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ABSTRACT

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In almost all European Union countries, the gender wage gap is increasing across the wages distribution. In this lecture I briefly survey some recent studies aiming to explain why apparently identical women and men receive such different returns and focus especially on those incorporating pyschological factors as an explanation of the gender gap. Research areas with high potential returns to further analysis are identified. Several examples from my own recent experimental work with Patrick Nolen are also presented. These try to distinguish between the role of nature and nurture in affecting behavioural differences between men and women that might lead to gender wage gaps.

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1. Introduction

Measuring the gender wage gap has occupied applied labour economists for decades and unfortunately the wage gap is not withering away.[2] Moreover a recently-established stylised fact is that, in almost all European Union countries for which we have harmonised data, this gender wage gap is increasing across the wages distribution. The different returns received by men and women to the same characteristics are often interpreted as measuring the "discrimination" that women face in the labour market. This discrimination – or differential returns to the same characteristics – has been viewed until relatively recently as a "black box" of labour economics. We really want to know more about what explains why apparently identical women and men receive different returns. In this lecture I briefly survey some recent studies addressing this issue, including work aiming to incorporate pyschological factors as an explanation of the gender gap, and highlight research areas with high potential returns to further analysis. I then present several examples from my own recent experimental work with Patrick Nolen that tries to distinguish between the role of nature and nurture in affecting behavioural differences between men and women that might lead to gender wage gaps (Booth and Nolen, 2008a, 2008b).

2. The gender pay gap and the glass ceiling

Albrecht, Bjorklund and Vroman (2003) show that in Sweden the gender pay gap is increasing across the wages distribution, and Arulampalam, Booth and Bryan (2007) find a similar result in

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[2] See Weichselbaumer and Winter-Ebmer (2007) for a recent meta-analysis of gender wage gaps and Azmat, Guell and Manning (2006) for a study of gender gaps in unemployment rates in OECD countries.

ten of the eleven other European countries they examined.[3]   Table 1 summarizes the Arulampalam *et al.* (2007) estimates of the gender wage gap in the private sector. The data are from the European Community Household Panel (ECHP), collected annually since 1994 in a standardized format facilitating cross-country comparisons.[4]

Insert Table 1 near here.

The first column of Table 1 gives the ordinary least squares (OLS) estimates of the mean gender wage gap, while the remaining columns give the quantile regression (QR) estimates calculated following the Machado and Mata (2005) decomposition method. The calculated wage gap measures the effect of different returns to men and women when women's attributes were used in the counterfactual decomposition. The OLS estimates reveal that, in the private sector, the average gender wage gap varies from around 12% in Denmark, up to 25% in Britain and Austria. But averages disguise the differences across the wages distribution revealed by the QR estimates. These show that, even when men and women have the same characteristics, there is typically a positive and increasing gender gap across the wages distribution due to different returns. In all countries except Spain, the private sector gender wage gap is highest at the 90th percentile. The country with the highest wage gap at the 90th percentile is Britain, followed by France and then Finland. The biggest gap between the 10th and the 90th percentile is found in the

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[3] The exception was Spain. Using the same data source, de la Rica, Dolado and Llorens (2008) disaggregate the Spanish data and find the gender wage gap is increasing across the distribution for highly educated workers only. It is interesting that, in Australia, Kee (2006) and Baron and Cobb-Clark (2008) find that the gender pay gap is constant in the public sector and increasing across the wages distribution only in the private sector.

[4] The authors estimated each specification separately by country, gender and sector (public and private). I report only the private sector estimates here, although similar findings are found in the public sector.

Netherlands. This phenomenon - of a gender pay gap that increases across the wages distribution and accelerates in the upper tail – is labelled a 'glass ceiling' effect.[5]

Although the gender pay gap is biggest at the top of the wage distribution, there does not seem to be any compelling *a priori* theoretical reason why this should be the case. Indeed, there are reasons why it might widen at the bottom. For example, women towards the bottom might have less bargaining power or be more subject to firm's market power than comparable men. This could be due to unobservable family commitments, or to social custom whereby a man's career takes precedence. Alternatively, at the bottom of the wages distribution minimum wage compliance may be unequal across gender, or trade unions might differentially represent the interests of their female and male workers. The situation where the gender pay gap widens at the bottom of the wage distribution is defined in Arulampalam *et al* (2007) as a sticky floor. The estimates reported in Table 1 provide some evidence of sticky floors only in Italy and France.

The availability of harmonised cross-country datasets has allowed researchers not only to chart variations in wage gaps across countries but also to explore the role of policies and institutions in explaining such variations (see Blau and Kahn, 1992, 1996, 2003; Arulampalam et al., 2007). This approach has focused on disentangling the contribution of gender-specific policies and of general wage-setting institutions to variations in the gender wage gap. The general conclusion of these studies is that, while institutions such as gender-specific policies do explain some of the cross-country variation, they do not explain *why* the gap and the glass ceiling exist.[6]

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[5] Albrecht et al. (2003), who used 1998 Swedish data to show that the gender pay gap is increasing across the wages distribution and accelerating in the upper tail, were the first to find this phenomenon and to label it as a 'glass ceiling' effect.

