How much do children really cost? Maternity benefits and career opportunities of women in academia

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Abstract

Motherhood and professional achievements appear as conflicting goals even for women in academia. This project explores this tension by focusing on parental and maternity leave and benefit provisions across 165 higher education institutions in the UK[1]. Generous maternity provisions generate countervailing incentives for female academics. On the one hand, advantageous policies can foster women's productivity in terms of research outcomes allowing them to take time out of work without income and career break concerns. On the other hand, women can exploit generous provisions without generating returnable results for the academic institution. We argue that adverse selection problems lead universities to differentiate among academic staff by offering two different types of maternity provisions (more vs. less generous maternity leaves) in order to "test" women's commitment and research ability before offering permanent contracts. Our results support this this line of argumentation. We also find that generous maternity leaves and childcare provisions positively affect the number of women at research and professorship levels.

1. Introduction

"May" children, holiday babies and post-tenure pregnancies: these are some of the labels attached to women's choices of having children in an academic environment (Armenti 2003, Keher 1995). Academic women seem to share a common burden in scheduling their maternity plans: to survive in academia and advance through the faculty ranks, women tend either to give birth during vacation time or to postpone their motherhood status to the end of their probation period and the achievement of tenure (Wolfinger et al. 2008, McDowell et al. 1999, 1992). The end result is, generally, an underrepresentation of women in academic positions (Ginther and Kahn 2004, Hawkins 1994, Finch 2003, Steinpreis et a. 1999), lower salaries (Ward 2001, Bellas 1994), lower research outcomes and promotions (Euwals and Ward 2005, McDowell et al. 1999), lower fertility (Wolfinger et al. 2008), and higher rates of family dissolution (Probert 2005) – while family and children seem to have either no impact or even a positive effect on the patterns of men performances in academic ranks (Stack et al. 2004, van Anders 2004).

The vast majority of studies on gender and academic achievements point to lower women's mobility (due to family responsibilities), child rearing burdens and women's preferences for academic disciplines (such humanities) that have low publication records as possible explanations of gender differences in higher education systems (*inter alia* Ginther et al. 2003, 2004; Mason et al. 2002, 2004; Hamermesh 1988). Other studies (Euwals and Ward 2005) link the gender gap in academia to women's 'gender-related' attitudes such as women's propensity to choose teaching rather than research institutions.

Despite the huge insights advanced by these contributions, research on this field is usually confined within a few universities or is specifically concerned with the career path of

women in specific disciplines such as economics and social sciences. In addition, a systematic analysis of family (un)friendly policies implemented across and within departments is missing in the literature.

In this project, we seek to fill this gap both theoretically and methodologically. We analyze 165 higher education institutions in the UK and their provisions on a number of leave arrangements.[2] We will examine the effect of such provisions on general hiring policies across universities, arguing that the generosity of parental leave regulations affect both the decision of women to apply at certain institutions as well as hiring committees' decisions to offer relatively more fixed term contracts to female academics. Another aspect of this project is to assess the impact of maternity leave provisions on the job performance, especially research activity of women in academia. Furthermore we analyze the effect of parental leave regulations on career achievements of women, e.g. research vs. teaching positions, tenure, promotions and salaries. Finally, this project sheds light on the question how maternity and childcare facilities affects personal choices of female academics with respect to family planning, career decisions, personal wellbeing and job satisfaction. For this endeavor we will gather data through a representative survey of British academics.

This paper introduces the first of a series of manuscripts that attempt addressing the above questions. We discuss the state of the art of the relevant scholarly works and present the data on maternity provisions across British HEIs. In addition, we offer a preliminary empirical evaluation of the impact of maternity provisions on promotions and hiring trends across UK universities.

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[2] So far, we have complete information on salary replacement for maternity leave, the amount of time mothers/fathers take off from work, the existence/absence of equal provisions for mothers and fathers (maternity leave vs. parental leave policies), childcare facilities and adoption leave across 118 (out of 165) UK universities.

2. Women, maternity leaves and academic achievements: a review.

The literature has advanced three likely explanations for women's disparities in the academic field. First, women tend to choose academic disciplines characterized by lower levels of publication records (such as history, linguistics, literature, for example) and the quality of their academic outcomes is less likely to enter in standard methods of research assessment (such as the Research Excellence Framework in the UK).[3] In this respect, Ginther and Hayes (1999, 2003) notice that, compared to natural and social sciences, gender disparities in humanities are more likely to result from mechanisms of promotion rather than salary inequalities not only because there are more women in humanities but also because academics in this field are paid less than in other sciences and it is less costly for academic institutions to fill the gender pay gap (Ginther and Kahn 2004, Kahn 1993). Still, significant differences can be observed even in these disciplines[4] and a second research strand relates gender inequalities to lower levels of mobility among academic women – the so-called "loyal servant" hypothesis (Booth et al. 2000, Blackab 2005). The argument works as a self-fulfilling prophecy: salary increases and academic promotions are partly dependent on outside offers. Women are less mobile than their male colleagues for personal and family constraints and they are perceived as such by heads of departments or faculty members in charge of career promotions. As a consequence, women are not only less likely to receive outside offers but they are also less likely to receive promotions from

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[3]   Yet, as Booth, Burton and Mumford (2000: 323) notice, REF methods should reduce eventual prejudices against women by making discrimination uneconomic for academic departments. Probably, the incidence of REF systems is more likely to hold for salary and pay scales for women rather than their levels of representation across faculties.

