.024	-0.0068	-0.0277
	(0.0579)	*(0.0844)*	*(0.0797)*	*(0.0624)*	*(0.1064)*	*(0.0757)*
Mills lambda				0.2094*	0.2777*	
				(0.1186)	*(0.1541)*	
Female	-0.1269***			-0.1588***		
	(0.026)			*(0.0409)*		
Constant	2.043***	1.8347***	2.1081***	1.7609***	1.4951***	1.7903***
	(0.0985)	*(0.1366)*	*(0.1452)*	*(0.191)*	*(0.3116)*	*(0.2618)*
Observations	1 528	739	789	1 377	666	711
F	18.11	5.96	9.21	12.48	3.75	6.12
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000
R^2	0.0871	0.0540	0.0763	0.0759	0.0437	0.0574
Adjusted R^2	0.0823	0.0449	0.0680	0.0699	0.0320	0.0481

Source: 1970 BCS, 29 and 34-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%; standard errors in parenthesis.

The starting hypothesis states that, through cultural scripting, women are signalled not to enter the high-paying degrees because they are not deemed appropriate for them as women, since these tend to be dominated by men. Hence, women would tend to choose degrees that are traditionally female, which coincidentally offer lower wages. If this holds, the coefficient associated with having a female-dominated degree should exhibit a negative sign. Results in Table 28 indicate that this is the case for the pooled and male samples, but not for women*, ceteris paribus*. Hence, these results do not support the hypothesis: on average, women with female-dominated degrees enjoy the same wage as women with male-dominated

degrees. This would be consistent with Chevalier's and Glover's (2000) findings (2011), according to which women in female-dominated fields have higher opportunities of promotions than women in male-dominated fields, so that the initial advantage that the latter may have disappears as women progress in their fields of study. Finally, it is important to note that men with this type of degree are punished while women are not: while women with female-dominated degrees do not earn significantly less than women with male-dominated degrees, men with female-dominated degrees earn 21% less than those men with male-dominated degrees at age 29. Although the associated coefficient is 13.7% when men are 34 years old, it is still considerably less than what men with male-dominated degrees earn and it is not significantly different from the coefficient estimated at age 29, so that it cannot be argued that this gap closes over time. This result is consistent with Sullivan, Joshi and Leonard's (2011) finding that British men from the 1958 cohort were penalized in their wages for having female qualifications.

5.4.6. Results for high-earnings occupations

Table 29 reports the results with the inclusion of a binary variable identifying those graduates working in a high-earnings occupation. . The model is different from a model with no regressors, its explanatory power is still extremely low and slightly lower than the models in section 5.4.6. The following differences are observed between these results and those obtained for the augmented human capital model discussed in section 5.4.3: (i) the coefficient associated with holding a professional higher degree for the female sample at 29 years old (column 2) is now significant at a 90% confidence level and exhibits a negative sign. (ii) The signs and significance levels of the coefficients associated with the years of working experience and years of working experience squared are robust and similar to those discussed in the augmented version of the model. (iii) As before, part-time employment is significantly and negatively associated with earnings at age 29 but it is not significant at age 34. (iv) Women no longer enjoy a premium for being married at age 29, instead they enjoy a premium of about 11% at age 34. And, (v) the coefficient for the Mills lambda stops being significant at age 34, so that the estimates are reported without it. Despite those differences, the results observed in the coefficients are consistent with previous findings.

TABLE 29:

Earnings functions, including working in a high-earnings occupation into the model

	29-year follow-up			34-year follow-up		
	Pooled (1)	Female (2)	Male (3)	Pooled (4)	Female (5)	Male (6)
Educational level						
Professional degrees (omitted)						
Professional higher degrees	-0.0476*	-0.0719*	-0.0215	0.0261	0.0216	0.034
	(0.0287)	*(0.0367)*	*(0.0447)*	*(0.0299)*	*(0.0452)*	*(0.0404)*
Years of working experience	0.1178***	0.1099***	0.1206***	0.1235***	0.1081***	0.1436***
	(0.0216)	*(0.0293)*	*(0.0322)*	*(0.027)*	*(0.0383)*	*(0.0407)*
Years of working experience squared	-0.0066***	-0.0058***	-0.007***	-0.0046***	-0.0039**	-0.0054***
	(0.0013)	*(0.0019)*	*(0.0019)*	*(0.0011)*	*(0.0016)*	*(0.0016)*
High-earnings occupation	*0.0898****	*0.1224****	*0.0632**	*0.1168****	*0.1143****	*0.1196****
	(0.0253)	*(0.0341)*	*(0.0372)*	*(0.0282)*	*(0.0437)*	*(0.037)*
Currently working part-time	-0.1783***	-0.144***	-0.2918*	-0.079	-0.0703	-0.1917
	(0.0544)	*(0.055)*	*(0.1735)*	*(0.0482)*	*(0.0551)*	*(0.163)*
Married	0.0789***	0.0436	0.1052***	0.1147***	0.1073**	0.1177***
	(0.0255)	*(0.0345)*	*(0.0377)*	*(0.0286)*	*(0.0435)*	*(0.0382)*
British, Irish or white	-0.0232	0.0172	-0.0533	-0.0408	-0.0379	-0.0387
	(0.058)	*(0.0839)*	*(0.081)*	*(0.0623)*	*(0.1062)*	*(0.0757)*
Female	-0.1575***			-0.1307***		
	(0.0248)			*(0.0294)*		
Constant	2.012***	1.8298***	2.0358***	1.9106***	1.8611***	1.7864***
	(0.0986)	*(0.1348)*	*(0.1472)*	*(0.1692)*	*(0.2306)*	*(0.2617)*
Observations	1 528	739	789	1 377	666	711
F	17.44	7.78	5.45	14.76	4.58	6.22
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
R^2	0.0841	0.0693	0.0465	0.0794	0.0465	0.0583
Adjusted R^2	0.0793	0.0604	0.0380	0.0741	0.0363	0.0489

Source: 1970 BCS, 29 and 34-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%; standard errors in parenthesis.

In this version of the model, a binary variable identifying those graduates in high-earnings occupations is included[75]. The initial hypothesis underlying this variable inclusion is that entering occupations that are highly valued in the market should be positively associated with higher wages. Results support this hypothesis, since the coefficients associated with this variable are positive and highly significant, *ceteris paribus*. Not only there seems to be a premium for entering high-paying occupations, this premium seems to be similar for women

[75] Some estimates were calculated considering interactions between this variable and having a high-earnings degree, since these might be related, but the interactive terms were not significant and, therefore, these variables are considered separately.

and men and across time, since the coefficients are not significantly different from one another at the standard confidence level. While women who enter a high-paying occupation earn over 12% more than those women who don't, men earn over 6% at age 29 and this premium increases to 12.7% at age 34, *ceteris paribus*. Thus, women should have an economic incentive to move into these occupations.

5.4.7. Results for female-dominated occupations

Table 30 presents the results with the inclusion of a binary variable identifying those graduates working in a female-dominated occupation. The model is different from a model with no regressors and its adjusted R^2 remains below 10%, although it is higher than the model including female-dominated degrees in section 5.4.5. In general, there is consistency in the magnitude and significant level of the results in comparison to those for the augmented human capital model discussed in section 5.4.3, with the only exception that holding a professional higher degree is now significant at a 95% confidence level for the pooled sample at 34, so that workers with a professional higher degree earn, on average, 6.6% more than those graduates with a bachelor degree, *ceteris paribus*. This is consistent with the literature and the main assumption of the human capital model.

As expected, results show that working in a female-dominated occupation is negatively and significantly associated with wages. This supports the initial hypothesis that female-dominated occupations are less valued in the market. Results also indicate that while both women and men are punished by entering into these occupations, men are punished even more than women when they are 29 than when they are 34. At 29, women in a female-dominated occupation earn, on average, 14% less than those women in male-dominated occupations and this gap remains about the same (15.4% although not statistically different from the previous estimate) when they reach 34, *ceteris paribus*. In contrast, 29 years old men in a female-dominated occupation earn, on average, 22.9% less than those men in male-dominated occupations and the differential persists around 22% when they are 34 years old, *ceteris paribus*. The difference in coefficients between women and men hold for the 29-year follow-up, but not for the 34 years old sample, hence, this might serve as weak supporting

evidence that women in female-dominated occupations might have a relative advantage in promotions and raises than men throughout their careers, although they would still be worse off than those women in male-dominated occupations.

TABLE 30:

Earnings functions, including working in a female-dominated occupation into the model

	29-year follow-up			34-year follow-up		
	Pooled (1)	**Female (2)**	**Male (3)**	**Pooled (4)**	**Female (5)**	**Male (6)**
Educational level						
Professional degrees (omitted)						
Professional higher degrees	-0.007	-0.0264	0.0163	0.0638**	0.0677	0.0595
	(0.0278)	*(0.0356)*	*(0.0431)*	*(0.0296)*	*(0.0442)*	*(0.0398)*
Years of working experience	0.1297***	0.1233***	0.1327***	0.1474***	0.1582***	0.1381***
	(0.0213)	*(0.0291)*	*(0.0316)*	*(0.0297)*	*(0.0454)*	*(0.0402)*
Years of working experience squared	-0.0074***	-0.0067***	-0.0078***	-0.0055***	-0.0057***	-0.0053***
	(0.0013)	*(0.0019)*	*(0.0019)*	*(0.0012)*	*(0.0018)*	*(0.0016)*
Female-dominated occupation	*-0.1976****	*-0.1506****	*-0.2607****	*-0.1989****	*-0.1676****	*-0.2436****
	(0.0265)	*(0.0326)*	*(0.0433)*	*(0.0301)*	*(0.0416)*	*(0.0448)*
Currently working part-time	-0.1423***	-0.1261**	-0.2063	-0.0963*	-0.1031*	-0.0641
	(0.0539)	*(0.055)*	*(0.1705)*	*(0.0541)*	*(0.0604)*	*(0.1626)*
Married	0.0934***	0.0656*	0.1146***	0.1042***	0.0764	0.1172***
	(0.025)	*(0.0341)*	*(0.0368)*	*(0.0297)*	*(0.0489)*	*(0.0375)*
British, Irish or white	-0.01	0.0364	-0.038	-0.0119	-0.0027	-0.0103
	(0.0572)	*(0.0833)*	*(0.0793)*	*(0.0616)*	*(0.1052)*	*(0.0747)*
Mills lambda				0.2154*	0.2956*	
				(0.1171)	*(0.1523)*	
Female	-0.0946***			-0.1239***		
	(0.026)			*(0.0404)*		
Constant	2.0231***	1.8751***	2.0541***	1.8295***	1.5668***	1.9131***
	(0.0972)	*(0.1345)*	*(0.144)*	*(0.189)*	*(0.3085)*	*(0.2595)*
Observations	1 528	739	789	1 377	666	711
F	23.23	9.07	10.44	16.67	5.67	9.07
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R^2	0.1090	0.0799	0.0855	0.0989	0.0646	0.0828
Adjusted R^2	0.1043	0.0711	0.0773	0.0930	0.0532	0.0737

Source: 1970 BCS, 29 and 34-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%; standard errors in parenthesis.

5.4.8. Full model

Table 31 provides the results for the full model, where all four variables of interest (having a high-earnings degree, having a female-dominated degree, working in a high-earnings occupation and working in a female-dominated occupation) are included in the estimation equations. As before, the model is different from a model with no regressors and has an extremely low explanatory power, reflected in values for the adjusted R^2 below 12.5%. Even though this is a better fit than the estimations in the previous sections, most of the variance in earnings remains unexplained by these variables. As it has been the norm with all the other estimations, having a higher professional degree does not significantly contribute to higher earnings relative to graduates with just a bachelor degree or equivalent, *ceteris paribus*. Again, this supports the hypothesis that while holding a university degree might be a threshold for being at the top of the wage distribution, once this degree is obtained, further education does not considerably increases wages, so that master and PhD programs might not be as profitable as one would expect, at least not early in the career life.