[6] For example, Arulampalam et al. (2007) estimated cross-country correlations between the OECD (2001) work-family reconciliation index and (a) sticky floors defined as the 10-50 pay difference; (b) glass ceilings defined as the 90-50 pay difference. The work-family index was negatively correlated with sticky floors and positively correlated with glass-ceilings, and both were statistically significant. Thus countries with more "generous" work-family

3. Interpreting gender gaps

A fundamental challenge for labour economists is to identify the extent to which observed gender differences in labour market outcomes for apparently identical men and women are due to discrimination, to other unobservable factors, or to intrinsic differences between men and women. The cross-country analyses are not really able to deal with this, though they do offer very useful suggestive evidence on correlations between policy and institutions on the one hand, and gender wage gaps on the other.

Do gender wage gaps and glass ceilings arise on the demand-side through discriminatory practices? Or does unobserved heterogeneity on the supply-side explain gender wage gaps better? In my lecture I use a demand-side and supply-side framework, but this can obscure factors affecting both workers and employers and should therefore be interpreted mainly as a convenient organizing structure. Next I briefly review potential causes that have been explored in the literature.

Expectations of family formation and fertility are private information and evolve slowly over time.[7] Employers base their behaviour on averages. For this reason women may not get pay increases, they may not get promoted when they deserve to, and they may not get offered the jobs they deserve. But is statistical discrimination the only explanation of these wage gaps that are widening over the wages distribution? Unfortunately, it is hard to distinguish statistical or other forms of discrimination from alternative hypotheses. However it is helpful to review some relevant studies in the recent literature.

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policies have a lower wage gap at the bottom of the wages distribution and a wider gap at the top. They concluded that family-friendly policies could be a double-edged sword. See also Datta Gupta, Smith and Verner (2006).

[7] For an historical overview of gender differences in US college enrollments and how these relate to a variety of influences - including expectations of labour force participation - see Goldin, Katz and Kuziemko (2006). See also Goldin (1990).

First, women's willingness to pursue outside offers and their ability to accept these may differ from that of men, reinforcing their poorer position in the labour market. Moreover, many labour markets are hierarchical, and promotions and appointments procedures can widen gender pay gaps. While promotions are typically subject to well-defined procedures, especially in larger organisations, exactly *where* in the rank-specific salary scale a successful candidate is appointed can depend on discrimination on the demand-side and individual negotiation skills in addition to experience on the supply-side (Booth, Francesconi and Frank, 2003).[8] If, towards the top of the wages distribution, promotions procedures favour men rather than women, then the gender pay gap might be bigger towards the top. Moreover, promotion criteria can act to perpetuate gender gaps. Landers, Rebitzer and Taylor (1996) show, in their study of US law firms, how criteria for promotion like excessively long hours of work can widen gender pay gaps towards the top of the lawyers' wage distribution.

Whether such criteria were devised to measure hard-to-observe output at a time when the workforce was largely male, or were a deliberate ploy designed to keep out women, remains a topic for debate. Institutional arrangements (such as the particular form of the tenure system of US academia) were also largely designed with men in mind and could be viewed as anachronistic for a mixed gender workforce, producing outcomes that may be orthogonal to the original intent. Ginther and Kahn (2004) provide an extensive analysis of this in the context of US tenure and its implications for female academic economists, implications which surely cannot have been intended when such arrangements were set in place.

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[8] Booth, Francesconi and Frank (2005), using data on promotions from the British Household Panel Survey, found that women gained less from promotions than did men, but that women were as likely as men to get promoted. In contrast, Cobb-Clark (2001) found, using NLSY data, that young women in the US were less likely to be promoted but had higher wage growth subsequent to promotion.

Organizational sociology highlights the phenomenon of 'presenteeism', whereby excessively long hours might emerge as part of the culture of the job but might not actually be required for efficiency (Simpson, 1998). These can be used to limit female access to these jobs.[9] Furthermore covert cultural values can pervade a particular organization, and may make women less inclined to apply for promotion. Kanter (1977) argues that gender differences in attitudes and behaviour within an organization arise because of differences in numbers and positions in the power structure. Others such as Lipman-Blumen (1976) posit instead that they arise because of social preferences for being surrounded by members of one's own gender. That males in female-dominated occupations might be adversely affected has rarely been considered in the economics literature (Riach and Rich, 2006; Booth and Leigh, 2008). However the greater the sex-ratio in any group, the more likely is any minority newcomer to be perceived stereotypically.[10]

Prejudice or discrimination at the hiring stage can also matter because it can affect women's willingness to bargain over offered wages – an example of the interaction of demand and supply factors. Suppose that women have a lower probability of being offered a particular job – for instance playing in an orchestra. Goldin and Rouse (2000) demonstrated that blind audition procedures can result in a higher proportion of female members of symphony orchestras. Although the authors did not address relative salaries, consider the following scenario. Assume a woman has overcome the hiring barrier for the organisation where she wishes to work and has actually got offered a job. Given this is hard – hiring procedures are not

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[9] The sociological literature emphasises the role of 'gatekeepers' who practice nepotism or discrimination before the point at which it would be caught by Equal Opportunities rules. Reskin (1993) notes that reliance on informal networks for recruitment may adversely affect women to the extent that these networks are sex-segregated. A recent study by van den Brink and Benschop (2008) of recruitment of professors into Dutch academia documents the prevalence of closed procedures whereby 'scouts' recruit academics, a process that can be very 'gendered' if the dominant group only networks with individuals from the same group.