[4]   See for example, Maliniak et al. (2013) who find that in the field of international relations women are systematically cited less than men after controlling for a large number of variables (publications, affiliations, tenure status and so on). Along similar lines, McDowell and Smith (1992) show a gender sorting effect on co-authorship, which contributes to lower article production for women.

inside their departments (given the assumption that they are reluctant to move). This will therefore affect their negotiation power and in turn their salary and promotion paths (Blackab et al. 2005). Several reasons are usually advanced to explain the mobility differential between men and women: women are more risk adverse (Jianakoplos and Bernasek. 1998), they "don't ask" for career advancements even when they are in a position of strength (Babcock and Laschever 2003, Solnick 2001)[5] and they are less likely to gain access to academic networks dominated by "old boys" (Blackaby et al. 2005: 97). Also, women are supposedly more likely (for "intrinsic" pastoral and caring attitudes) to invest in teaching rather than research activities and this affects not only their market value for research lead universities but also their patterns of promotions within their departmental environment (Monroe et al. 2008, Wyn et al. 2000, Park 1996, Singell 1996). More plausibly, the lower propensity to move depends on child bearing and family related tasks, which is what a third stream of research, contends (Gregg and Waldfogel 2005, Probert 2005, Deem 2003, Bailyn 2003, Burgess et al. 2002, Thornton 2003, Waldfogel 1998, Lyness et al. 1999). In a series of works, Mason and co-authors (2002, 2003, 2004) argue that children and maternity breaks and the lack of family friendly policies negatively affect the career path of women in academia. Compared to their male colleagues (who are more likely to benefit from family formation and fatherhood) women pay a huge prize for having children in academia in the form of lower promotion rates, higher exit patterns and personal vicissitudes (family dissolution and divorce). There is some evidence for these trends: in 1998, for the UK economics departments alone, female representation was 4% of

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[5] Notice that Mitchell and Hesli (2013) find that women bargain more frequently than men for a wide variety of resources. However, this research is confined to a 2009 APSA survey of political science faculty members and it does give information on the whether women have higher or lower success rates than men when bargaining.

professors, 11% of senior lecturers or readers, 17% of permanent lecturers, 28% of fixed term lecturers, and 33% of PhD/research students (Booth et al. 2000). Also, about 73% of female academics (at permanent lecturer levels) were likely to leave their department (while male exits amounted to 55%, *ibid*). Even in the USA, where affirmative actions are more pronounced, exit rates have comparable figures for lower-rank faculty women who also have a 144% greater probability of being divorced than ladder-rank men (Mason and Goulden 2004: 93, Perna 2005).[6] More generally, these trends suggest that the probability of exit from academia is higher for women at the early stage of their career (which usually coincides with their fertility age) while the lack of family oriented policies disproportionally disadvantages women's professional and personal conditions. Despite the cautious optimism of some scholars on future improvements of career paths for women (McDowell et al. 1999), all studies advance policy recommendations on more beneficial maternity leaves provisions and childcare facilities as necessary actions for reducing gender disparities in the academic environment. Yet, to date, we do not know whether the status of women academics has improved over the last years neither we have updated information on maternity and parental provisions for faculty members in the UK system. This is exactly where our research fits in. The next sections provide for a description of the current statutory and university maternity schemes and sketch possible lines of arguments linking maternity leave provisions and benefits at HEIs to career choices and paths of women in academia.

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[6] This study uses data from the Survey of Doctorate Recipients as well as data from a 2002 to 2003 survey of the work and family issues facing ladder-rank faculty in the nine campuses of the University of California system.

3. Maternity Policies across UK Universities

In the UK, women employees are entitled to Statutory Maternity Pay (SMP) if they have worked for the same employer continuously for at least 26 weeks up to the 15th week before the expected week of childbirth and they earn on average at least £109 a week.

The women that qualify for the SMP are paid the 90% of the average weekly earnings (before tax) for the first 6 weeks and the lower of £136.78 or 90% of the average weekly earnings for the next 33 weeks (7 April 2013).

Most of the Universities provide an extra Occupational Maternity Pay (OMP) that tops up the SMP in the first 39 weeks of maternity leave. The eligibility criterion to access the OMP usually depends on the length of service and both the payments and the eligibility criteria may vary among the institutions. For example, the University of Liverpool's OMP, regardless of the length of service, pays full salary for the first 8 weeks, half salary plus the SMP rate for the next 16 weeks and only the SMP for the last 15 weeks of maternity ordinary leave. The London School of Economics and Political Science instead pays full salary replacement for the first 18 weeks and the SMP at the lowest rate for the last 21 weeks, if the woman has been employed for at least 26 continuous weeks before the expected date of childbirth. Others universities may offer different OMP payments schemes that either may depend on the length of service of the employee (in such case the employee cannot choose the contract she prefers), or may not depend on eligibility criteria and the employee is free to choose between different salary schemes. For instance, at the University of Durham women can choose, if they satisfy the unique eligibility criterion, the salary scheme they prefer during the ordinary maternity leave period. There are two different contracts, women can choose either a contract granting full salary for the first 8 weeks, half

pay (plus SMP) for the next 16 weeks and only the SMP rate for the last 15 weeks, or another type of leave scheme that pays full salary for the first 16 weeks and the SMP rate for the last 23 weeks. [7]

In general, there is considerable variation across UK HEIs. From 124 HEIs across England, Wales, Scotland and Northern Ireland for which data was available, 25 (ca. 20 %) offered different maternity packages that either required specific eligibility criteria or could be chosen among freely by mothers to be.