In contrast, work experience is highly significant in explaining earnings, *ceteris paribus*. For a 29 year old graduate woman with average experience, an additional year of working experience rises her wage rate by 2.8% (column 2) and the estimated rate of return on experience when they reach age 34 equals 2.9% (column 5) , *ceteris paribus*. Although these coefficients are not significantly different, they do show that women experience a premium for additional years of experience and this premium is consistent over time. The rate of return on work experience for men is also stable throughout time, being close to 1% on both the 29 and 34 year old samples, *ceteris paribus*. As before, the coefficient associated with years of work experience squared are small, negative and highly significant in all cases, providing evidence that the returns on experience are decreasing.

Holding a high-earnings degree is positively associated with earnings for men, but this is not significant for women in the 34-year follow-up at the standard confidence levels once it has been conditioned on occupational choice. Hence, this provides only weak evidence to the hypothesis in hand. Men with a high-earnings degree earn over 15% more than those with a different type of degree and this premium is consistent across waves (with the coefficients not

being significantly different from one another), *ceteris paribus*. Thus, men who choose these particular programs are better off. This does not seem to hold for women once occupation has been taken into account. While women with high-earnings degrees earn about 7.1% more than those with other types of degrees when they are 29 years old, the premium disappears in a five year span, *ceteris paribus*. So, entering a high-earnings program does not entail higher earnings for women as their career progresses. Not only that, but the initial premium women enjoy is less than half of the premium given to men with a 90% confidence level. Both of these issues could be signalling discrimination against women in these fields: women do not seem to have access to the same wages as their male counterparts in the highest valued fields. Although this finding does not support the initial hypothesis (i.e., that crossing over to more demanded fields of study might offer better economic opportunities to women), it does support Chevalier's (2011) findings about higher inequality among certain types of degrees.

The full model does not provide compelling evidence supporting the hypothesis that more traditional female-dominated degrees are associated with lower wages either. This only seems to hold for the male samples (columns 3 and 6), but does not hold for women, which is the focus group, once occupational choice is introduced into the model. Three possible interpretations can be derived from these results: firstly, if female-dominated degrees were, in fact, at the bottom of the wage distribution for graduates but having a university degree gives access to the top of the wage distribution, then this variable need not be significant, since it is simply the starting point for any graduate[76]. It could also be the case that, even if these fields of study were associated with lower starting wages, if women in such fields have better opportunities for promotions and rises than women in male-dominated fields, they would effectively end up earning similar wages, which is again consistent with Chevalier's (2011) argument. Thirdly, this finding could also support Walker and Zhu's (2011) and Glover's (2000, p.18) argument that there is no evidence of a higher demand for certain type of degrees, so that degree choice does not contribute to explain differences in earnings. In any of these scenarios, it will be rational for women to persist studying female-dominated degrees, since entering high-paying degrees and male-dominated degrees are not associated with higher premiums and they could incur into a personal cost by entering these male-dominated fields. Finally, the fact that, *ceteris paribus*, men with a female-dominated degree do earn, on

[76] This hypothesis could be tested using interquantile analysis, which is a possibility for future research.

average, 14.5% (7.7%) less than men with male-dominated degrees at age 29 (34) might provide some supporting evidence that men face a higher punishment for transgressing gender typing.

TABLE 31:

Earnings functions, full model

	29-year follow-up			34-year follow-up		
	Pooled (1)	Female (2)	Male (3)	Pooled (4)	Female (5)	Male (6)
Educational level						
Professional degrees (omitted)						
Professional higher degrees	-0.0299	-0.0588	0.0052	0.0413	0.0455	0.0514
	(0.0282)	*(0.0364)*	*(0.0433)*	*(0.0296)*	*(0.0454)*	*(0.0393)*
Years of working experience	0.119***	0.111***	0.1188***	0.1114***	0.1455***	0.1192***
	(0.0212)	*(0.0291)*	*(0.0311)*	*(0.0267)*	*(0.0458)*	*(0.0395)*
Years of working experience squared	-0.0067***	-0.0058***	-0.007***	-0.0042***	-0.0051***	-0.0045***
	(0.0013)	*(0.0019)*	*(0.0019)*	*(0.0011)*	*(0.0018)*	*(0.0016)*
High-earnings degree	*0.1163****	*0.0683**	*0.1536****	*0.1238****	*0.0435*	*0.1841****
	(0.0252)	*(0.0354)*	*(0.0356)*	*(0.0289)*	*(0.0465)*	*(0.0363)*
Female-dominated degree	*-0.0437*	*0.0219*	*-0.1562****	*-0.0296*	*-0.0032*	*-0.0797**
	(0.0276)	*(0.0339)*	*(0.0452)*	*(0.0313)*	*(0.0436)*	*(0.0461)*
High-earnings occupation	*0.07****	*0.1139****	*0.0203*	*0.0784****	*0.0831**	*0.0653**
	(0.0248)	*(0.0337)*	*(0.0361)*	*(0.0281)*	*(0.044)*	*(0.0365)*
Female-dominated occupation	*-0.1614****	*-0.1397****	*-0.2007****	*-0.1521****	*-0.1465****	*-0.1778****
	(0.0272)	*(0.0335)*	*(0.0438)*	*(0.0313)*	*(0.044)*	*(0.0455)*
Currently working part-time	*-0.1311***	*-0.1148***	*-0.1656*	*-0.0464*	*-0.0919*	*-0.0761*
	(0.0534)	*(0.0547)*	*(0.1671)*	*(0.0476)*	*(0.0606)*	*(0.1589)*
Married	0.0834***	0.0525	0.1116***	0.1144***	0.0737	0.1141***
	(0.0249)	*(0.0341)*	*(0.0362)*	*(0.0281)*	*(0.049)*	*(0.037)*
British, Irish or white	-0.0059	0.0214	-0.0186	-0.0165	-0.0193	0.0058
	(0.0567)	*(0.0828)*	*(0.0779)*	*(0.0612)*	*(0.1056)*	*(0.0733)*
Mills lambda					0.2544*	
					(0.1533)	
Female	-0.069***			-0.0514*		
	(0.0265)			*(0.0312)*		
Constant	1.9775***	1.8564***	2.0208***	1.9506***	1.6119***	1.8734***
	(0.097)	*(0.1343)*	*(0.1427)*	*(0.1666)*	*(0.309)*	*(0.2538)*
Observations	1 528	739	789	1 377	666	711
F	20.64	8.02	11.36	16.45	4.59	10.31
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R^2	0.1303	0.0992	0.1274	0.1170	0.0716	0.1284
Adjusted R^2	0.1240	0.0868	0.1162	0.1099	0.0560	0.1159

Source: 1970 BCS, 29 and 34-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%; standard errors in parenthesis.

While degree choice does not seem to be significantly related to earnings in the full model, occupational choice does. Working in a high-earnings occupation is significantly and positively related to wages for the pooled (columns 1 and 4) and female samples (columns 2 and 5), as well as the male 34-year follow-up (column 6). At least for women, working in a high-earnings occupation is associated with an average wage premium of about 12.1% when they are 29 and 8.7% when they reach 34, *ceteris paribus*, although these coefficients are not significantly different from one another at the standard confidence level. While 29 year old men working in high-earnings occupations do not enjoy a premium associated with their occupational choice when all variables are included, they do benefit from a premium of about 6.7% by the time they turn 34, which is a similar premium as that enjoyed by women. The fact that it is the occupational choice and not the degree choice that is associated with higher earnings has some consequences in terms of the initial research question: while choosing a degree choice implies making an investment, choosing an occupation does not. So, the intuition that having a university degree is what matters might not be so wrong: the degree serves as a floor that guarantees graduates a minimum standard of living and, as long as they are flexible to move around occupations, they will not be restricted by their degree choice. This finding falsifies the initial hypothesis.

From all the four variables of interest, working in a female-dominated occupation is the only one that shows consistent results in the full model. The coefficients associated with this variable are negative and highly significant, and they are not significantly different from one another, neither across time nor genders. Regardless of age, women in female-dominated occupations earn, on average, about 13% less than women working in male-dominated occupations, *ceteris paribus*. Similarly for men, this gap is estimated to be 18.2% by the time they are 29 and 16.3% by the time they are 34 years old, *ceteris paribus*. These results provide evidence in favour of two hypothesis: (i) gender-typing of occupation is, in fact, detrimental to women because when an occupation is predominantly female the average wage is lower relative to those occupations dominated by men. And, (ii) men are also consistently punished for transgressing gender typing of occupations as well as degrees.

As for the control variables, their coefficients do not vary much relative to the results discussed for the augmented human capital model. So, part-time employment is, in general,

not significant[77], except for the pooled (column 1) and female (column 2) 29 years old samples. In both these cases, part-timers earn about 10% less than full-timers, *ceteris paribus*.This coefficient could also be non-significant because what explains the lower wage for part-timers is their individual traits, mainly that part-timers are more likely to be married women with preschool children, with female-dominated degrees and working in female-dominated occupations. Consistent with previous discussions, being married is associated with a wage premium for men and the pooled sample. However, this variable stops being significant for women in both waves, so that married women no longer enjoy a premium for their marital status, *ceteris paribus*. As in previous sections, ethnicity is not relevant in determining wages for graduates. Some self-selection is still observed for women in the 34-year follow-up, but this variable stops being significant for the pooled sample in the full model. And, finally, although the coefficient on being female is still negative and highly significant in both waves, its level is reduced in less than half its size relative to the one estimated in section 5.4.3. All else equal, this difference is significant at a 99% and 90% confidence level for the 29 and 34 years old samples, respectively. This implies that the introduction of occupational and degree choices might be capturing differences in characteristics among the genders. It also implies that this coefficient is still capturing important characteristics associated with gender differences not captured by other variables. And, it is important to notice that, although the coefficient values are reduced, they are still of a considerable size and increasing with time. So, *ceteris paribus*, a female graduate earns, on average, at least 5% less than her male counterpart, simply for being a woman. This makes evident the structural barriers that woman face in the labour market, which are highlighted by the results already discussed.

5.4.9. Wage decomposition

Table 32 presents the results for the wage gap decomposition as developed in Oaxaca and Ransom (1994) and using the Stata command developed by Jann (2008). Results are provided for the augmented human capital model and the full model, respectively estimated

[77] Part-time employment has been found to be not significant in explaining earnings for this cohort when studying workers (Makepeace, Dolton and Joshi, 2004, p. 254).

in sections 5.4.3 and 5.4.8. Since the samples are the same, the estimated mean wages and wage differentials are the same across models. The adjusted log wage and wage differentials vary for the 34-year follow-up across the models due to the Heckman adjustment used for this wave. Hence, the results that are specific for each model are those that involve weighting assumptions, i.e., the male productivity advantage, the male overpayment and the female underpayment.

As expected, the mean wage is increasing over time for both genders. Between ages 29 to 34, the female average gross wage increased from 10.3 to 13.6 pounds of 2005; while the male average wage increased from 12.3 to 16.4 real pounds. This implies that the mean average wage increased at a very similar rate for women (32.1%) and men (32.5%) over a five years span, which is surprising since one would expect the male average wage to increase at a significantly faster pace due to discrimination in the market against women. Hence, in both waves men earn, on average, over 19% more than women do, if self-selection is not accounted for. However, if this gross wage differential is adjusted for self-selection in the 34-year sample, men actually end up earning over 28% more than women. This gross adjusted wage differential is similar between the two models, which implies consistency. That is, if self-selection accounts for the women with characteristics associated with higher pay rates then, after controlling for this, the wage gap would, in fact, be higher if women with other (less demanded) characteristics remained in the labour market.