[10] Some recent economics research, to be discussed below, explores how the sex-ratio of experimental groups (where subjects are randomly assigned to single-sex or coed groups) affects subjects' choices; see Gneezy, Niederle, and Rustichini (2003), Gneezy, Niederle, and Rustichini (2003), Booth and Nolen (2009a, b). But this research has not looked at new entrants or the role of the timing of new entrants.

always impartial, as Goldin and Rouse demonstrated - the woman may be so grateful for the job offer that she will not bargain as aggressively as comparable men for her starting salary. The book by Babcock and Laschever (2003) - *Women Don't Ask* - has numerous instances of interviewed women who were in exactly this situation.

Gender differences in willingness to bargain over wages would have to become more important towards the top of the wage distribution for this hypothesis to contribute to explaining the glass ceiling effect. It is possible that women towards the bottom have their wages set by pay-bargaining awards while those towards the top have their wages set by individual negotiation. If this is the case, then the fact that "women don't ask" could contribute to the glass ceiling. Babcock and Laschever (2003) provide a battery of evidence from psychology studies and their own interviews with women to support their thesis that women are unwilling to bargain on their own account, although being very competent at doing so for others. Babcock and Laschever argue that historically women were accustomed to work without pay at a type of work devalued by every objective *financial* measure – home production. Hence women are relatively unaccustomed to evaluating their time and abilities in economic terms.[11]

The example of hiring into the orchestra serves to emphasise the potential importance of bargaining. It is well known from bargaining theory that an individual's share of the cake in a bargained outcome is increasing in his or her fall-back option, as well as increasing in the weight given to each agent's net gain to reaching a bargain.[12] If women are less likely to get outside offers, then they are in a weaker position with regard to bargaining with the firm, since their

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[11] They suggest negotiation courses to help women to bargain over pay, and argue that companies could benefit from adopting affirmative action, not least since it would reduce turnover. They cite the experience of the accountancy and consulting firm Deloitte and Touche, who in 1991 decided to embark on cultural change in favour of women. This makes a fascinating case study of how within-company attitudes towards women can be changed.

[12] Recall that the solution to the generalized Nash bargaining model is the weighted product of the two parties net gain to reaching an agreement. Thus the weighting parameter – as well as the fall-back option – affect the negotiated outcome.

outside option is lower. Moreover, if they are less skilled at individual bargaining on their own behalf – perhaps because it conflicts with some notion of female identity – the weighting parameter will be lower.

But why then do employers not compete to make greater profits by hiring women with weak bargaining power and lower outside offers, thereby driving up their wages? This question takes us back to the taste-based employer discrimination model of Becker (1971). Since that time, economists have become much more willing to ask how preferences have formed, drawing on insights from other disciplines like psychology and sociology. Employers' tastes for discrimination may arise because of 'homosocial' preferences, defined by Lipman-Blumen (1976) as the social preference for being with members of one's own gender without any implication of erotic attraction. In other words, men may feel more comfortable being surrounded by men.[13] This has some similarities to the nepotism argument developed by Goldberg (1983). In that model, firms gain utility from working with a particular group of workers and nepotistic firms can coexist with other firms in the long run.[14]

Until recently there has been remarkably little empirical research by economists on how employers' gender role attitudes vary with gender. Although audit studies are important measures of hiring discrimination, they typically do not establish the gender of those making hiring decisions although there are some exceptions.[15] The disciplines of sociology and psychology have important insights that could be useful to economists modelling preference formation. An example of the former is provided by Ridgeway (1993), who explores how gender stereotypes are

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[13] Lipman-Blumen (1976) notes that this same-sex interest or homosociality is reinforced by a stratification system in which men and all-male institutions have had almost exclusive access to major resources, and that the dominance order among men is based upon control of resources. See also Britton (1990) and also Akerlof and Kranton (2000) who also mention the notion of men fearing to lose their masculinity when women are working in the same job as they are.

[14] A recent survey of literature on this theme can be found in Weichselbaumer and Winter-Ebmer (2007).

[15] For a useful survey, see Riach and Rich (2002), and for recent studies see Bertrand and Mullainathan (2004), Carlsson and Rooth. (2007) and Booth and Leigh (2008).

cued by gender categorization. In the psychological literature, the role congruity model of Eagly and Karau (2002) aims to explain why women are discriminated in some roles but not in others. They suggest that perceived incongruity between the female "communal" gender role and the "agentic" leadership role results in two forms of prejudice. First, women are perceived less favourably than men as potential leaders. And second, if women do manage to obtain a position of leadership they are then evaluated less favourably because they do not fit society's prescriptions of what is appropriate behaviour for women. This ambivalence can produce a variety of effects that may make it harder for women to achieve positions of leadership.[16] Some evidence of this was found in the recent experimental study by Beaman et al. (2008), which showed that first-time women leaders received worse evaluations despite outperforming male counterparts on many performance dimensions. However in that study exposure to female leaders tended to reduce prejudice, and second-time leaders were rated as for men.