These examples allow differentiating between two types of maternity leave arrangements across UK universities: higher salary replacement schemes vs longer but less paid leaves. In the following section, we advance a theoretical intuition, which can explain the rationale behind the provision of these two different typologies of contracts.

3.1. Linking Maternity Leave Provisions to University Characteristics

Generous maternity leaves come with benefits and costs. Research shows that, high replacement incomes are beneficial to mothers' employment rates and their attachment to the labor market in the short run (Waldfogel et al. 1999; Winegarden and Bracy 1995; Ruhm 1998) but long leaves depreciate the human-capital of female workers and jeopardize their employment prospects, in the long run (Ruhm 1998; Pylkkaenen and Smith 2003; Stoiber 1990; Beblo and Wolf 2002; Wetzels and Tijdens 2002). Also, the more frequent career breaks of women affect their productivity levels and earning capacity, thus

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[7] Along similar liners, at the Arts University College at Bournemouth women have the right to receive full salary for the first 6 weeks plus, depending on the length of services, they can be entitled either to other 12 weeks of half salary (plus SMP) and the last 21 weeks of only SMP if they have been working for at least 52 continuous weeks at the university, or to 33 weeks of SMP if they have been working for at least 26 weeks.

increasing the gender wage gap and the unequal treatment of women in the labour market (Klerman and Leibowitz 1997; Ondrich et al. 1996, Pe ´rivier 2004; Fagnani 1996).

These observations coupled with the observation of the two types of maternity schemes offered by academic institutions point to the existence of two opposite effects of generous maternity provisions at university level: on the one hand, rewarding maternity leaves could positively affect women's productivity levels and their willingness to stay in academia. If women are entitled to take time off from working (without having income concerns), they are more likely to concentrate on their academic research, which in turn, might also reduce their chances of having a career break or take further time (parental or seek leaves) out of work. On the other hand, long or frequent leaves could dis-incentivize women's work investments (given that they can consider these benefits as granted), which in turn affects their research outcomes and their contractual power in the job market. As the Organisation for Economic Co-operation and Development observes "women who make full use of their maternity or parental leave entitlements receive, on average, lower wages in the years following their resumption of work than those who return before leave expires". In short, there is a trade-off between the benefits of generous salary replacement rates in the short run and the costs of extended maternity leaves in the long run.

The replacement and length effects confront universities with an adverse selection problem in granting maternity benefits. Extensive and favorable maternity coverage impose a cost on universities and hiring/promotion committees cannot know in advance whether the recipients are returnable for the department – unless they are able to distinguish among maternity recipients by identifying "research" and "teaching" academic profiles. For example, given the high returns of high REF scores (in terms of funds allocation), research

oriented universities have an incentive to invest in research staff rather than teaching and admin personnel and they can thus offer different maternity allowances to researchers and teachers.

If we assume that 1) all higher education institutions are identical 2) all maternity recipients are also identical and 3) the proportion of "research" and "teaching" academic profiles is the same for each institution, all universities can either stipulate uniform contracts to all recipients (pooling contracts) or offer two different typologies of maternity schemes (separating contracts), such as higher salary replacement contracts for short leaves or longer leaves contracts at lower salary replacement rates, or both – and each recipient would choose the most suitable one.

Given that academic institutions are not identical and the cost of maternity schemes is different across universities and within departments, we would expect to see similar separating contracts across similar academic institutions and dissimilar pooling contracts across different universities. In this latter case, the type of maternity schemes should be correlated with universities characteristics (i.e. budget, size, academics/admin ratios etc.) but "research" oriented universities may prefer pooling contracts granting maternity benefits (in terms of pay and leave) above the average (which, for the UK case is about 10 weeks) to reduce the women's incentive to take further time out of work after the maternity deadline while "teaching" oriented institutions would find more convenient to grant longer maternity leaves at lower pay rates (or probably hire new members to replace the academics on leave).

The following section connects these general theoretical expectations to variance in maternity benefits across UK universities and derives more specific possible causal mechanisms.

3.2 *Generosity of maternity benefits and career paths*

Arguably the best indicator for the generosity of maternity benefits is the number of weeks full salary replacement is paid. On the one hand, if women can take more time out of work – without income cuts – they are certainly advantaged in terms of adapting to their motherhood status without being pressured by income concerns or the need to multitask administration, teaching and research tasks. This increases the probability that women return to their research position without having to take a career break and with possibly minor effects on research and publication activity. On the other hand, salary replacement represents the most costly part of maternity packages for universities.