However, as mentioned in section 5.3, these results differ from other estimates of the gender wage gap for this cohort (Neuburger, 2010; Makepeace, Dolton and Joshi, 2004; Joshi, Makepeace and Dolton, 2007), mainly by estimating a higher gender wage gap. These differences may be explained, at least in part, by the target population, which is restricted only to graduates, and by the smaller size of the sample. Since missing wages were not imputed and observations were dropped when values were missing, it should be acknowledged that results may be more biased than initially expected. It could also be that graduates do, in fact, face higher gender wage gaps. Graduates tend to be located at the top of the labour market hierarchy, where it is more difficult to have vertical gender integration (Glover, 2000) and there is some supporting evidence of a glass ceiling in the British labour market (Mumford and Smith, 2009; Chzhen and Mumford, 2011; Connolly and Long, 2008; and Arulampalam, Booth

and Bryan, 2004). Thus, one would expect the gender wage gap to be higher for graduates, as it is the case here. For example, Neuburger (2010) reports a gross log wage differential of 0.17 and 0.22 log points at ages 29 and 34 for working cohort members. These estimates are slightly lower than the 0.18 and 0.25 log point difference estimated here for graduates. However, Neuburger (2010) does not find evidence of a glass ceiling effect for this cohort when analyzing all workers; neither do Lanning *et al*. (2013), who estimate a gender pay gap of 25% for 38 year old graduates. This could suggest that the graduate sample used in this chapter might be more biased than expected. Also, Neuburger (2010) finds selection adjustments to be significant at ages 29 and 34 for all workers, and of a magnitude of about 0.06 log points in each case; while the sample for graduates estimated here only finds a selection adjustment of over 0.07 log points to be significant for the 34 year old sample. Because maternity seems to determine self-selection and non-graduates tend to experience their first birth earlier, it would be expected for the selection adjustment to be significant earlier in life when considering all workers. At the same time, if there is a glass ceiling, one would also expect these adjustments to be stronger in magnitude for graduate women, all of which would be consistent with the results obtained. However, other authors, like Rake (2000, who used the British Household Panel Survey data), argue that graduate women should face a smaller wage gap during their lifetimes (7%) than less qualified women (11%). However, this argument is based on the assumption that high-skilled women are barely affected by the probability of having children, which is a strong assumption. As discussed in sections 4 and 5.3, motherhood takes quite a toll on female careers, even for graduates. Also, Rake's argument does not take into account that probabilities of getting into managerial and top positions are narrower for women than men, which is another of the big disadvantages graduate women face in front of their male peers. Hence, the estimated gender wage gaps for this sample may not be consistent with previous literature.

Columns 1 through 3 present the estimations for the human capital model with control variables for the 29 year follow-up. If the pooled structure is taken as the competitive standard (column 1), 90.8% of the wage differential is explained by discrimination against women and the remaining 9.1% corresponds to differences in group characteristics, which is usually taken as a proxy for the male productivity advantage. If the female wage structure is taken as the standard (column 2), 91.6% of the wage differential is explained by the male

overpayment and the remaining 8.4% is explained by differences in the observed characteristics. If the male wage structure is assumed to be the standard, the differential in observed characteristics increases to 15%, with 85% of the wage differential being explained by discrimination against women. In all cases, however, the estimated differential in observed characteristics is only significant at a 90% confidence level when the pooled and female wage structures are taken as the standard, so that the observed wage differential is almost explained in its totally by the discrimination coefficient[78].

If degree and occupational choices are taken into account for the 29 years old follow-up, the differential in observed characteristics becomes significant in all cases. Under the pooled structure (column 7), differences in observed characteristics account for 61.1% of the wage differential and female underpayment explains the remaining 38.9%. If the female wage structure is taken as the standard (column 8), the differences in observed characteristics explain a smaller part of the wage gap (42.1%), so that nepotism in favour of men explains most of the differences in wages (57.9%). Finally, if the male wage structure is assumed to be the standard (column 9), most of the gender wage gap would be explained by differences in observed characteristics (92.7%), with discrimination against women explaining the remaining 7.2%. Thus, degree and occupational choices are significant in explaining the traits differential observed between genders. It is also worth noting that the pooled sample is very similar to the male structure, suggesting that the real structure is probably closer to the male wages than the female wages and, therefore, the lower wages reported for women obey mainly to discrimination against them.

The wage decomposition for the 2004 wave for the human capital model with control variables exhibits some similarities with the decomposition for the 1999 wave (columns 4 to 6). In both, over 70% of the wave differential is explained by the discrimination coefficient. In fact, if the pooled (column 4) or female (column 5) wage structures are taken as the standard, the discrimination coefficient explains about 80% of the gender wage gap. If male wages are taken as the standard, then the discrimination coefficient explains 74.14% of the gender wage gap. When degree and occupational choices are included, observed group differences become highly significant in all cases and account between 45% and 69% of the wage gap. That is, at

[78] Neuburger (2010) also finds an unexplained differential of over 80% when studying all workers.

age 34, differences in observed characteristics explain a smaller part of the wage differential in comparison to the estimates at age 29 when the pooled or male wage structures are taken as the norm, so that, in such cases, the discrimination coefficient gains weight in the wage differential. Differences in observed characteristics explain a smaller percentage of the gender wage gap when the female wage structure (column 11) is taken as the standard (45.6%), so that under this scenario 54.36% of the wage gap is explained by nepotism in favour of men. Under the pooled standard (column 10), differences in characteristics explain 54.84% of the wage differential, with discrimination against women explaining the remaining 45.16%. And finally, differences in observed characteristics are highest (68.79%) if the male wage structure (column 12) is taken as the standard, so that the discrimination coefficient drops to 31.21%.

In synthesis, including degree and occupational choices allow for a significant explained differential in the gender wage gap. These differences in characteristics explain between 42% and 93% of the gross wage differential at age 29 and 45% and 69% of the adjusted wage differential at age 34.

TABLE 32:

Gender wage gap decomposition

	29-year follow-up	34-year follow-up
Male mean log wage	2.513***	2.7942***
	(0.0183)	*(0.0186)*
Female mean log wage	2.3354***	2.6135***
	(0.0164)	*(0.0209)*
Log wage differential	0.1776***	0.1808***
	(0.0246)	*(0.028)*
Male mean wage	12.341***	16.350***
	(0.2256)	*(0.304)*
Female mean wage	10.333***	13.646***
	(0.1694)	*(0.2849)*
Wage differential	1.1943***	1.1981***
	(0.0293)	*(0.0335)*

34-year follow-up	Augmented human capital model	Full model
Adjusted log wage differential	0.2591***	0.2509***
	(0.048)	*(0.0468)*
Adjusted wage differential	1.2958***	1.2851***
	(0.0622)	*(0.0601)*

	Augmented human capital model						Full model					
	29-year follow-up			34-year follow-up			29-year follow-up			34-year follow-up		
	Pooled (1)	Female (2)	Male (3)	Pooled (4)	Female (5)	Male (6)	Pooled (7)	Female (8)	Male (9)	Pooled (10)	Female (11)	Male (12)
Differences in characteristics	0.0162*	0.015*	0.0267	0.0533***	0.0512***	0.067*	0.1086***	0.0748***	0.1647***	0.1376***	0.1144***	0.1726***
	(0.0083)	*(0.0081)*	*(0.0187)*	*(0.0148)*	*(0.0162)*	*(0.0353)*	*(0.0145)*	*(0.0164)*	*(0.0263)*	*(0.0194)*	*(0.0237)*	*(0.0383)*
Male overpayment	0	0.1626***	0	0	0.2079***	0	0	0.1028***	0	0	0.1364***	0
	(0.0011)	*(0.0249)*	*(0)*	*(0.0008)*	*(0.0472)*	*(0)*	*(0.0031)*	*(0.0279)*	*(0)*	*(0.0023)*	*(0.05)*	*(0)*
Female underpayment	0.1613***	0	0.1508***	0.2058***	0	0.1921***	0.069***	0	0.0128	0.1133**	0	0.0783
	(0.0244)	*(0)*	*(0.0299)*	*(0.0445)*	*(0)*	*(0.0613)*	*(0.0249)*	*(0)*	*(0.034)*	*(0.046)*	*(0)*	*(0.0622)*
As percentage of gender gap	**Pooled (1)**	**Female (2)**	**Male (3)**	**Pooled (4)**	**Female (5)**	**Male (6)**	**Pooled (7)**	**Female (8)**	**Male (9)**	**Pooled (10)**	**Female (11)**	**Male (12)**
Differences in characteristics	9.1%	8.4%	15.0%	20.57%	19.76%	25.86%	61.1%	42.1%	92.7%	54.84%	45.60%	68.79%
Male overpayment	0.0%	91.6%	0.0%	0.00%	80.24%	0.00%	0.0%	57.9%	0.0%	0.00%	54.36%	0.00%
Female underpayment	90.8%	0.0%	84.9%	79.43%	0.00%	74.14%	38.9%	0.0%	7.2%	45.16%	0.00%	31.21%
Observations	1 528	739	789	1 377	666	711	1 528	739	789	1 377	666	711

Source: 1970 BCS, 29 and 34-year follow-ups.

* p < 10%, ** p < 5%, *** p<1%; standard errors in parenthesis.

5.5. Conclusions

Using data for graduates at ages 29 and 34 from the 1970 British Cohort Study, this chapter tests the hypothesis that choosing high-paying degrees and occupations is positively associated with higher earnings, so that women would benefit financially from entering such fields. The alternative hypothesis is that due to wage inequalities within such fields of study and occupations women with high-paying degrees or in high-earnings occupations might not be better off than those women with degrees or in occupations that are not as highly valued by the market. The implication of this alternative hypothesis would suggest that it is rational for women to remain in the traditionally female degrees and occupations, since these might offer them better career opportunities than the more competitive and male-dominated environments. Results support the alternative hypothesis more strongly than the initial one.

Although degree choices are significant when they are introduced by themselves in the human capital model, they are not significant for women when all the variables of interest are included in the model. While men with high-earnings degree benefit from a wage premium, women with this type of degree initially enjoy a wage premium that is less than half of that of men's; and such premium disappears by the time they are 34 years old. Thus, there does not seem to be an incentive for women to invest in high-earning degrees, at least not in early stages of their career. Also, while having a female-dominated degree is negatively and significantly associated with wages for men, it is not significant for women. Again, this suggests that studying a traditionally female degree is not associated with lower wages for women, although men are punished for this gender transgression. This also supports the alternative hypothesis: even if female-dominated degrees were associated with lower wages, women have access to higher wages in these fields of study than in the male-dominated ones.

In contrast, occupational choice is significantly associated with wages: working in a high-earnings occupation is significantly and positively associated with wages for women and this premium is estimated in over 8%. Working in a female-dominated occupation is negatively associated with wages in all cases. This supports the hypothesis that occupational segregation is detrimental for women, since the female-dominated occupations are the ones

associated with lower wages, but men who transgress the gender norms are punished as well for their transgression.

Finally, the observed gender wage gap is about 19% for both periods analysed, but it increases over 28% (about 0.25 log points differential) when adjusting for self-selection in the female sample, which implies that the real wage gap is, in fact, higher than the one observed. These, however, are higher than wage differentials estimated by other authors. When accounting for degree and occupational choices, between 42% and 93% of the gross wage differential at age 29 is explained by differences in group characteristics; so that 7% to 58% of such differential is explained by the discrimination coefficient. As cohort members grow older and graduate women approach their fertility peak, differences in productivity account for a lower percentage of the adjusted wage differential (between 45% and 69%), so that the discrimination coefficient becomes even more relevant in explaining the adjusted wage gap (between 31% and 55%). Hence, if the policy implication for closing the gender wage gap that stemmed from the initial hypothesis was to encourage women to enrol in high-earnings degrees and enter high-earnings occupations, results from these estimates suggest that this policy might be short in tackling the problem, since there seem to be stronger structural barriers that keep women from enjoying higher wages even after crossing over into these fields of study and occupations.