How are such prejudices formed? Social custom and conditioning - in particular gender identity as argued by Akerlof and Kranton (2000) and Eagly and Karau (2002) - may influence preferences for employee-type. According to the gender identity hypothesis, individuals operate within society's constraints and their utility may be powerfully affected by social custom and conditioning. One only has to consider the Taliban's attitudes to women to see this. Society's prescriptions about appropriate modes of behaviour for each gender might result in women and men experiencing a loss of identity should they deviate from the relevant code. If this is the case, male bosses might be happier employing men to higher-ranking posts, since both are then

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[16] Women obtaining leadership roles may thus elicit negative reactions, even while receiving some positive evaluation for achieving this role. This mix of positive and negative evaluations – or ambivalence - "is inherent in the epithets often applied to powerful women, such as *dragon lady* and *Battle-Ax* (Tannen, 1994) ... Margaret Thatcher, British prime minister, … was labeled not only as "Iron Lady" but also as "Her Malignancy" and "Attila the Hen" (Genovese, 1993). To the extent that a woman who fulfills a leader role elicits a mixture of positive and negative reactions—that is, an ambivalent reaction—storage of these reactions in memory could have a variety of effects. As attitude researchers have shown, ambivalence can produce less consistency in expressions of an attitude across time and situations and a propensity for reactions to polarize—that is, become very negative or even sometimes very positive—depending on the particulars of the judgment." (Eagly and Karau, 2002: 576.)

adopting modes of behavior dictated by social custom. Of course these prescriptions are endogenous to a society, as noted by thinkers such as John Stuart Mill (1869). Prescriptions might arise and continue because it is in the dominant group's interest to maintain them (see also Lipman-Blumen, 1976, and Seabright, 2005). They can be weakened or removed when this group loses power. For example, the female suffrage movement can be viewed as a movement aiming to remove the prescription that women were not capable of voting responsibly.

How does the gender identity model affect the gender wage gap?[17] If individuals do feel a loss of identity by deviating from a particular prescription of predominantly men in power, we might expect the predictions to be observationally equivalent to the tastes for discrimination models: male bosses will typically hire fewer women to positions of power and the women they do hire will receive lower wages when they are hired. It is not clear *a priori* how this would operate if there are female bosses, since the outcome will depend on where a female boss's identity lies.

Using a unique UK data source on academic economists' labour market experiences, Blackaby, Booth and Frank (2005) investigated gender differences in pay and promotions. The academic labour market is an excellent source for more general insights on discrimination, since there are well-defined ranks so it is clear when an individual has been promoted. In other organisations, considerable effort has to be made to infer the actual ranking of different jobs (Baker et al., 1994). Moreover, some aspects of productivity – such as publications – are readily measurable.[18] Blackaby et al (2005) found a gender promotions gap and a within-rank gender pay gap, controlling for a host of factors including career breaks, best career-publications, and a

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[17] See Akerlof and Kranton (2000) and Booth and van Ours (2009) for empirical evidence of the gender identity model in the context of working hours.

[18] With limited exceptions, such as Lazear's (2000) study of windshield installations, the actual measurement of productivity of individuals in either the commercial or public sectors is extremely difficult, particularly for managerial workers most likely to have significant promotion opportunities.

measure of outside offers. They also found that men receive more outside offers and gain higher pay responses. Why might this be the case? On the one hand, universities in the UK are non-profit institutions, and hence more able to follow tastes for discrimination. But on the other hand, the UK government and the EU have adopted a strong position in favour of equal opportunities. Blackaby *et al*. suggested their findings supported the *loyal servant* hypothesis. Women might be less aggressive in asking for pay rises. However the Blackaby *et al.* results were also consistent with a model in which universities are paying women less as a cost-minimising strategy or as a taste for discrimination.

Any rational employer will pay its individual workers as little as it can get away with provided productivity is unaffected. But is the gender pay gap declining with the feminization of occupation? Albrecht *et al.* (2003) and Arulampalam *et al.* (2006) showed that the inclusion of occupational and industry controls made little difference to the glass ceiling results with only a couple of exceptions. But what about the proportion of women within the organization? Women may do better in organisations in which there is already a high proportion of females. They may prefer to work with similar individuals; they may gain from mentoring opportunities and they may benefit from female networks.[19]

Bell (2005) uses the US ExecuComp dataset, containing information on total compensation for the top five highest-paid executives of a large group of US firms for the period 1992-2003, to estimate the impact of women-leaders on the careers of other executive women. She finds that women executives working in women-led firms earn 15-20% more in total compensation than women working in other firms, ceteris paribus. Women-led firms also hire proportionately more

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[19] Booth and Leigh (2008) in a field experiment involving job applications, found that in female-dominated occupations there is a pro-female bias in call-back rates that is increasing with the proportion of women in the occupation. Their finding is consistent with the pro-female bias in US secretary applications submitted in the 1970s (Levinson 1975) and UK secretary applications submitted in the 2000s (Riach and Rich 2006).

top women executives. This is consistent with the notion of mentoring or networking by women.[20] Cardoso and Winter-Ebmer (2007), using a panel of linked employer-employee data for Portugal, also find that women in female-led firms earn higher wages. However men earn lower wages, and a higher share of women reduces the wage level. These findings are interpreted as reflecting the importance of promotions for wage increases: if more women are being mentored, fewer promotion slots will be available for men but also the expectation of a female being promoted will be lower.