Indeed looking at generosity of maternity pay across British HEIs reveals a large variance across universities which cannot only be explained by different financial constraints faced by the HEI. For example, the number of weeks for which full salary replacement is granted varies from 0 (e.g. Leeds Metropolitan University) to 26 week in HEIs such as Oxford, Manchester, Birkbeck College and the Royal College of Arts. The variance is large and clearly cannot just be attributed to financial status of the HEI or its research intensity. Places as diverse as Warwick, Essex, Bristol, Exeter, Kent, Bath, Leeds, Birmingham City, Bangor, Heriot-Watt, Strathclyde Universities or Goldsmith College only grant 8 weeks of fully paid maternity leave. While HEIs such as Keele University, Heythrop College or Cambridge University pay mothers 18 weeks of full salary replacements. Table 1 gives a summary.

Table1: number of weeks of full salary replacement across British HEIs

weeks of full salary replacement	no. packages	Percent
0	7	4.64
4	29	19.21
6	17	11.26
8	32	21.19
9	4	2.65
12	3	1.99
13	7	4.64
14	2	1.32
16	13	8.61
17	1	0.66
18	29	19.21
19	1	0.66
20	1	0.66
26	5	3.31
Total	151	100

It seems obvious that these different provisions should affect career paths of young female academics differently. We argue that better maternity leave provisions, especially in form of salary replacement during the maternity leave, allows female academics to return to full time research and teaching positions earlier with a lower probability of taking a career break, moving into primarily teaching and/or administrative positions or leaving academia for good. This should partially explain the "leaking pipe" phenomenon that can be observed especially in research intense disciplines.

Undoubtedly, generous maternity pay is expensive for universities, yet, once a policy is implemented it is not easy to change. As consequence and despite equal opportunity regulations and efforts made by universities to increase the share of female academics, expensive maternity packages generate countervailing incentives. This might be less pronounced in public institutions such as universities than small companies, for example

where maternity leave of employees has direct consequences for the employer and functioning of the company. Still, these incentives exist and we expect them to have detectable effects on the contracts offered to female academics. Fixed term contracts, for example, can be used to a) test the women's suitability for a research position, b) make it more likely that women drop out of academia when they have to care for children, and c) also lowers the probability that a women on a fixed term contract becomes eligible for the full maternity leave benefits. We thus expect that HEIs with more generous maternity packages are relatively more likely to offer limited, non-permanent or fixed term contracts to female academics.

One of the more debated issues, in the political as well as the academic arena, is the effect of childcare provisions on female productivity and career trajectories. It seems intuitive that easy access to childcare options close to one's workplace generates efficiency gains and thus opens up time for research activities beyond teaching and administrative tasks.

However, there is much variation across UK HEIs that cannot be explained by mere size of the institutions, research intensity or financial resources. From 131 UK HEIs about 56% offer childcare at the nursery and kindergarden level while 44% don't provide childcare facilities. To some extend childcare provisions should make a difference at the margin for career decisions and ability to perform of female academics.

The next section offers some very preliminary estimation results attempting a first cut at testing the above sketched lines of argument. We also point out the many caveats of this preliminary empirical analysis and how we plan to solve the obvious endogeneity and identification issues.

4. Data and Preliminary Empirical Analysis

The UK Higher education sector provides a useful start to empirically investigate the link between maternity provisions, productivity, career paths and hiring practices. Firstly, unlike in other countries (such as Germany, Norway, Sweden or Denmark), maternity policies vary greatly across UK HEIs because the statutory regulations present a benchmark (minimum) standard of maternity benefits and universities usually top up these basic provisions to different degrees. In comparison, the German maternity benefits represent an upper ceiling, which companies and even public institutions cannot reduce because it would violate legal standards. Secondly, the university sector allows gathering very good data on hiring, promotion and career paths. In addition it is rather easy to define research productivity and performance by looking at number and quality of publications as well as number of citations – while it is rather difficult to get such clear cut individual level data in other sectors (either corporate or public or non-governmental).

We therefore focus on the UK HE sector despite the drawbacks that this choice might have for generalizability and external validity of our results.

To date, the UK HE sector counts 165 HEIs, 4 of these in Northern Ireland, 11 in Wales and 19 in Scotland. We collected data on parental leave regulations and childcare provisions for 131 institutions of which we could match 122 to data on composition of academic staff from the Higher Education Statistics Agency (HESA). For the time being, we only gathered current information on maternity provisions which is to date and thus cross-sectional. These latest regulations were implemented at different points in time between 2007 and 2013 across UK HEIs.[8] We collected information for more than 50

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[8]   We are aware that not having information over time poses serious identification problems. We are currently collecting data on maternity provisions that were in place before the last round of

different variables on maternity benefits, such as eligibility, length of leave, salary replacement, existence, eligibility and characteristics of different maternity packages, as well as additional paternity and parental leave provisions, childcare provisions and financial support for childcare.