6. Concluding remarks

"One is not born, but rather becomes, a woman."
(Simone de Beauvoir, 1949)

Women persistently earn less than men and wages between the genders have shown limited convergence over time. The obvious economic consequence of this is that working women, on average, have access to a lower standard of living than men. While discrimination by employers may explain a significant part of the gender wage gap, a portion of it is also explained by the labour supply decisions of women. For example, they might choose to work intermittently, work fewer hours or change jobs less than men. In particular, occupational segregation stands out as one of the main reasons in explaining the gender wage gap, since women are found to be concentrated in occupations with lower wages. The simple version of the human capital model fails to explain such observed persistence of gender segregated occupations, since the theory would predict that, as long as it is profitable, workers in less productive sectors would invest in training to be able to move to the more productive ones, which would result in a convergence of wages. Profit maximising employers would respond by hiring the most productive of these trainees. However, this convergence does not occur.

Other social factors might be influencing these labour supply decisions of women. In particular, occupational segregation has been found to respond to the construction and performance of gender: women might choose certain occupations to avoid coercion or to fit into a particular ideal of femininity. Similarly, the skill-bias technological change hypothesis provides an alternative explanation in understanding the wage gap between skilled and unskilled workers. According to this hypothesis, this gap will increase as long as the growth in the supply of skilled workers is not able to meet the growth in its demand. Because technology, mathematics and science have been associated with masculinity in the construction of gender, and because the more technological jobs are associated with higher productivities and therefore wages, it might be that the segregation of women in less

technological occupations is contributing to the persistence of the gender wage gap and that this segregation finds its root in a need for gender identification.

The present research explores this hypothesis. Specifically, it studies the degree decisions of graduate women, those women who consciously invest and make educational choices that could determine their future jobs and wages. The main hypothesis in which this research is based is that girls are less encouraged than boys to interact and feel comfortable with mathematics, science and technology because these subjects are signalled to them as being inappropriate for their gender. This identification of such subjects with masculinity at an early age might deter women from enrolling into the most profitable degree programs, such that the driving force in their decision is not merely economic but highly influenced by how we respond to social categories. Initially, this hypothesis is tested using the 1970 BCS: a regression analysis is carried out to test whether gender beliefs of sixteen year old teenagers are associated with the gender beliefs and working behaviour of their mothers as well as other socioeconomic characteristics. A second stage tests whether the degree choices of those cohort members who went to university are associated with their gender beliefs and the mathematical and technological capabilities developed earlier in life. Because the 1970 BCS might not provide enough information on how graduate women chose their degree, personal experiences from 144 female academics at the University of York were collected in order to further explore these relationships. The information collected provides a better understanding of the process by which women choose their degree program, while allowing for a similar analysis to that done with data from the 1970 BCS. Finally, the hypothesis that those women with degrees in high-paying subjects will earn more than those in more traditional female degrees is tested using the 1970 BCS. Although the results do not completely falsify the hypothesis in hand, they suggest that the relationship between how women conceptualize their gender, how they relate to mathematics, science and technology, their degree choice and their wage later in life is more complex and subtle than initially suggested.

Using data from the 1970 BCS, regressions were estimated to test whether teenagers choose to reproduce the gender values and scripts observed in their households. The results from chapter 3 suggest that there may be a weak intergenerational transmission of believes from mothers to daughters: growing up with a working mother and who believes that "*girls*

are just as capable as boys to become engineers" is positively associated with women believing that "*women can do the same job as men*". Similarly, girls are more likely to express gender-equal beliefs regarding sex and marriage if their mothers believed that "*women should have the same opportunities as men*" and had more liberal views on what constitutes women's roles as mothers and wives. Five main conclusions are drawn from these findings: (i) a girl's gender beliefs are likely to be associated with the maternal values and work behaviour, but this is not true for boys, who do not seem to respond to any of the variables in hand. Although the research does not look into it, the construction of masculinity might be more difficult to modify and holds stronger to the belief of female inferiority than the construction of femininity. (ii) Different behaviours associated with femininity might respond to different signals, scripts and behaviours. Hence, what girls might interiorize as being a feminine or appropriate behaviour for them might vary depending on the topic in question. For example, a person could be conservative regarding sexuality but could still believe that women are as capable as men; and what reinforces one belief does not have to reinforce the other. This implies that people might express different degrees of gender equality beliefs. (iii) Although the mother figure influences a girl's beliefs in gender equality both through discourse and by example, this relationship is not as strong as expected, so that other factors not captured by the variables might be more relevant in explaining how gender is constructed. For instance, the influence of media culture and peers might have a stronger role in explaining identity. (iv) The results provide some evidence in favour of the hypothesis, but this is not robust, so that the transmission of intergenerational beliefs might not be as strong as initially assumed. And, (v) other control variables, such as household social class, religion, country of birth, etc., were not found to be significant, supporting the hypothesis that how we construct gender permeates different social strata.

Regarding degree choices, the results also provide supporting evidence in favour of the hypothesis that women with more gender equal beliefs might be more willing to transgress into the less traditional and higher-paying degrees, since the results provide a positive association between believing that "*women can do the same job as men*" and holding a high-earnings degree. At the same time, being in the top 15% of the class, understanding electronics and wanting to work with numbers are positively related to women studying high-paying degrees. And, while being good at mathematics and developing programming skills at

an early age do not necessarily encourage girls to go into high-earnings degrees, they are negatively associated with the more traditional female-dominated ones, so that encouraging girls in mathematics and technology might serve as a useful strategy to promote less traditional degree options. Ability, which is sometimes taken to be innate not only to people but specific genders, is not associated with the degree type. Although the results are not as robust as initially expected, they do suggest that the variables positively (negatively) associated with choosing a high-earnings degree are either negatively (positively) or not associated with choosing a female-dominated degree. So, more gender equal environments, in which subjects like mathematics and technology are not associated with masculinity but rather girls are encouraged to study them, might encourage girls to pursue degrees that offer better financial opportunities later in life.

Because the data from the 1970 BCS offers limited information on the relationship between degree choice and the construction of gender and the exposure to mathematics, technology and science at an early age, information was collected regarding these experiences from 144 female academics at the University of York. Evidently, academics are not fully representative of all female graduates, but nonetheless they make up a subsample with a variety of degrees. Therefore, the opportunity to survey them provides ample information regarding the different experiences by which women choose to enrol in a particular degree. Hence, the information drawn from this survey complements the previous findings by providing more detailed information on how women come to choose a degree over another. In particular, the possibility of asking open-ended questions allows for women to share their own perspective and experiences, which in turn allows for the identification of patterns or different factors that might also influence the degree choice.

When asked about the reasons leading to a degree choice, it becomes clear that economic variables are not its main determinants. On the contrary, tastes for particular subjects and attending university are the main motivation in choosing a degree program. This suggests either lack of information or a low weight of future economic wellbeing in the utility function when making such decision. Respondents whose decision was influenced by someone were also more likely to enrol in high-earnings degrees, suggesting that this third party might be more concerned about future earnings and status, although this is not always

the case and there are instances in which the advice actually reinforces the sex-typing of occupations. Similarly, the signalling of occupational sex-typing seems to have been conveyed stronger to older respondents. For younger women, the association of mathematical, scientific and technological subjects with masculinity was transmitted in more subtle ways, although it is still persistent. This implies that gendering occupations not only varies over time but is also learned differently. Whereas a few decades ago girls were explicitly banned from certain occupations (for example, they might have been told "*girls don't become engineers*"), now they are discouraged by questioning their capabilities or preferences but this is not directly being associated with their condition as women, so that it's not seen as a class problem but as an individual one ("*girls can become engineers, but you are not good at mathematics*"). Because this is not understood within a gender context, it follows that the regressions results do not provide a significant association between holding conservative beliefs and the type of degree chosen: a woman can express liberal views and still opt-out of high-earnings degrees without drawing a direct link between these two.

The majority of women do not recall having been treated differently because of their gender. However, when this happened they were less likely to choose high-earnings degrees and more likely to choose a female-dominated ones. In contrast, excelling in school and participating in extracurricular activities that enhance mathematical, scientific and technological capabilities is positively associated with holding high-earnings degrees. The kind of stimuli they receive at home and school is also different: parents are more likely to be supportive than teachers. In particular, the mother's role as supervising their homework and educational process is taken for granted, while the father plays a more interesting figure in encouraging them to explore mathematical, technological and scientific fields. Parents also discourage their children differently: while mothers transmit their technological and mathematical reticence to their daughters, fathers tend to convey more conservative aspirations for them.

Therefore, there are two main findings derived from the testimonies that are later reflected in the degree regression estimations. Firstly, sex-typing of subjects occurs within a discourse that does not directly associate gender to this subject, so that women do not feel that they are been discriminated or excluded from these subjects, rather they claim that they

do not have the capabilities or the interest to enter them. While the outcome is still the same (women do not enter the most profitable fields of study), the experience is different, since they see this segregation as their own choice and do not feel coerced or limited in anyway. Their choice is experienced exclusively from an individual perspective and it is not perceived as a problem for women considered as a class. Evidently, from a policy perspective this makes it more difficult to try to include women in these fields, since subject sex-typing is not interiorized as being problematic.

Secondly, while the initial hypothesis claimed that positive experiences with mathematics, science and technology might encourage girls to enter less traditional and more profitable degrees, results (particularly in the testimonies) point to experiences of discouragement as being the key factor in keeping women away from these subjects. Enhancing mathematical, technological and scientific capabilities encourages girls to enter less traditional degrees, but not necessarily the high-earnings ones. In contrast, a single bad experience can mark them forever: it reverberates in their self-esteem and their confidence in their own capabilities which puts them off those subjects traditionally associated with masculinity. Therefore, while it is important to keep expanding and enrolling girls in less traditional courses at school and university, this is not enough to reduce occupational segregation. How women construct their self-esteem is strongly linked to the capabilities they develop and the degrees they pursue later in life. This requires a more active and complex policy that monitors the treatment women receive within the classrooms, not just their enrolment in courses or non-traditional activities. Clearly, this demands a more transversal policy to promote gender equality than initially thought of.

The main argument throughout the research is that, if women are encouraged to transgress traditional gender roles and enter high-earnings degrees they will have access to the more profitable occupations and jobs, so that they will be better off financially. This hypothesis was tested using data for graduates at ages 29 and 34 from the 1970 British Cohort Study. The results do not provide robust supporting evidence in favour of this hypothesis: while degree choices are significant when introduced individually in the human capital model, they are not significant in the full model. Further, having a high-earnings degree is associated with a male wage premium that persists over time, but women with high-earnings degree only

enjoy an initial premium and it is about half the size of that of men's. Similarly, men are punished for having a female-dominated degree, but women are not. These findings suggest that women entering more profitable degrees are not necessarily better off than those who remain in the traditionally female degrees. Hence, these results are not consistent with the skilled-bias technological change hypothesis but are consistent with theories of discrimination. Therefore, it seems to be rational for women not to invest in such degrees, since their expected return is not significantly higher.

In contrast, occupational choice is significantly associated with wages: women working in high-earnings occupations enjoy a premium of more than 8%, while working in a female-dominated occupation is negatively associated with wages. Consistent with the literature, occupational segregation is an important factor in explaining the gender wage gap, even among graduates. This is also consistent with the results derived from the online survey, according to which the main reason for choosing a degree was attending a university: holding a degree, irrespective of its type, is what is important, but not the specific capabilities you develop while studying that degree. That is, holding a degree might give you access to certain types of jobs, regardless of the degree subject.