Taking a different approach, Bagues and Esteve-Volart (2007) investigate whether or not the gender composition of recruiting committees matters. They use data from Spanish public examinations for positions in the four main Corps of the Spanish Judiciary, where the allocation of 150,000 female and male candidates to evaluating committees is random. This paper is the first, to my knowledge, to analyze the degree to which candidates' success is affected by the gender of their evaluators. They found that a female candidate was significantly less likely to be hired whenever randomly assigned to a committee with a relatively greater the share of female evaluators. Evidence from multiple choice tests suggested that this was due to female majority committees overestimating the quality of male candidates.

Customer preferences may also play a role, as suggested by Becker (1971). Yet relatively few studies have addressed this; see Weichselbaumer and Winter-Ebmer (2007) for a recent summary. An interesting paper by Beckman and Phillips (2005) uses a sample of the largest U.S. law firms matched to their publicly traded clients to model the growth rate of women partners as a function of whether the corporate client has women in prominent leadership positions. They find support for a bargaining power hypothesis whereby law firms promote women when their corporate

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[20] Bell concludes in favour of "affirmative action at the very top of the corporate hierarchy". See Holzer (2007) for a survey of studies exploring the effectiveness of affirmative action in the US.

clients have women in key leadership positions. These effects are strengthened when the law firm has few clients, suggesting that interorganizational influence is stronger when an organization is more dependent on its exchange partner. They also interpret their results as supporting a related homosocial preferences explanation, or what economists might term nepotism.

The reader will note that there are some conflicting results in the studies summarised above. Much more research remains to be done in reconciling these For example, we would like to know if the differences between studies arise from differences in institutions across countries or across occupations, or if instead they arise from differences in the methodologies employed. But maybe research explicitly addressing psychological factors can explain some of the anomalies, and to this we now turn.

4. Psychological factors and survey-based evidence

It has been suggested that there might be gender differences in risk aversion, feedback preferences or in liking for competition, and that these could potentially have a large impact on the supply-side of the labour market. In particular we would like to know if personality differences between women and men can explain gender differences in observed outcomes. For example, obtaining promotion and pay raises often involves competition, and it may be that women do not like to compete but men do. A relatively recent and rapidly growing literature attempts to investigate – using either survey or experimental data - if women and men differ systematically in some psychological characteristics that might explain the fact that women are under-represented in high-paying jobs and high-level occupations. If so, then once these differences are controlled for, perhaps the gender pay gap will disappear.

We first look at what survey-based evidence has to say about the role of psychological factors in affecting gender wage gaps. Clearly the use of contemporaneous survey-based measures of risk-aversion, self-esteem and competitive or collaborative behavioural traits is dogged by potential endogeneity. However, personality variables are incorporated into the analysis of Goldsmith et al. (1997), Bowles et al. (2001), and Mueller and Plug (2004). Using NLSY data, Goldsmith et al. (1997) show that personality variables as well as human capital are correlated with wages, but they do not investigate the gender dimension. However, Mueller and Plug (2006) do, using a Wisconsin-based survey. While their psychological variables are contemporaneous with measured earnings, they nonetheless find interesting correlations between measures of personality and earnings. Manning and Swaffield (2008) avoid the endogeneity issue by using predetermined psychological information - mainly measured at age 16 - from the British Cohort Study to estimate gender wage gaps at age 30. They find that, on labour market entry, there is no gender wage gap for otherwise identical, fully "work-committed" women and men (those with no children, no intention of having children, and with continuous full-time work experience). However, by age 30 there remains a substantial unexplained gap: women who have continuous full-time employment, have had no children and express no desire to have them, earn about 8 log points less than equivalent men after 10 years in the labour market. Manning and Swaffield then investigate the role of psychological variables in explaining this, focusing on risk attitudes, competitiveness, self-esteem, 'other-regarding', and career-orientation.[21] The psychological variables are found to explain an 'upper-bound' of 4.5 log points of the gender wage gap.

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[21] Risk attitudes are proxied by wearing a seat-belt, completion of a first-aid course, smoking and drinking and the like, while competitiveness relates to sporting and game activities. The authors are disarmingly frank about the difficulties associated with using some of these proxies and the 'tangential' nature of some of the variables.

Some of these survey-based measures of psychological factors are rather indirect. Moreover it is not easy to find measures of psychological factors that are genuinely predetermined or that do not change over time. It is therefore of great interest to see if alternative methods of data collection can shed light on whether or not there are significant gender differences in psychological factors that could explain gender pay gaps and glass ceilings.

5. Experimental studies and personality differences

5.1 .Summary

Recent laboratory-based experiments show that, when given the choice of whether or not to enter tournaments, women do indeed `shy away from competition' while men might choose to compete too much (see *inter alia* Gneezy, Niederle and Rustichini (2003); Datta Gupta, Poulsen, and Villeval, 2005; Dohmen and Falk, 2006; Niederle and Vesterlund, 2007). Understanding why women seem less inclined than men to compete may provide insight, on the supply-side, into why a gender gap still exists in the workplace.

Gneezy, Leonard and List (2008) explore the role that culture plays in determining gender differences in competitive behaviour. They investigate two distinct societies - the Maasai tribe of Tanzania and the Khasi tribe in India. The former is patriarchal while the latter is matrilineal. They find that, in the patriarchal society, women are less competitive than men, a result that is consistent with the findings of studies using data from Western cultures. But in the matrilineal society, women are more competitive than men. Indeed, the Khasi women were

found to be as competitive as Maasai men.[22] The authors interpret this as evidence that culture has an influence.