For this preliminary analysis we use information on the number of weeks for which full salary replacement is granted. This variable is described above and highly correlates with other indicators for the generosity of maternity benefits, e.g. the overall length of salary replacement beyond SMP. In addition, we analyze the effect of different universities packages offered by different universities and their different eligibility criteria. Finally, we examine whether childcare directly provided by HEIs affects overall composition of staff. The following analysis is, of course, a preliminary attempt to empirically investigate the effect of maternity leaves provisions on women's performances in academia. Before we start analyzing the relationship between maternity provisions and career paths of female academics we turn to investigate implications of the argument about adverse selection. If universities could a) discriminate between research active and non-active academic staff and b) could screen female job candidates before hiring them, they probably would but equal opportunity and anti-discrimination regulations do not permit this. Thus, our expectation is that universities only can tackle this inherent problem of generous maternity leave provisions on average. We thus, analyze whether HEIs with different characteristics implement different maternity provisions with respect to generosity and eligibility. To measure generosity we use the number of weeks that a mother receives full salary

revisions was implemented. Once we have the data, we can implement a difference-in-difference design because the implementation of better maternity provisions can be used as a discontinuity because it represents a natural experiment.

replacement. This variable highly correlates with other measure for the generosity of maternity benefits and is probably the most expensive ingredient of maternity leave packages. In addition we analyse whether a HEI offers different maternity packages. Usually the main difference between offered packages is eligibility – to obtain more generous maternity leave provisions a future mother will have to be employed for a longer period of time with the same institution. This allows the employer to exempt temporal and fixed term staff from more generous maternity benefits. Our expectation would be that richer and more research intensive institutions provide a) more generous maternity benefits but b) have a larger incentive to screen or discriminate and thus have different packages. We therefore regress these two variables on the net income of the HEI (in mill. of £, data from 2012/13)[9] which should fairly well proxy the wealth of an institution. In order to operationalize the research intensity of a HEI we use 3 measures: a) the ratio of income from research grants to total income, b) the overall institutional RAE (Research Assessment Exercise) score from 2008, and c) the percentage of submitted items that were deemed 4* (international recognition) publications in the 2008 RAE in order to measure research excellence. Table 2 presents the results for the generosity of offered maternity benefits (weeks of full salary replacement) and table 3 the shows the findings for whether a HEI has different maternity leave packages. Since the the generosity of maternity pay is measured in number of weeks – this variable is a count variable that displays overdispersion, hence the last column that shows the results for of a negative binomial specification should be considered the most appropriate modelling strategy. The question whether a university offers different packages (usually two) is binary, e.g. 1 – there are

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[9] This measure highly correlates with total income and surplus/deficit of the institution.

different packages, 0 – otherwise. The probit estimates in the second column present the appropriate modelling strategy in this case.[10]

Table 2: Generosity of Maternity Provisions

dependent variable: no. of weeks with full salary replacement	OLS	Poisson	NegBin
Institutional net income in mill. £ (2012/13)	0.000	0.000	0.000
	(0.003)	(0.000)	(0.000)
Proportion of Income due to research grants	0.132**	0.012***	0.013***
	(0.053)	(0.003)	(0.005)
RAE score 2008	0.027	0.003***	0.003*
	(0.017)	(0.001)	(0.002)
Percent of 4* submissions (RAE 2008)	0.157*	0.012**	0.013
	(0.093)	(0.005)	(0.009)
Intercept	4.042**	1.706***	1.703***
	(1.702)	(0.101)	(0.164)
R^2 (adjusted – OLS, pseudo – Pois/NB)	0.259	0.125	0.054
Chi^2 (Pois./NB); F-statistic (OLS)	13.846	147.297	51.563
Chi^2 (alpha≠0 – overdispersion)			131.029
N	148	148	148
*p<0.1, **p<0.05, ***p<0.01			

The results in table 3 clearly support the notion that high quality and intensity research institutions provide more generous maternity benefits on average. These institutions usually have very high standard for hiring academic staff and this selection process ensures that female academics are high quality – thus providing them with generous salary replacement benefits will enable them to keep up the research activity. However, the overall wealth of the university has no impact on the generosity of maternity provisions.

Table 3: Different Maternity Packages

dependent variable: different maternity packages	OLS	Probit
Institutional net income in mill. £	0.000	0.001

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[10] Both models in tables 2 and 3 remain unaffected by heteroscedasticity (Breusch-Pagan and Szroeter tests generate insignificant results, supporting the Null of homoscedasticity). Hence we do not use robust standard errors.

(2012/13)	0.000	-0.001
Proportion of Income due to research grants	0.018***	0.072***
	-0.004	-0.021
RAE score 2008	0.002	0.008
	-0.001	-0.005
Percent of 4* submissions (RAE 2008)	-0.016**	-0.071**
	-0.007	-0.029
Intercept	0.008	-1.558***
	-0.13	-0.519
R^2 (adjusted – OLS, pseudo – Pois/NB)	0.169	0.164
Chi^2 (Pois./NB); F-statistic (OLS)	8.498	31.522
N	148	148
*p<0.1, **p<0.05, ***p<0.01		

The case is not that clear cut for the offer of different packages. Research income and research excellence seem to exert opposing effects which need to be investigated in more detail. [MORE INTERPRETATION]

To test the effects of maternity and childcare provisions, we can only use aggregate data on academic staff composition on the left-hand-side of our models. HESA provides yearly data for UK HEIs on the composition of academic (and other) staff. We use the most recent wave here which provides data for the academic year 2012/13. We use HEI staff data from 2006 on the right-hand-side of our model in order to identify effects of maternity provisions off the baseline effect before maternity policies were changed from 2007 onwards.