A gender wage gap of about 19% was estimated for both periods. Because graduate women tend to reproduce after their thirties, this gender wage gap is actually higher than initially estimated (over 28%) once it is adjusted for self-selection at age 34. However, these pay gaps are higher than those reported by other authors (Neuburger, 2010; Lanning *et al*., 2013; Rake, 2000; Makepeace, Dolton and Joshi, 2004; Joshi, Makepeace and Dolton, 2007) and might be biased upwards due to the sample. At age 29 and accounting for degree and occupational choices, the discrimination coefficient explains between 7% and 58% of the gross wage differential, but it becomes higher at age 34, explaining between 31% and 55% of the adjusted wage gap. Therefore, women may encounter structural barriers in the labour market that do not seem to respond to their degree choice. This suggests that the initial hypothesis, according to which encouraging women to enrol in high-earnings degrees could help close the gender wage gap, is somehow naïve. The barriers graduate women face in the labour market do not seem to be strongly related to their degree choice, but rather strongly linked to motherhood, a topic outside the scope of this analysis.

In this sense, the results derived from the research are quite pessimistic: the predominant discourse among governments and international organizations take research and development, as well as the most technological, dynamic sectors of the economy, to be a clear investment in promoting growth and higher standards of living; thus concerning itself with how to make growth more inclusive (UN System Task Team on the Post-2015 UN Development Agenda, 2013). Consequently, for over two decades, there has been an international discussion about why not enough women study science, technology, engineering and mathematics (UN DAW-UNESCO, 2010; Rathgeber, 2009; OECD, 2012). Among others, programs like United Nations Girls' Education Initiative; Girls Who Code; Discover Engineer Summer Camp; UNESCO Chairs in Gender, Science and Technology; and the Code of Best Practices in ICT of the European Commission aim at tackling this problem (Rathgeber, 2009). The obvious reasoning is that the inclusion of women in these fields will result in a higher standard of living for them (and a greater freedom of choice to maximise their well-being). That is, it is not that science, technology, engineering and mathematics are deemed superior to other fields from a normative perspective (this is never implied on a discourse that acknowledges human development as the goal of its policies), but rather that these fields can give women access to higher incomes. Given that poverty and dependency have always been effective mechanisms in perpetuating the subjection of women, it is worth studying the different options through which women can achieve economic independence and material wellbeing, without which human development cannot be reached. An education that invests in a particular type of human capital highly valued in the labour market is one of these many possibilities.

With this in mind, the present research tested a very straight forward hypothesis: if girls were encouraged to explore with mathematics, science and technology, so that they would no longer associate these fields with masculinity, a higher percentage of girls would eventually pursue degrees that are highly valued by the market and women would have access to higher wages and higher financial well-being. As expected, the high-paying fields are, in fact, constituted mainly, but not exclusively, by fields requiring mathematical, scientific and technological skills. One would expect then that developing these capabilities will result in higher wages. However, the results are pessimistic in several ways: sex-typing of occupations

is apparently too deeply rooted in what constitutes gender identity, so that girls can be more easily discouraged by one bad experience than encouraged to feel confident about their abilities in mathematics, science and technology. Not only that, even if they are encouraged enough and develop preferences in order to choose a high-paying degree program, it will not necessarily be true that they will have access to higher wages and opportunities than the women choosing traditional career paths. The structural barriers they face once they enter the labour market, and especially those associated with motherhood, seem to limit their opportunities for advancement. So, even if a woman played by the book, she would still find sticks and no carrots. Why then be a path breaker, if there is no reward?

This leads to another question, which is that of satisfaction. Throughout the whole research and in accordance with economic theory, it has been taken as given that women behave rationally, so that if the human capital model fails to explain the degree choices of women it is not because women are irrational but because the model fails to incorporate the social factors that shape women's preferences. This assumption allowed to focus the analysis on how the construction of gender identity and early experiences might shape preferences that reinforce subject sex-typing. Female rationality was never in question and was not intended to be[79]. In fact, four out of five graduate women and men in the sample report satisfaction with their job, irrespective of their degree type. As expected, this suggests that the approach was correct: like men, women act in order to maximize their utility, but they choose differently because their preferences are gendered. What needs to be more fully understood is how do preferences become gendered; and how might this gendering work against women's opportunities? The results presented above suggest that women foresee the difficulties they would face if they choose to be path breakers and act rationally seeking to maximise their own benefit, given the circumstances. How then can the circumstances be change, so that preferences can be freed from gender stereotypes and real opportunities be offered to women?

The results presented in this thesis suggest the problem needs to be addressed from different fronts: encouraging girls to engage with mathematics, science and technology alone

[79] Rationality and freedom are the core axioms of Economics. As long as the analysis used an Economic approach, these are taken as given.

is not an effective tool for enrolling more women in sex-atypical degrees. For it to be more effective, the policy has to be accompanied by constant reinforcement of self-confidence, because what is also keeping girls from these fields of study appears to be the belief that they (as individuals) are not good enough for these career paths. So, a correct approach should include the unified promotion of girl's self-esteem in mathematics, science and technology. This would imply a whole body of policies from early schooling up to university level promoting the inclusion of women at all levels. These efforts, however, would only go as far as widening female degree choices and capabilities. For women to benefit from higher economic opportunities, it will be necessary to push for policies seeking vertical integration within occupations that can more fully achieve the attraction, recruitment, promotion and retention of women within an organization (Glover, 2000, UN DAW-UNESCO, 2010).

Finally, as with all applied analyses, the scope of this analysis is limited: measuring how social constructs and interactions (such as gender performance and beliefs and childhood experiences) might influence economic decisions (capital investment and wages) implies the need to quantify these variables. One of the main setbacks in doing so is the availability of data. The 1970 BCS was the only dataset available that included variables regarding the household background, school performance, gender beliefs among generations in a household, mathematical and technological capabilities at an early age, degree choices and employment information later in life. However, due to its nature, this dataset suffers from serious problems of nonresponses that make it difficult to draw conclusions for a representative sample of the population. In particular, it was problematic to balance samples for estimations: every additional variable included substantially reduced the sample size, so that the final balanced samples used are often small in size and may even produce biased results. This affects the robustness of results and how far these results can be extrapolated with validity.

Nevertheless, the findings of this thesis suggest that patterns do exist and that gender construction and sex-typing may be deterring women from entering certain degrees. The lack of robustness and low explanatory power indicates the complex nature of the topic being investigated. Focusing on understanding how the construction of gender and exposure to mathematics, science and technology might influence degree choices, when degree choices

are not found to be significantly associated with earnings, suggests that a more holistic research framework may provide better explanations of the gender wage gap. For example, an ethnographic approach that addresses how women disassociate their self-esteem and confidence in mathematics, science and technology from their gender could provide additional insightful information as to why women abstain from entering the most profitable degree programs. The results obtained throughout the thesis also support further research: for instance, it will be valuable to know if the relations established above affect younger cohorts (such as those entering university now). Future research could also consider how the degree choices, conditional on other social and environmental factors, affect job satisfaction in women, so that the research question can come full circle.

7. Appendices

Appendix 1: Observations per variable used in estimating gender identity and degree choice, as percentage of cohort size

Panel 1: Responses for variables associated with gender beliefs	Responses				% of wave respondents *			% of initial population **			
	Total (A)	Female (B)	Male (C)	Missing	Total	Female	Male	Total (A/17196)	Female (B/8279)	Male (C/8906)	% female (B/A)
1 Cohort initial population (birth wave)	17 196	8 279	8 906	11							48.1%
2 Total respondents in the 5-year follow-up	13 135	6 327	6 808								48.2%
3 Total respondents in the 10-year follow-up	14 875	7 162	7 713								48.1%
4 Total respondents in the 16-year follow-up	11 615	5 800	5 815								49.9%
5 Fully agrees that women can do the same job as men	5 426	3 118	2 308		46.7%	53.8%	39.7%	31.6%	37.7%	25.9%	57.5%
6 Average sexual equality score	5 491	3 150	2 341		47.3%	54.3%	40.3%	31.9%	38.0%	26.3%	57.4%
7 Agrees with sexual equality	5 491	3 150	2 341		47.3%	54.3%	40.3%	31.9%	38.0%	26.3%	57.4%
8 Average maternal gender equality score	12 989	6 256	6 733		98.9%	98.9%	98.9%	75.5%	75.6%	75.6%	48.2%
9 Mother believed women should have same work opportunities	12 953	6 241	6 712		98.6%	98.6%	98.6%	75.3%	75.4%	75.4%	48.2%
10 Mother believed girls are just as capable to be engineers	12 946	6 236	6 710		98.6%	98.6%	98.6%	75.3%	75.3%	75.3%	48.2%
11 Mother worked since child's birth	11 509	5 556	5 953		87.6%	87.8%	87.4%	66.9%	67.1%	66.8%	48.3%
12 Mother worked at least once between 1980-1986	13 948	6 803	7 145		93.8%	95.0%	92.6%	81.1%	82.2%	80.2%	48.8%
13 Mother regularly worked during child's infancy	10 087	4 944	5 143		86.8%	85.2%	88.4%	58.7%	59.7%	57.7%	49.0%
14 Care about what your mother thinks about you	6 203	3 577	2 626		53.4%	61.7%	45.2%	36.1%	43.2%	29.5%	57.7%
15 Mother's age at delivery	15 389	7 454	7 935		89.5%	90.0%	89.1%	89.5%	90.0%	89.1%	48.4%
16 Household social class	14 090	6 838	7 252		94.7%	95.5%	94.0%	81.9%	82.6%	81.4%	48.5%
17 Grew up with siblings in the household	9 647	4 931	4 716		83.1%	85.0%	81.1%	56.1%	59.6%	53.0%	51.1%
18 At least one sister in the household	8 186	4 132	4 054		70.5%	71.2%	69.7%	47.6%	49.9%	45.5%	50.5%
19 Known changes in family composition	11 615	5 799	5 816		100.0%	100.0%	100.0%	67.5%	70.0%	65.3%	49.9%
20 Cohort member has a single parent	9 584	4 848	4 736		82.5%	83.6%	81.4%	55.7%	58.6%	53.2%	50.6%
21 Cohort member has a religion	6 044	3 480	2 564		52.0%	60.0%	44.1%	35.1%	42.0%	28.8%	57.6%
22 Cohort member is Christian	6 044	3 480	2 564		52.0%	60.0%	44.1%	35.1%	42.0%	28.8%	57.6%
23 Cohort member is British, Irish or white	13 584	6 759	6 825		79.0%	81.6%	76.6%	79.0%	81.6%	76.6%	49.8%
24 Country of birth place	15 706	7 605	8 101		91.3%	91.9%	91.0%	91.3%	91.9%	91.0%	48.4%

Source: 1970 BCS, birth, 5, 10, 16, 29 and 34-year follow-ups.

* 15, 23 and 24 are from the birth wave and thus are expressed relative to the totals in line 1; 8-11 belong to the 5-year follow-up (line 2); 12 and 16 are divided by the totals in line 3; and the remaining variables come from the 16-year follow-up (line 4).