With the exception of Gneezy et al. (2008), the experimental literature in this area has been largely conducted with college-age men and women attending co-educational universities. And yet it is well-known that the academic achievement of girls and boys responds differentially to co-education, with boys typically performing better and girls worse than in single-sex environments (Kessler et al., 1985; Brutsaert, 1999). Moreover, psychologists argue that the gendered aspect of individuals' behaviour is brought into play by the gender of others with whom they interact (Maccoby, 1998). In two papers with Patrick Nolen – see Booth and Nolen (2009a, 2009b) - we therefore sampled a different subject pool to that normally used in the experimental economics literature, in order to investigate the role that single-sex and coeducational schooling might play in shaping competitive behaviour and risk-taking.

Our main conjecture is that schooling can modify preferences in an economically important way: in particular, that girls from single-sex schools will have different preferences for risk and competition than those from co-ed schools. Studies show that there may be more pressure for girls to maintain their gender identity in schools where boys are present than for boys when girls are present (Maccoby, 1990; Brutsaert, 1999). In a coeducational environment, girls are more explicitly confronted with adolescent subculture (such as personal attractiveness to members of the opposite sex) than they are in a single-sex environment (Coleman, 1961). This may lead them to conform to boys' expectations of how girls should behave to avoid social rejection (American Association of University Women, 1992). If competitive behaviour or risk avoidance is viewed as being a part of female gender identity while risk-seeking is a part of male

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[22] The experimental task was to toss a tennis ball into a bucket that was placed 3 metres away. A successful shot meant that the tennis ball entered the bucket and stayed there.

gender identity, then being in a coeducational school environment might lead girls to make less competitive and risky choices than boys.

5.2. The Design of the Experiment

In September 2007, students from eight publicly-funded schools in the counties of Essex and Suffolk in the UK were conducted in buses to the Colchester campus of the University of Essex to participate in a controlled experiment.[23] In Suffolk county there are no single-sex publicly-funded schools. In Essex county the old single-sex "grammar" schools remain.[24] These grammar schools are, like the coeducational schools, publicly funded. We asked participating coeducational schools from both Essex and Suffolk to provide students only from the higher-ability academic stream so that they would be more comparable to the grammar school students.[25]

Our subjects were 260 students from years 10 and 11 who were attending either single-sex or coeducational schools. At no stage were the schools we selected, or the subjects who volunteered, told why they were chosen. Four of the schools were single-sex. On arrival, the students from each school were randomly assigned into groups of four, which were of three

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[23] Experimnetal subjects came from two adjacent counties in south-east England, Essex and Suffolk. All the single-sex schools are in Essex.

[24] In the UK, schools are controlled by local area authorities but frequently "directed" by central government. Following the 1944 Education Act, grammar schools became part of the central government's tripatrtite system of grammar, secondary modern and technical schools (the latter never got off the ground). By the mid-1960s, the central Labour government pressured local authorities to establish "comprehensive" schools in their place. Across England and Wales, grammar schools survived in some areas (typically those with long-standing Conservative boroughs) but were abolished in most others. In some counties the grammar schools left the state system altogether and became independent schools; these are not part of our studies. However, in parts of Essex, single-sex grammar schools survive as publicly-funded entities, while in Suffolk they no longer exist.

[25] To compare students of roughly the same ability we recruited from the top part of the distribution in the two coeducational schools in Essex: only students in the academic streams were asked to participate. Students from Suffolk do not have the option to take the 11+ exam and therefore higher ability students are unlikely to be selected out of Suffolk schools in the same way as in Essex. Nonetheless we only recruited students from the academic streams in the Suffolk as well.

types: all-girls; all-boys; or mixed. Mixed groups had at least one student of each gender and the modal group comprised two boys and two girls. The composition of each group - the appropriate mix of single-sex schools, coeducational schools and gender - was determined beforehand. Thus only the assignment of the girls or boys from a particular school to a group was random.

The experiment took place in a large auditorium with 1,000 seats. Students in the same group were seated in a row with an empty seat between each. It was easy for subjects to see which other students were in the same group. If two students from the same school were assigned to a group, they were seated as far apart as possible (for example, in a group of four, two other students would sit between the students from the same school). One supervisor, a graduate student, was assigned to every five groups. Once the experiment began, students were told not to talk, and supervisors enforced this rule.

5.3. Experimental tasks

At the start of the experiment, students were told that they would be performing a number of tasks, one of which would be randomly chosen for payment at the end. Since the payment-round was randomly selected *ex post*, students should maximize their payoff in each round to maximize their overall payment. Moreover, students did not have the opportunity to hedge across tasks, as only one round was selected for payment.