Our first dependent variable is a count variable of the number of female professors (given that professorship remains one of the most obvious promotion hurdles and career path indicators), we add the total number of staff to the right-hand-side of our models to correct for the obvious size effects, we also add the number of female professors in 2006 to the RHS in order to identify the effect of maternity benefits better. The "leaking pipe" argument most obviously refers to the reduction in the female academics climbing up the

academic career ladder. Full professors are at the top of this ladder and we should expect the strongest effect here.

As argued above the generosity of maternity benefits might implicitly affect the kind of contracts that is offered to female academics, we thus analyze the number of permanent female staff as compared to total staff. Finally, we also look at the share of female academics with incomes in the highest salary bracket (> 56'467.00£ in 2013). In order to show that these effects are not existent for male staff we also show the same results for the number of male professors in 2013.

We regress these 4 dependent variables on our main indicators for the generosity of maternity provisions (number of weeks with full salary replacement, existence of different packages, and whether the HEI offers childcare through an institutional nursery/kindergarden). We control for the total number of academic staff and for previous values of our 4 dependent variables (e.g. no. of female professors, no. of female staff with permanent contracts, number of female staff in highest salary bracket, no. of male professors in 2006) in order to identify the effect of maternity benefits off the baseline values. To control for institutional characteristic that might affect female employment we use the net income of the institution (in millions of £), and as performance indicators the student-staff ratio as well as the percentage of 4* submission in the 2008 RAE. Moreover, we control for regional effect by including dummies for Wales, Northern Ireland, and Scotland.

Since all four variables are count variables that display over-dispersion (as figures 1a-d show), we employ poisson and negative binomial estimations which we compare to linear OLS results[11].

Figure 1a-d: Histogram for number of female professors, female academics with fixed term contracts, women in research positions, and the number of male professors in 2013.
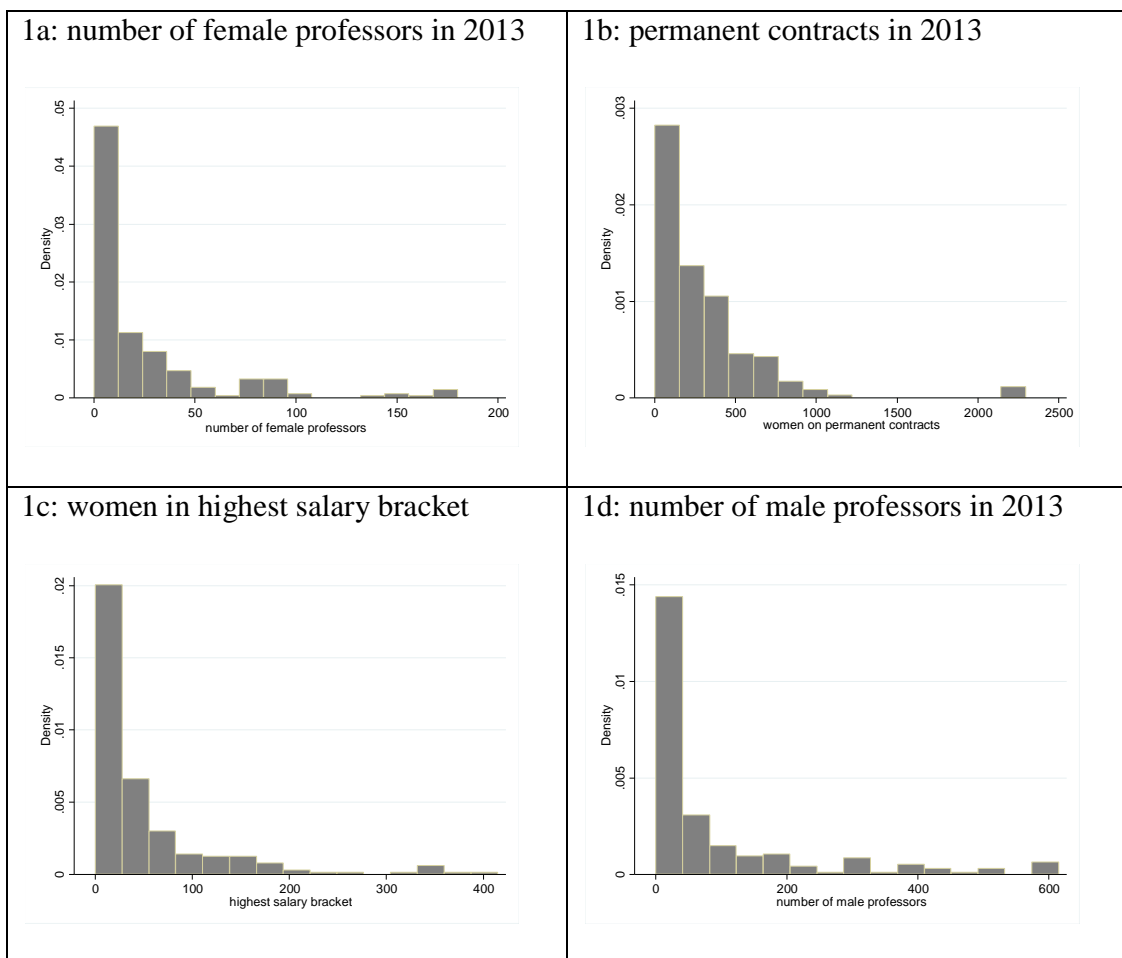
[11] In addition all 4 models suffer from heteroskedasticity (significan Breusch-Pagan and Szroeter test results). We therefore show estimates with White robust standard errors.