** Expressed as a percentage of the initial cohort population, as recorded in the birth wave.

… appendix 1 (continued)…

Panel 2: Responses for variables associated with degree choice at age 29	Responses				% of graduates*			% of 1999 respondents **			% of initial population ***			
	Total (A)	Female (B)	Male (C)	Missing	Total (A/2064)	Female (B/1022)	Male (C/1042)	Total (A/11261)	Female (B/5790)	Male (C/5471)	Total (A/17196)	Female (B/8279)	Male (C/8906)	% female (B/A)
Cohort initial population (birth wave)	17 196	8 279	8 906	11										48.1%
Total respondents in the 16-year follow-up	11 615	5 800	5 815											49.9%
Total respondents in the 29-year follow-up	11 261	5 790	5 471											51.4%
Total graduates in the 29-year follow-up	2 064	1 022	1 042											
Degree in a high-paying field	1 985	978	1 007		96.2%	95.7%	96.6%	17.6%	16.9%	18.4%	11.5%	11.8%	11.3%	49.3%
Degree in a female-dominated field	1 985	978	1 007		96.2%	95.7%	96.6%	17.6%	16.9%	18.4%	11.5%	11.8%	11.3%	49.3%
Believes women can do the same job as men	4 345	2 584	1 761		56.9%	63.8%	50.1%	38.6%	44.6%	32.2%	25.3%	31.2%	19.8%	59.5%
Average sexual equality score	4 402	2 612	1 790		57.4%	64.3%	50.7%	39.1%	45.1%	32.7%	25.6%	31.5%	20.1%	59.3%
Average ability score at age 5	8 191	4 231	3 960		73.0%	73.6%	72.5%	72.7%	73.1%	72.4%	47.6%	51.1%	44.5%	51.7%
Top 15% of academic ability	2 772	1 529	1 243		28.6%	31.0%	26.3%	24.6%	26.4%	22.7%	16.1%	18.5%	14.0%	55.2%
Believes to be good at mathematics	4 341	2 566	1 775		57.0%	63.7%	50.5%	38.5%	44.3%	32.4%	25.2%	31.0%	19.9%	59.1%
Can write computer programs	3 808	2 152	1 656		48.5%	51.5%	45.7%	33.8%	37.2%	30.3%	22.1%	26.0%	18.6%	56.5%
Understands electronics	5 001	2 953	2 048		62.5%	69.3%	55.8%	44.4%	51.0%	37.4%	29.1%	35.7%	23.0%	59.0%
Job: Having high earnings/wages matters very much	4 494	2 646	1 848		57.9%	65.0%	51.1%	39.9%	45.7%	33.8%	26.1%	32.0%	20.8%	58.9%
Job: Helping others matters very much	4 503	2 657	1 846		57.9%	64.9%	51.2%	40.0%	45.9%	33.7%	26.2%	32.1%	20.7%	59.0%
Job: Working with figures matters very much	4 453	2 625	1 828		57.6%	64.5%	50.9%	39.5%	45.3%	33.4%	25.9%	31.7%	20.5%	58.9%
Job: Having a real challenge matters very much	4 468	2 633	1 835		57.7%	64.7%	50.9%	39.7%	45.5%	33.5%	26.0%	31.8%	20.6%	58.9%
Job: Making or building things matters very much	4 457	2 627	1 830		57.8%	64.7%	51.0%	39.6%	45.4%	33.4%	25.9%	31.7%	20.5%	58.9%

Source: 1970 BCS, birth, 5, 10, 16, 29 and 34-year follow-ups.

* Expressed as a percentage of the total graduates reported in the 29-year follow-up.

** Expressed as a percentage of the total respondents in the 29-year follow-up.

*** Expressed as a percentage of the initial cohort population, as recorded in the birth wave.

… appendix 1 (continued)…

Panel 3: Responses for variables associated with degree choice at age 34	Responses				% of graduates*			% of 2004 respondents **			% of initial population ***			
	Total (A)	Female (B)	Male (C)	Missing	Total (A/2087)	Female (B/1052)	Male (C/1035)	Total (A/9665)	Female (B/5039)	Male (C/4626)	Total (A/17196)	Female (B/8279)	Male (C/8906)	% female (B/A)
Cohort initial population (birth wave)	17 196	8 279	8 906	11										48.1%
Total respondents in the 16-year follow-up	11 615	5 800	5 815											49.9%
Total respondents in the 34-year follow-up	9 665	5 039	4 626											52.1%
Total graduates in the 34-year follow-up	2 087	1 052	1 035											
Degree in a high-paying field	1 853	934	919		88.8%	88.8%	88.8%	19.2%	18.5%	19.9%	10.8%	11.3%	10.3%	50.4%
Degree in a female-dominated field	1 853	934	919		88.8%	88.8%	88.8%	19.2%	18.5%	19.9%	10.8%	11.3%	10.3%	50.4%
Believes women can do the same job as men	3 934	2 357	1 577		56.7%	64.3%	49.1%	40.7%	46.8%	34.1%	22.9%	28.5%	17.7%	59.9%
Average sexual equality score	3 981	2 383	1 598		57.2%	64.7%	49.6%	41.2%	47.3%	34.5%	23.2%	28.8%	17.9%	59.9%
Average ability score at age 5	7 130	3 739	3 391		74.0%	74.1%	73.9%	73.8%	74.2%	73.3%	41.5%	45.2%	38.1%	52.4%
Top 15% of academic ability	2 451	1 355	1 096		28.3%	30.4%	26.1%	25.4%	26.9%	23.7%	14.3%	16.4%	12.3%	55.3%
Believes to be good at mathematics	3 940	2 347	1 593		56.8%	64.0%	49.6%	40.8%	46.6%	34.4%	22.9%	28.3%	17.9%	59.6%
Can write computer programs	3 406	1 938	1 468		47.6%	50.8%	44.4%	35.2%	38.5%	31.7%	19.8%	23.4%	16.5%	56.9%
Understands electronics	4 502	2 681	1 821		62.6%	69.3%	55.7%	46.6%	53.2%	39.4%	26.2%	32.4%	20.4%	59.6%
Job: Having high earnings/wages matters very much	4 062	2 411	1 651		57.7%	65.1%	50.2%	42.0%	47.8%	35.7%	23.6%	29.1%	18.5%	59.4%
Job: Helping others matters very much	4 071	2 423	1 648		57.7%	65.0%	50.3%	42.1%	48.1%	35.6%	23.7%	29.3%	18.5%	59.5%
Job: Working with figures matters very much	4 022	2 388	1 634		57.5%	64.6%	50.3%	41.6%	47.4%	35.3%	23.4%	28.8%	18.3%	59.4%
Job: Having a real challenge matters very much	4 041	2 399	1 642		57.6%	64.8%	50.2%	41.8%	47.6%	35.5%	23.5%	29.0%	18.4%	59.4%
Job: Making or building things matters very much	4 028	2 396	1 632		57.6%	64.9%	50.1%	41.7%	47.5%	35.3%	23.4%	28.9%	18.3%	59.5%

Source: 1970 BCS, birth, 5, 10, 16, 29 and 34-year follow-ups.

* Expressed as a percentage of the total graduates reported in the 34-year follow-up.

** Expressed as a percentage of the total respondents in the 34-year follow-up.

*** Expressed as a percentage of the initial cohort population, as recorded in the birth wave.

Appendix 2: Subject fields of study classified as traditionally female

In medicine and dentistry:
- Medicine
- Other in medicine and dentistry

In subjects allied to medicine:
- Subjects allied to medicine
- Anatomy, physiology and pathology
- Pharmacology, toxicology and pharmacy
- Pharmacy
- Complementary medicine
- Nutrition
- Aural and oral sciences
- Nursing
- Medical technology
- Other in subjects allied to medicine

In biological sciences:
- Biological sciences
- Biology
- Psychology
- Other in biological sciences

In veterinary science, agriculture & related subjects:
- Pre-clinical veterinary medicine
- Animal science
- Food and beverage studies

In physical sciences:
- Forensic and archaeological science

In technologies:
- Polymers and textiles

In social studies:
- Social studies
- Sociology
- Social policy
- Social work
- Anthropology
- Psychology
- Other in social studies

In business & administrative studies:
- Industrial relations
- Human resource management
- Catering and institutional management
- Office skills

In mass communications & documentation:
- Mass communications and documentation
- Information services
- Publicity studies
- Other in mass communications and documentation

In linguistics, classics & related subjects:
- Linguistics, classics and related subjects
- Linguistics
- Comparative literary studies
- English studies
- Literacy
- Celtic studies
- Other linguistics, classics and related subjects

In European language,literature & related subjects:
- European language, literature and related subjects
- French studies
- German studies
- Italian studies
- Spanish studies
- Russian and East European studies
- Other European languages, literature and related subject

In East, Asiatic, African, American and Australian languages, literature:
- East, Asiatic, African, American and Australian languages, literature
- Modern Middle Eastern studies
- American studies
- Other East, Asiatic, African, American and Australian languages
- Other or unspecified Modern languages

In historical & philosophical studies:
- Historical and philosophical studies
- History by topic
- History of art
- Other in historical and philosophical studies

In creative arts & design:
- Creative arts and design
- Fine art
- Design studies
- Music
- Drama
- Dance
- Crafts
- Other in creative arts and design

In education:
- Education
- Training teach
- Research and study skills in education
- Academic studies in education
- Techniques in teaching children
- Techniques in teaching adults
- TEFL/TESOL
- Education for those with special needs
- Others in education

In combined degrees:
- Combined degree
- Combined degree with language studies
- Combined degree in humanities, creative arts, education
- Combined degree with language studies
- Combined degree with language studies
- Combined degree
- Other in combined subjects
- Combined or general social science
- Combined or general arts

* Subject field classification is taken from the Labour Force Survey User Guide - Volume 5 (ONS, 2009)

Appendix 3: Degree subject fields associated with high earnings

In medicine and dentistry:	**In architecture, building & planning:**
Medicine *	Others in architecture, building and planning
Pre-clinical medicine	**In social studies:**
Clinical medicine	Economics
Neurophysiological basis of behavior	**In Law:**
Clinical dentistry	Law
Other in medicine and dentistry *	Law by area
In subjects allied to medicine:	Law by topic
Pharmacology, toxicology and pharmacy *	Other in law
Complementary medicine *	**In business & administrative studies:**
Aural and oral sciences *	Business and administrative studies
In veterinary science, agriculture & related subjects:	Management studies
Clinical veterinary medicine and dentistry	Operational research
Animal science *	Finance
In physical sciences:	Accounting
Materials science	Human resource management *
Physics	Office skills *
Astronomy	Land and property management
In mathematical & computer sciences:	Tourism, transport and travel
Mathematics	Other in business and administrative studies
Operational research	**In mass communications & documentation:**
Statistics	Other in mass communications and documentation *
Computer science	**In linguistics, classics & related subjects:**
Information systems	Classical Greek studies
Software engineering	Other linguistics, classics and related subjects *
Artificial intelligence	**In European language,literature & related subjects:**
Other in mathematics and computing sciences	Latin American languages, literature and culture
In engineering:	Scandinavian studies
Engineering	**In East, Asiatic, African, American and Australian languages, literature:**
General engineering	Japanese studies
Aerospace engineering	Other East, Asiatic, African, American and Australian languages *
Naval architecture	**In historical & philosophical studies:**
Electronic and electrical engineering	History by area
Production and manufacturing engineering	History by topic *
Chemical, process and energy engineering	**In creative arts & design:**
Other in engineering	Crafts *
In technologies:	Imaginative writing
Minerals technology	**In education:**
Metallurgy	Research and study skills in education *
Ceramics and glasses	Others in education *
Others in technology	**In combined degrees:**
	Combined degree (group E - A/B with group D)

* Also classified as female subject degrees.

** Subject field classification is taken from the Labour Force Survey User Guide - Volume 5 (ONS, 2009)

Appendix 4: Online questionnaire

Hello,

I am a Ph.D. student in the School of Politics, Economics and Philosophy. As part of my research project I am running a survey to identify whether or not social experiences regarding gender, mathematics, science and technology influence female degree choices and how this might impact job satisfaction. I will really appreciate it if you were willing to participate in the survey by clicking the link below:

The survey will take you a maximum of 30 minutes to complete. You are free to leave questions unanswered if you wish to and are free to quit the survey at any time. You can also return to it if you don't finish it at once. All the information that you disclose is confidential, will be used in ways that do not allow identification of your responses and will only be used for research purposes. The study has approval by the Economics, Law, Management, Politics and Sociology Ethics Committee of the University of York. If you have any questions, please contact Laura C. Blanco at the following email address: lcrb500@york.ac.uk.

Please note that this survey is intended for female academic staff in the University of York. If by mistake you are not a female academic, please ignore the email.

Thank you for your time.