Most tasks involved students solving as many of 15 mazes as possible in five minutes.[26] Before the first task was explained, students were shown a practice maze, given instructions on how to solve it, and allowed to ask questions of clarification. Immediately before each round,

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[26] No student was able to solve all 15 mazes. Mazes were of the type found at http://games.yahoo.com/games/maze.html. The level of difficulty was the easiest of the "Easy to Hard" scale found at the bottom right hand side on the webpage. These mazes were also used by a number of other papers in this small literature.

students were told the nature of the task to be carried out and the payment for that round. At no stage were students told how they performed relative to others in their group. While there were five rounds in our experiment, I briefly outline here the results of just two – Rounds 3 and 5 (the others are discussed in Booth and Nolen, 2009b).[27]

Competitive behaviour was measured by how students' choices between opting for payment via a tournament (winner-takes-all) or by piece-rate in Round 3 of the experiment, as will be explained in Section 5.4. For risk, we instead looked at whether or not, in Round 5, students' chose a real-stakes gamble for the payment mechanism, as will be explained in Section 5.5.below

5.4. Competitive behaviour

As in Gneezy et. al. (2003), Datta Gupta et al. (2005) and Niederle and Yestrumskas (2007), we measured performance in solving paper mazes to look at competitive behaviour. Round 3 involved the choice of a Tournament or a Piece Rate. Students were asked to choose either Option 1 or Option 2, and that payment would depend on which option they chose if this round was randomly selected for payment. (Option 1 delivered £0.50 per correct maze solved, while Option 2 delivered £2 per correct maze IF the individuals solves more mazes than anyone else in her group did the previous round and zero otherwise.)[28] Competing against other group-members' *previous* round tournament scores removed the strategic element of trying to figure out

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[27] Round 1 was a mandatory piece-rate (students were told they would each receive £0.50 for each maze solved correctly if this round was randomly selected for payment). Round 2 was a mandatory tournament in which students were told to solve as many mazes as possible and that, if this round was randomly selected for payment, the group-winner would receive £2 for each maze solved correctly and the other members zero. We used both these variables as controls for ability, learning and the like in later rounds (see Booth and Nolen, 2009b). At the end of the experiment, students also completed an exit questionnaire before being paid (both the show-up fee of £5 plus any payment from performance in the randomly selected round).

[28] If there was a tie, the winner was chosen at random. Payments were adjusted according to the size of the group: in 3-student groups the winner would get £1.50 per maze; in 2-student groups the winner would get £1 per maze.

choices other group-members might be making in that round. It also ensured that students did not have to consider any externalities their current decisions might impose on other group-members, as argued in Niederle and Vesterlund (2007).

Our estimates showed that a girl's environment plays an important role in explaining why she chooses not to compete. We looked at the choices made by girls from single-sex and co-ed schools and found that there are robust differences in their behaviour. *Ceteris paribus*, girls from single-sex schools were significantly more likely to choose to enter the tournament than coeducational girls. We also examined the effect of a randomly-assigned environment, being placed to an all-girls group for the experiment. Being in an all-girls group for only 20 minutes affected the decision a girl makes and made her more likely to choose to enter the tournament. We also compared girls' behaviour with that of boys from single-sex and coeducational schools, and found that girls from single-sex schools behaved more like boys. These findings are consistent with the gender identity hypothesis and with the education literature that suggest that there is greater pressure for girls to maintain their gender identity in schools where boys are present than for boys when girls are present (Maccoby, 1998).

In Booth and Nolen (2009b) we present and extensively discuss a number of sensitivity checks. In summary, we found that, across all specifications, the single-sex school coefficient is statistically significant in explaining tournament choice even after controlling for family background, age, and ability; instrumenting for attendance at a single-sex school or comparing single-sex school students to students from Suffolk where selection is not an issue; and even when controlling for risk preferences using responses from the post-survey questionnaire.

5.5. Choosing the Real-stakes Gamble[29]

In a companion paper, Booth and Nolen (2009a), we investigated if girls are less likely than boys to choose a real-stakes gamble. To elicit this, Round 5 of the experiment asked each student to choose Option One or Option Two. Option One was to get £5 for sure. Option Two was to flip a coin and get £11 if the coin came up heads or £2 if the coin came up tails. This round allowed us to look at the pure risk aversion differences between girls and boys.[30] Uncertainty exists only over the payoff and is unrelated to either ability or to performance in any previous round. The expected monetary value of the gamble, £6.50, is higher than the alternative choice, a certain outcome of £5. Assuming a constant relative risk aversion utility function $u(x)=x^{1-\sigma}/(1-\sigma)$, where $\sigma \geq 0$ is the degree of relative risk aversion, we calculate that the value of σ making an individual just indifferent between choosing the gamble and the certain outcome is 0.83. Individuals with $\sigma > 0.53$ will choose the certain outcome, while those with $\sigma < 0.83$ will choose the gamble.

The dependent variable takes the value one if the individual chose the gamble and zero otherwise. The mean for coed school girls is 0.54 while for single-sex school girls it is 0.86. For boys the means are 0.88 and 0.78 for coed and single-sex boys respectively.

Insert Table 3 near here.

The marginal effect reported in Column [1] of Table 2 reveals that women are significantly less likely to choose the gamble over the safe option than boys. This supports the findings in much of the literature. The specification in Column [2] adds controls for school-type and experimental group composition. In this specification the gender gap for girls in coed schools becomes even

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[29] Eckel and Grossman (2002) provide a summary of gender differences in much of the experimental literature and Eckel and Grossman (2008) focus on risk and gender. See also Dohmen and Falk, 2006; and Dohmen, Falk, Huffman, Sunde, Schupp and Wagner (2006). The latter provide evidence of a gender differential in risk attitudes for a representative German sample.

[30] Booth and Nolen (2009b) also report the results from a hypothetical lottery, involving a much larger payoff, which was presented to subjects in the post-experiment questionnaire.

more obvious; girls now choose to enter the lottery 36 percentage points less than coed boys. However, girls in single-sex schools are now just as likely to enter the tournament as boys from coed and single-sex schools.