Tables 4, 6-8 depict the estimation results for the three operationalizations of the dependent variable separately.

We will discuss the caveats of the empirical analysis and future plans to solve these problems below in more detail. Yet, is seems clear that the presented results possibly suffer from endogeneity, reversed causality and identifications issues. Bearing this in mind we interpret the empirical results cautiously and see them as very preliminary evidence for the outlined arguments.

Table 4: Female Professors

dependent variable: No. of female professors in 2012/13	OLS	Poisson	NegBin
No. of female professors in 2006/07	0.683***	0.012***	0.012***
	(0.173)	(0.002)	(0.002)
nursery in institution?	-0.109	0.390***	0.535***
	(2.182)	(0.115)	(0.161)
no. of weeks with full salary replacement	0.533***	0.021**	0.018*
	(0.200)	(0.008)	(0.010)
different packages?	3.222	0.042	-0.035
	(3.015)	(0.120)	(0.148)
total no. of staff 2012/13 in 100s	1.537***	0.038***	0.045***
	(0.573)	(0.009)	(0.012)
Institutional net income in mill. £ (2012/13)	0.002	-0.001***	-0.001***
	(0.030)	(0.000)	(0.001)
Student Staff Ratio	-0.369*	-0.015	0.011
	(0.214)	(0.017)	(0.025)
Percent of 4* submissions (RAE 2008)	0.228	0.034***	0.040***
	(0.198)	(0.009)	(0.013)
Northern Ireland	-2.329	0.027	0.01
	(6.812)	(0.122)	(0.211)
Wales	9.489	0.226	-0.134
	(8.733)	(0.330)	(0.490)
Scottland	-2.215	0.185*	0.333**
	(2.253)	(0.105)	(0.134)
Intercept	-7.906	1.883***	1.284**
	(4.955)	(0.374)	(0.538)
R^2 (adjusted – OLS, pseudo – Pois/NB)	0.888	0.726	0.159
Chi^2 (Pois./NB); F-statistic (OLS)	80.315	686.131	462.156

Chi^2 (alpha≠0 – overdispersion)			464.592
N	121	121	121

*p<0.1, **p<0.05, ***p<0.01; Robust White SEs in Parentheses

The findings in table 4 indicate that independent of the size of an institution (total number of staff and total net income of the institution) more generous maternity benefits, e.g. more week of fully paid maternity leave, are associated with a higher number of female professors which, apparently reduce the leakage and allow female academics to stay in the profession and climb up the promotion ladder. This notion is re-enforced by the positive impact of childcare provided by the university (results in the Poisson and Negative Binomial specification). Interestingly, strong research universities employ on average more female professors than institutions which are less focused on research. Here the explanation seems to be that the hiring process is already much more focused on strong research profiles that the leaking pipe phenomenon becomes less of a problem. The expectation then is that generous maternity provisions have a stronger positive impact on career development in research intense environments.

This prediction is supported when we look at the substantive results. Table 5 uses the estimated coefficients from the negative binomial model in table 4 to calculate conditional predictions. As we can see from the predicted number of female professors in table 5, generous maternity provisions always exert a positive effect on the number of female professors but this effect is much stronger in high quality research institutions. In the case of the top research institutions, a change in the number of weeks with full salary replacement (from 0 to 26 weeks) increases the number of female professors by 30%.

Table 5: predicted number of female professors

Percent of 4* submissions (RAE 2008)	No. of weeks with full salary replacement:	Minimum (0)	Median (8)	Maximum (26)

	Nursery			
0	No	25	27	31
0	Yes	33	36	41
5	No	29	31	35
5	Yes	38	41	47
55	No	117	125	145
55	Yes	157	168	194

(other variables at median)

These findings have to be taken with a grain of salt: it could well be that institutions with a larger body of female professors are forced to implement better maternity provisions due to lobby work and pressure exerted by less dependent female professors. We turn to these endogeneity issues in more detail below.

The finding in table 6 support the cautious interpretation of results in table 4: the generosity of the maternity pay positively affects the number of women in the highest salary bracket (so not always significantly) supporting the notion that allowing women to take time off without worrying about income does have positive effects for their ability to engage in academic research and climb up the career ladder. Childcare provision by the university only turn out to have a significant impact in the poisson and negative binomial specifications –which, given the distribution of the dependent variable, are, however, the most appropriate specifications.

Table 6: Female academics in highest salary range 2012/13

dependent variable: No. of female academics on highest salary scale in 2012/13	OLS	Poisson	NegBin
nursery in institution?	-2.578	0.253*	0.295**
	(7.311)	(0.142)	(0.133)
no. of weeks with full salary replacement	0.881*	0.004	0.008
	(0.524)	(0.011)	(0.010)
different packages?	-5.84	-0.033	-0.001
	(8.502)	(0.146)	(0.141)
total no. of staff 2012/13 in 100s	6.067***	0.069***	0.068***
	(1.868)	(0.011)	(0.011)