Best regards,

Laura C. Blanco
Ph.D. student
School of Politics, Economics and Philosophy
University of York

Project information sheet

Thank you for taking part on this survey. It is part of a Ph.D. research project in the School of Politics, Economics and Philosophy. The purpose of this survey is to identify whether or not social experiences regarding gender, mathematics, science and technology influence female career choices and how this might impact job satisfaction. The survey will take you approximately 30 minutes to complete. You are free to leave questions unanswered if you wish to and are free to quit the survey at any time. All the information that you disclose is confidential, will be used in ways that do not allow identification of your responses and will only be used for research purposes. The study has approval by the Economics, Law, Management, Politics and Sociology Ethics Committee of the University of York. If you have any questions, please contact Laura C. Blanco at the following email address: lcrb500@york.ac.uk.

Please tick if you agree with the above conditions and are willing to participate on this survey.	☐

1. Please state your academic background.	
1.1.1. What is your Bachelor degree subject (discipline) on?	_____
1.1.2. Year of graduation	_____
1.1.3. Did you graduate with honors?	☐ Yes ☐ No
1.1.4. Which university did you graduate from?	_____
1.2.1. What is your Masters (MA., MSc., MBa., MPhil.) degree subject (discipline) on?	_____
1.2.2. Year of graduation	_____
1.2.3. Did you graduate with honors?	☐ Yes ☐ No
1.2.4. Which university did you graduate from?	_____
1.3.1. What is your PhD degree subject (discipline) on?	_____
1.3.2. Year of graduation	_____
1.3.3. Which university did you graduate from?	_____

2. When you first entered college, how important were the following in choosing your degree program?

	Very unimportant	1. Unimportant	2. Neither important nor unimportant	3. Important	4. Very important
1. To earn a high income, be well off financially.	☐	☐	☐	☐	☐
2. Job security.	☐	☐	☐	☐	☐
3. To be economically independent.	☐	☐	☐	☐	☐
4. To get an academic education, learn more.	☐	☐	☐	☐	☐
5. To help other people or creatures (planet, etc.).	☐	☐	☐	☐	☐
6. To research, develop new technologies, innovate.	☐	☐	☐	☐	☐
7. To work with people.	☐	☐	☐	☐	☐
8. To make your parents or mentors proud.	☐	☐	☐	☐	☐
9. To have prestige, be successful or influential.	☐	☐	☐	☐	☐
10. To create art.	☐	☐	☐	☐	☐
11. To study or work with math or science.	☐	☐	☐	☐	☐
12. Not to study or work with math or science.	☐	☐	☐	☐	☐
13. To follow a family tradition.	☐	☐	☐	☐	☐
14. To be happy.	☐	☐	☐	☐	☐
15. Allow time for family and children.	☐	☐	☐	☐	☐
16. Other. _____	☐	☐	☐	☐	☐

2.17. From the above, what was your main reason in choosing your degree program? _____

2.18. If there is anything you want to comment on your reason for choosing your degree program, please feel free to do so.

3.1. Was there anyone who influenced your degree choice?	☐ Yes ☐ No (go to 4)
3.2. Who?	_____
3.3. How did this person influenced your degree choice?	

4.1. Did you ever attend a co-educational (mixed-sex) institution?	☐ Yes ☐ No (go to 5)
4.2. Looking back, do you feel teachers at school treated girls the same way they treated boys?	☐ Yes (go to 5) ☐ No
4.3. If no, how was the treatment different?	

5.1. Were you ever encouraged by any teacher to learn or explore with mathematics, science or technology?	☐ Yes ☐ No (go to 6)
5.2. Please specify the teacher's gender.	☐ Female ☐ Male
5.3. How would this person encourage you?	

6.1. Were you ever discouraged by any teacher to learn or explore with mathematics, science or technology?	☐ Yes ☐ No (go to 7)
6.2. Please specify the teacher's gender.	☐ Female ☐ Male

6.3. How would this person discourage you?

7.1. Was your high school a (if more than one, tick for the longest attended):

☐ 1. Comprehensive school?	☐ 4. Fee paying private school?
☐ 2. Grammar or selective school?	☐ 5. Technical school?
☐ 3. Secondary modern school?	☐ 6. Other. _____

7.2. Overall, were you at the top 15% of your class in high school?	☐ Yes ☐ No
7.3. Is there any specific subject or subjects in which you excelled?	☐ Yes ☐ No (go to 8)
7.4. Please specify:	1. _____ 2. _____ 3. _____

8. As a student, did you ever engaged in any of these extracurricular activities? (Please tick).

☐ 1. Robotics or computer clubs or camps.	☐ 5. School magazines or newspapers.
☐ 2. Math or science clubs or fairs.	☐ 6. Community or volunteering work.
☐ 3. Stage arts (theater, dancing, singing, etc.).	☐ 7. I never engaged in extracurricular activities.
☐ 4. Sport clubs or teams.	☐ 8. Other. _____

9. If there is any other school experience that influenced your choice of career or that you feel commenting on, please feel free to do so.

10. When you were little, did you own and frequently play with:	
☐ 1. Building blocks (Lego, Meccano, etc.).	☐ 9. Music instruments and radios.
☐ 2. Toolboxes, workbenches.	☐ 10. Citizens' band radios, computer or electronic games.
☐ 3. Electric trains, remote control cars or planes.	☐ 11. Crafts, painting, sewing, knitting, etc.
☐ 4. Puzzles or table games.	☐ 12. Barbie dolls or similar adult dolls.
☐ 5. Chemistry or science sets (magnets, electronics…).	☐ 13. Other dolls and doll houses.
☐ 6. Telescopes, microscopes.	☐ 14. Make-up sets, beauty salon.
☐ 7. Robots, rockets, gear sets.	☐ 15. Easy-bake ovens, vacuum cleaners, shopping baskets, etc.
☐ 8. Balls, bikes, swings.	

11.1. Did you grow up with siblings or other children in the house?	☐ Yes	☐ No (go to 12)
11.2. Were any of these children boys?	☐ Yes	☐ No

11.3. If you had sisters, did your sisters own and frequently play with:	
☐ 1. Building blocks (Lego, Meccano, etc.).	☐ 9. Music instruments and radios.
☐ 2. Toolboxes, workbenches.	☐ 10. Citizens' band radios, computer or electronic games.
☐ 3. Electric trains, remote control cars or planes.	☐ 11. Crafts, painting, sewing, knitting, etc.
☐ 4. Puzzles or table games.	☐ 12. Barbie dolls or similar adult dolls.
☐ 5. Chemistry or science sets (magnets, electronics…).	☐ 13. Other dolls and doll houses.
☐ 6. Telescopes, microscopes.	☐ 14. Make-up sets, beauty salon.
☐ 7. Robots, rockets, gear sets.	☐ 15. Easy-bake ovens, vacuum cleaners, shopping baskets, etc.
☐ 8. Balls, bikes, swings.	

11.4. If you had brothers, did your brothers own and frequently play with:	
☐ 1. Building blocks (Lego, Meccano, etc.).	☐ 9. Music instruments and radios.
☐ 2. Toolboxes, workbenches.	☐ 10. Citizens' band radios, computer or electronic games.
☐ 3. Electric trains, remote control cars or planes.	☐ 11. Crafts, painting, sewing, knitting, etc.
☐ 4. Puzzles or table games.	☐ 12. Barbie dolls or similar adult dolls.
☐ 5. Chemistry or science sets (magnets, electronics…).	☐ 13. Other dolls and doll houses.
☐ 6. Telescopes, microscopes.	☐ 14. Make-up sets, beauty salon.
☐ 7. Robots, rockets, gear sets.	☐ 15. Easy-bake ovens, vacuum cleaners, shopping baskets, etc.
☐ 8. Balls, bikes, swings.	

12.1. Do you feel confident using electronic devices?	☐ Yes ☐ No
12.2. How old were you when you first used a computer (in years)?	_____
12.3. Can you programme computers?	☐ Yes ☐ No (go to 13)
12.4. How old were you when you first learned to program computers?	_____

13.1. Were you ever encouraged by any of your parents to learn or explore with mathematics, science or technology?	☐ Yes ☐ No (go to 14)
13.2. Please specify which parent.	☐ Mother ☐ Father
13.3. How would your parent(s) encourage you?	

14.1. Were you ever discouraged by any of your parents to learn or explore with mathematics, science or technology?	☐ Yes ☐ No (go to 15)
14.2. Please specify which parent.	☐ Mother ☐ Father

14.3. How would your parent(s) discourage you?

15.1. Looking back, what do you think your mother wanted you to be?	_____
15.2. What do you think your father wanted you to be?	_____
15.3. Do you feel any of your parents supported you differently or had different aspirations for you because you were a girl?	☐ Yes ☐ No (go to 16)
15.4. Please specify which parent.	☐ Mother ☐ Father

15.5. How would you be treated differently?

16. If there is any other family or childhood experience that influenced your choice of degree or that you feel commenting on, please feel free to do so.

17. The following are a series of opinions sometimes expressed by people. Please state the degree in which you agree or disagree with them.

		Strongly disagree	1. Disagree	2. Neither agree nor disagree	3. Agree	4. Strongly agree
1.	Scientists and mathematicians are boring and unattractive.	☐	☐	☐	☐	☐
2.	Girls don't like getting dirty, working with machines or in a lab.	☐	☐	☐	☐	☐
3.	Boys are better at mathematics than girls.	☐	☐	☐	☐	☐
4.	Engineering is for boys, not girls.	☐	☐	☐	☐	☐
5.	A female mechanic is a tomboy.	☐	☐	☐	☐	☐
6.	Male nurses are usually gay.	☐	☐	☐	☐	☐
7.	Women are better teachers because of their mother instinct.	☐	☐	☐	☐	☐
8.	A woman can be beautiful or smart, but not both.	☐	☐	☐	☐	☐
9.	A mother should stay at home looking after her children.	☐	☐	☐	☐	☐
10.	Women should not prioritize their career over having a family.	☐	☐	☐	☐	☐
11.	Men are not attracted to smart women.	☐	☐	☐	☐	☐
12.	It's better for a relationship if the man earns more money than the woman.	☐	☐	☐	☐	☐
13.	When jobs are scarce, men should have more right to a job than a woman.	☐	☐	☐	☐	☐
14.	Women can do the same job as men.	☐	☐	☐	☐	☐

18. In your opinion, would your mother agree or disagree with these statements:

		Strongly disagree	1. Disagree	2. Neither agree nor disagree	3. Agree	4. Strongly agree
1.	It's better if the husband earns more money than his wife.	☐	☐	☐	☐	☐
2.	When jobs are scarce, men should have more right to a job than a woman.	☐	☐	☐	☐	☐
3.	Women can do the same job as men.	☐	☐	☐	☐	☐

19. In your opinion, would your father agree or disagree with these statements:

	Strongly disagree	1. Disagree	2. Neither agree nor disagree	3. Agree	4. Strongly agree
1. It's better if the husband earns more money than his wife.	☐	☐	☐	☐	☐
2. When jobs are scarce, men should have more right to a job than a woman.	☐	☐	☐	☐	☐
3. Women can do the same job as men.	☐	☐	☐	☐	☐

20. When choosing your degree, did you ever worry that your degree choice might:

20.1 Make you feel less attractive or beautiful?	☐ Yes	☐ No
20.2 Make you feel insecure?	☐ Yes	☐ No
20.3 Make you feel threatened or not accepted by male coworkers?	☐ Yes	☐ No
20.4 Make you feel lonely?	☐ Yes	☐ No
20.5 Keep you away from your family projects?	☐ Yes	☐ No

20.6. If there is any other issue you would like to comment on this regard, please feel free to do so.

21. Overall, how satisfied are you with:

	Very dissatisfied	1. Dissatisfied	2. Neither satisfied nor dissatisfied	3. Satisfied	4. Very satisfied
21.1. Your job?	☐	☐	☐	☐	☐
21.2. Your degree choice?	☐	☐	☐	☐	☐
21.3. Your life?	☐	☐	☐	☐	☐

22.1. Does your mother have a professional degree?	☐ Yes ☐ No (go to 22.3)
22.2. What subject degree does your mother have?	_____
22.3. Did your mother work when you were in school age (under 17)?	☐ Yes ☐ No (go to 23)
22.4. What was your mother's main occupation?	_____

23.1. Does your father have a professional degree?	☐ Yes ☐ No (go to 23.3)
23.2. What subject degree does your father have?	_____
23.3. Did your father work when you were in school age (under 17)?	☐ Yes ☐ No (go to 24)
23.4. What was your father's main occupation?	_____

24. People sometimes describe themselves as belonging to a particular social class. When you were growing up, would you describe your household as belonging to the:

☐ Working class ☐ 1. Lower middle class ☐ 2. Middle class ☐ 3. Upper middle class ☐ 4. Upper class

25. Did you grow up in the United Kingdom?	☐ Yes ☐ No
26. Do you currently have a life partner?	☐ Yes ☐ No
27.1. Do you have any children?	☐ Yes ☐ No (go to 28)
27.2. How many children do you have?	_____
27.3. How many children under 16 do you have?	_____

28.1. Would you consider your health to be:

☐ Poor. ☐ 1. Fair. ☐ 2. Good. ☐ 3. Excellent.