Column [2] also shows that girls in all-girls groups for the experiment are 12 percentage points more likely to enter the lottery than girls in mixed groups, suggesting that girls in same-gender experimental groups are less risk averse than girls in mixed gender experimental groups. However the effect from being in an all-girls group does not cancel out the effect of being female and thus it seems that girls in same gender experimental groups do not choose to enter the tournament as much as coed boys. The IV results, reported in detail in Booth and Nolen (2009) support these findings.

5.7 Summary of our experimental results

In summary, in our experimental analysis we established at least one setting - in addition to the Kasai tribe of India studied by Gneezy et al. (2008) - in which it is untrue that the average female avoids competitive or risky behaviour more than the average male. On average girls from single-sex schools are found in our experiment to be as likely as boys to choose the real-stakes gamble and to be as likely as boys to choose competitive behaviour. This suggests that observed gender differences in competitive behaviour, and in behaviour under uncertainty, found in previous experimental studies might reflect social learning rather than inherent gender traits alone.

These results matter, not least because of the under-representation of women in high-paying jobs and top level management positions. While any gender differences in risk aversion and the like could explain some of the observed disparities in labour force achievement, gender differences in risk aversion are not necessarily innate, as shown by our experiment. Women may

be trained to be so by their environment. Appropriate policy action might therefore be directed not only to removing discrimination on the demand side but also towards developing female confidence in risk-taking and negotiation on the supply side.

What does this suggest for gender gaps and glass ceilings? First, women educated at single-sex schools should be more likely to choose tournaments, which could be considered as analogous to promotions. They should also be found in higher levels of management within organizations than should coeducated girls. These are testable hypotheses using survey data. Second, our findings also suggest that women in gender-segregated groups will be more competitive and less risk-averse than in mixed-sex groups. Finally, since the number of single-sex publicly funded schools in most European countries has been declining, one might also expect this could have had some impact on female competitive behaviour over time.

5. Conclusion

It is certainly the case that studies using survey-based psychological variables, as well as studies using data generated from laboratory experiments, do find gender differences in competitive behaviour and risk-taking. These could feed into explaining gender pay gaps and glass ceilings. Moreover, the most recent experimental evidence indicates that these gender differences in psychological variables are not necessarily innate, a finding that would be hard, if not impossible, to show using survey-based evidence alone.

It is clear that these distinct empirical approaches – involving survey-based data on the one hand and data from laboratory or field experiments on the other hand – can enrich our understanding of gender differences in behavioural outcomes. Combining the insights from each methodology, we now know that some small part of the gender pay gaps and glass ceilings may

be due to psychological differences between men and women. However these differences cannot be considered innate. They can be shaped by the environment in which individuals are placed.

The title of this talk was 'gender and competition'. While the competitive behaviour investigated in the recent economics experiments relates at face value to the supply-side of the labour market, it could also feed through to the demand side. Whether or not it transfers into the largely male corridors of power and into the demand-side of the economy is a largely unresearched area.

The insights from other disciplines about the formation of nepotistic or homosocial preferences, gender identity and role incongruity would seem to offer labour economists a potentially rewarding way forward. And for those who are interested in understanding how we arrived at this point, so too do the political economy approaches as exemplified in the studies by, *inter alia,* John Stuart Mill (1869), Lizzeri and Persico (2004) and Doepke and Tertilt (2008). There remains much work to be done by labour economists in exploring the ways in which gender plays out in the labour market.

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Table 1: Estimated wage gap, private sector

	OLS	Quantile regression estimates				
		10%	25%	50%	75%	90%
Austria	0.251	0.212	0.207	0.215	0.233	0.269
Belgium	0.144	0.090	0.120	0.144	0.174	0.218
Britain	0.247	0.201	0.224	0.246	0.272	0.302
Denmark	0.118	0.045	0.081	0.110	0.163	0.209
Finland	0.211	0.134	0.165	0.207	0.250	0.284
France	0.234	0.197	0.174	0.189	0.236	0.294
Germany	0.162	0.139	0.142	0.146	0.159	0.200
Ireland	0.230	0.185	0.215	0.240	0.256	0.269
Italy	0.172	0.156	0.138	0.146	0.169	0.205
Netherlands	0.127	0.029	0.068	0.107	0.172	0.249
Spain	0.211	0.214	0.211	0.207	0.202	0.205

Source: Arulampalam, Booth and Bryan (2007) and ECHP data.

Notes: (a) Regressions include controls for training, age, education, tenure, marital status, health, unemployment experience, part-time, fixed term & casual contracts, region (where possible), sector, year. (b) All reported coefficients are statistically significant at the 1% level.

Table 2: Probability of choosing the gamble in Round 5

Variables	[1]	[2]
Female	-0.16***	-0.36***
	(0.05)	(0.07)
Attends single-sex school		-0.13
		(0.10)
Female*Attends single-sex school		0.33***
		(0.06)
Allocated to all-girls group		0.12*
		(0.06)
Allocated to all-boys group		-0.05
		(0.10)
Observations	260	260
Model type	Probit	Probit

Notes:
 i.   Robust standard errors in parentheses.
 ii. * denotes significance at 10% level, ** at 5% level, ***at 1% level.
 iii. Source: Booth and Nolen (2009a), first two columns of their Table 2.