28.2. Do you often feel miserable or depressed?	☐ Yes ☐ No
29. Could you please state your age (in years)?	_____

30.1. What is your current academic ranking?

☐ 1. Professor.	☐ 6. Senior researcher.
☐ 2. Reader.	☐ 7. Research fellow.
☐ 3. Senior lecturer.	☐ 8. Research assistant.
☐ 4. Lecturer B.	☐ 9. Other. _____
☐ 5. Lecturer A.	_____

30.2. Are you in a fixed or permanent contract?	☐ Permanent ☐ 1. Fixed

31.1. On average, how many hours do you work per week?	_____ hours
31.2. How long have you being working for the University?	_____ years

31.3. Could you please state your current job band?

☐ 1. Band 1, bar 1. ☐ 2. Band 1, bar 2. ☐ 3. Band 2. ☐ 4. Band 3.

31.4. Could you please state your annual gross wage?	£_____
31.5. Relative to other members in your department, do you feel you earn less or more than the average?	☐ Less ☐ 1. About the same ☐ 2. More
31.6. Relative to other women in your department, do you feel you earn less or more than the average?	☐ Less ☐ 1. About the same ☐ 2. More

31.7. Relative to other members in your department, how successful do you think you could be in bargaining a raise or a change in your current contract?

☐ Less successful. ☐ 1. As successful. ☐ 2. More successful.

32.1. Since graduation, have you ever taken time out of the workforce?	☐ Yes ☐ No (go to 33)
32.2. In total, how much time did you take out (in months)?	_____ months.
32.3. Was any of this time out due to maternity leave?	☐ Yes ☐ No (go to 33)
32.4. How much time did you take out for maternity leave (in months)?	_____ months.

33.1. Since graduation, have you ever worked part-time?	☐ Yes ☐ No (go to 34)
33.2. In total, how much time have you worked part-time (in years)?	_____ years.
33.3. Are you currently working part-time?	☐ Yes ☐ No

34. Do you currently work in a department that matches your education?	☐ Yes ☐ No

35. If there is any other issue you would like to comment on your job (satisfaction, environment or situation in general), please feel free to do so.

36.1. Would you be willing to take part on a follow-up in-depth interview?	☐ Yes ☐No (end survey)
36.2. Could you please provide an email address in case I need to contact you to set up an appointment for an interview (this does not mean you would necessarily be contacted).	_____

Thank you very much for your time.

Appendix 5: Observations per variable used in estimating earnings, as percentage of cohort size

Panel 1: Responses for variables associated with wages at age 29	Responses				% of graduates*			% of 1999 respondents **			% of initial population ***			% female
	Total (A)	Female (B)	Male (C)	Missing	Total (A/2064)	Female (B/1022)	Male (C/1042)	Total (A/11261)	Female (B/5790)	Male (C/5471)	Total (A/17196)	Female (B/8279)	Male (C/8906)	(B/A)
Cohort initial population (birth wave)	17 196	8 279	8 906	11										48.1%
Total respondents in the 29-year follow-up	11 261	5 790	5 471											51.4%
Total graduates in the 29-year follow-up	2 064	1 022	1 042											
Natural logarithm of gross hourly wage*	7 386	3 545	3 841		76.7%	74.8%	78.6%	65.6%	61.2%	70.2%	43.0%	42.8%	43.1%	48.0%
Professional higher degree	11 261	5 790	5 471		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	65.5%	69.9%	61.4%	51.4%
Years of working experience	11 029	5 650	5 379		99.7%	99.8%	99.6%	97.9%	97.6%	98.3%	64.1%	68.2%	60.4%	51.2%
Years of working experience squared	11 029	5 650	5 379		99.7%	99.8%	99.6%	97.9%	97.6%	98.3%	64.1%	68.2%	60.4%	51.2%
High-earnings degree	1 985	978	1 007		96.2%	95.7%	96.6%	17.6%	16.9%	18.4%	11.5%	11.8%	11.3%	49.3%
Female-dominated degree	1 985	978	1 007		96.2%	95.7%	96.6%	17.6%	16.9%	18.4%	11.5%	11.8%	11.3%	49.3%
High-earnings occupation	9 177	4 263	4 914		91.4%	88.9%	93.9%	81.5%	73.6%	89.8%	53.4%	51.5%	55.2%	46.5%
Female-dominated occupation	9 177	4 263	4 914		91.4%	88.9%	93.9%	81.5%	73.6%	89.8%	53.4%	51.5%	55.2%	46.5%
Currently working part-time	11 227	5 775	5 452		100.0%	100.0%	99.9%	99.7%	99.7%	99.7%	65.3%	69.8%	61.2%	51.4%
Currently working	11 227	5 775	5 452		100.0%	100.0%	99.9%	99.7%	99.7%	99.7%	65.3%	69.8%	61.2%	51.4%
Married	11 246	5 784	5 462		100.0%	100.0%	100.0%	99.9%	99.9%	99.8%	65.4%	69.9%	61.3%	51.4%
Ever worked part-time	11 029	5 650	5 379		99.7%	99.8%	99.6%	97.9%	97.6%	98.3%	64.1%	68.2%	60.4%	51.2%
Has preschool children	11 261	5 790	5 471		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	65.5%	69.9%	61.4%	51.4%
British, Irish or white	11 224	5 776	5 448		100.0%	100.0%	99.9%	99.7%	99.8%	99.6%	65.3%	69.8%	61.2%	51.5%
Gender equal beliefs in labor market	11 115	5 726	5 389		99.6%	99.9%	99.3%	98.7%	98.9%	98.5%	64.6%	69.2%	60.5%	51.5%
Industry	9 062	4 215	4 847		90.8%	88.3%	93.4%	80.5%	72.8%	88.6%	52.7%	50.9%	54.4%	46.5%

Source: 1970 BCS, 29-year follow-ups.

* Expressed as a percentage of the total graduates reported in the 29-year follow-up.

** Expressed as a percentage of the total respondents in the 29-year follow-up.

*** Expressed as a percentage of the initial cohort population, as recorded in the birth wave.

… appendix 5 (continued)…

Panel 2: Responses for variables associated with wages at age 34	Responses				% of graduates*			% of 2004 respondents **			% of initial population ***			
	Total (A)	Female (B)	Male (C)	Missing	Total (A/2087)	Female (B/1052)	Male (C/1035)	Total (A/9665)	Female (B/5039)	Male (C/4626)	Total (A/17196)	Female (B/8279)	Male (C/8906)	% female (B/A)
Cohort initial population (birth wave)	17 196	8 279	8 906	11										48.1%
Total respondents in the 34-year follow-up	9 665	5 039	4 626											52.1%
Total graduates in the 34-year follow-up	2 087	1 052	1 035											
Natural logarithm of gross hourly wage*	6 202	2 980	3 222		72.9%	68.5%	77.4%	64.2%	59.1%	69.6%	36.1%	36.0%	36.2%	48.0%
Professional higher degree	9 665	5 039	4 626		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	56.2%	60.9%	51.9%	52.1%
Years of working experience	9 538	4 962	4 576		99.7%	99.7%	99.7%	98.7%	98.5%	98.9%	55.5%	59.9%	51.4%	52.0%
Years of working experience squared	9 538	4 962	4 576		99.7%	99.7%	99.7%	98.7%	98.5%	98.9%	55.5%	59.9%	51.4%	52.0%
High-earnings degree	1 853	934	919		88.8%	88.8%	88.8%	19.2%	18.5%	19.9%	10.8%	11.3%	10.3%	50.4%
Female-dominated degree	1 853	934	919		88.8%	88.8%	88.8%	19.2%	18.5%	19.9%	10.8%	11.3%	10.3%	50.4%
High-earnings occupation	8 791	4 514	4 277		95.3%	95.3%	95.3%	91.0%	89.6%	92.5%	51.1%	54.5%	48.0%	51.3%
Female-dominated occupation	8 791	4 514	4 277		95.3%	95.3%	95.3%	91.0%	89.6%	92.5%	51.1%	54.5%	48.0%	51.3%
Currently working part-time	9 643	5 028	4 615		100.0%	100.0%	100.0%	99.8%	99.8%	99.8%	56.1%	60.7%	51.8%	52.1%
Currently working	9 643	5 028	4 615		100.0%	100.0%	100.0%	99.8%	99.8%	99.8%	56.1%	60.7%	51.8%	52.1%
Married	9 640	5 029	4 611		100.0%	100.0%	100.0%	99.7%	99.8%	99.7%	56.1%	60.7%	51.8%	52.2%
Ever worked part-time	9 538	4 962	4 576		99.7%	99.7%	99.7%	98.7%	98.5%	98.9%	55.5%	59.9%	51.4%	52.0%
Has preschool children	9 665	5 039	4 626		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	56.2%	60.9%	51.9%	52.1%
British, Irish or white	9 644	5 032	4 612		100.0%	99.9%	100.0%	99.8%	99.9%	99.7%	56.1%	60.8%	51.8%	52.2%
Gender equal beliefs in labor market	8 915	4 728	4 187		93.3%	95.2%	91.4%	92.2%	93.8%	90.5%	51.8%	57.1%	47.0%	53.0%
Industry	7 920	3 698	4 222		87.5%	81.7%	93.4%	81.9%	73.4%	91.3%	46.1%	44.7%	47.4%	46.7%

Source: 1970 BCS, 34-year follow-ups.

* Expressed as a percentage of the total graduates reported in the 34-year follow-up.

** Expressed as a percentage of the total respondents in the 34-year follow-up.

*** Expressed as a percentage of the initial cohort population, as recorded in the birth wave.

Appendix 6: Standard Occupational Classification codes (1990) classified as traditionally female

102	347	621
123	349	622
124	350	630
130	363	640
132	370	641
139	371	643
172	383	644
173	390	650
177	391	651
190	392	652
191	400	659
221	401	660
231	410	661
232	411	670
233	412	671
234	420	673
235	421	720
239	430	721
270	450	722
290	451	790
293	452	791
300	459	792
340	460	850
341	461	862
342	462	864
343	463	952
344	490	953
345	556	958
346	559	959

Appendix 7 Standard Occupational Classification codes (1990) associated with high earnings

100	219
101	220
103	221
110	223
111	231*
120	232*
125	233*
126	234*
127	235*
150	242
151	250
152	251
153	252
155	253
200	260
201	262
202	290
209	312
211	331
212	332
213	350
214	362
215	610
216	

* Also classified as female occupations.

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