Institutional net income in mill. £ (2012/13)	-0.015	-0.001***	-0.002***
	(0.109)	(0.000)	(0.000)
Student Staff Ratio	-0.92	-0.024	0.002
	(0.658)	(0.020)	(0.020)
Percent of 4* submissions (RAE 2008)	0.376	0.022**	0.028***
	(0.419)	(0.010)	(0.010)
Northern Ireland	3.499	0.127	-0.071
	(10.800)	(0.199)	(0.396)
Wales	-0.407	-0.076	-0.131
	(11.531)	(0.289)	(0.262)
Scotland	1.626	0.219*	0.263**
	(6.782)	(0.131)	(0.124)
Intercept	-8.415	3.213***	2.650***
	(12.799)	(0.440)	(0.454)
R^2 (adjusted – OLS, pseudo – Pois/NB)	0.814	0.718	0.13
Chi^2 (Pois./NB); F-statistic (OLS)	38.976	227.336	278.07
Chi^2 (alpha≠0 – overdispersion)			1407.336
N	121	121	121
*p<0.1, **p<0.05, ***p<0.01; Robust White SEs in Parentheses			

Finally, we examined the effect of maternity benefits and childcare provisions on the number of female academics on permanent contracts. This operationalization of the dependent variable is a first attempt at capturing underlying incentives for hiring women in academia. The idea is that generous maternity packages are very costly and could incentivize universities to "test" women's ability before offering permanent contracts. Results in table 7 offer some (cautious) support for this argument. The generosity of maternity pay exerts a consistently significant negative effect on the number of permanent contracts and it seems indeed to be the case that institutions with more generous pay packages also offer relatively less permanent contracts to female academics in order to screen or exclude those on fixed term contracts from generous maternity pay.

However, more longterm efficient provisions such as childcare (institutional nursery) affect the number of permanent contracts positively.

Table: Female Academics with Permanent/open end contracts

dependent variable: No. of women with permanent contracts in 2012/13	OLS	Poisson	NegBin
No. of women with permanent contracts in 2006/07	0.974***	0.001***	0.001***
	(0.128)	(0.000)	(0.000)
nursery in institution?	6.466	0.194***	0.226***
	(17.488)	(0.072)	(0.075)
no. of weeks with full salary replacement	-3.629**	-0.014***	-0.014**
	(1.608)	(0.006)	(0.006)
different packages?	-23.455	-0.185**	-0.188*
	(30.594)	(0.091)	(0.109)
total no. of staff 2012/13 in 100s	0.152	0.029*	0.034
	(5.179)	(0.015)	(0.025)
Institutional net income in mill. £ (2012/13)	0.450*	0.000	-0.001
	(0.269)	(0.001)	(0.001)
Student Staff Ratio	-2.892	0.017**	0.021***
	(1.855)	(0.009)	(0.008)
Percent of 4* submissions (RAE 2008)	0.385	0.008	0.012**
	(1.047)	(0.005)	(0.005)
Northern Ireland	8.788	0.068	-0.066
	(37.354)	(0.229)	(0.345)
Wales	57.614*	-0.06	-0.064
	(29.127)	(0.153)	(0.133)
Scottland	46.312	0.291***	0.320***
	(30.327)	(0.094)	(0.089)
Intercept	71.684*	4.763***	4.648***
	(40.552)	(0.219)	(0.202)
R^2 (adjusted – OLS, pseudo – Pois/NB)	0.905	0.762	0.107
Chi^2 (Pois./NB); F-statistic (OLS)	34.222	255.711	276.684
Chi^2 (alpha≠0 – overdispersion)			4267.248
N	121	121	121
*p<0.1, **p<0.05, ***p<0.01; Robust White SEs in Parentheses			

To sum up, even cautiously interpreted the preliminary empirical result appear to support the notion that maternity benefits and childcare provisions impact career paths of female academics as well as hiring decisions in HEIs.

In order to show that this is not a spurious effect that affects all academics we also regressed the number of male professors on the same right-hand-side variables. The results are shown in table 8.

Table 8: Number of Male Professors

dependent variable: No. of male professors in 2012/13	OLS	Poisson	NegBin
No. of male professors in 2006/07	0.636***	0.003***	0.003***
	(0.150)	(0.001)	(0.001)
nursery in institution?	-0.702	0.417***	0.550***
	(5.700)	(0.154)	(0.175)
no. of weeks with full salary replacement	0.649	0.005	0.012
	(0.546)	(0.009)	(0.009)
different packages?	5.194	-0.051	-0.047
	(7.971)	(0.133)	(0.160)
total no. of staff 2012/13 in 100s	2.198	0.029**	0.031***
	(1.714)	(0.011)	(0.012)
Institutional net income in mill. £ (2012/13)	0.146	-0.001***	-0.001**
	(0.103)	(0.000)	(0.000)
Student Staff Ratio	-0.896*	-0.018	0.007
	(0.467)	(0.017)	(0.020)
Percent of 4* submissions (RAE 2008)	0.723	0.039***	0.034**
	(0.540)	(0.010)	(0.013)
Northern Ireland	-5.807	0.19	0.018
	(17.578)	(0.139)	(0.317)
Wales	28.061**	0.178	0.170
	(11.990)	(0.133)	(0.152)
Scotland	-6.725	0.312***	0.359***
	(9.349)	(0.114)	(0.129)
Intercept	-17.396	3.266***	2.679***
	(13.388)	(0.381)	(0.443)
R^2 (adjusted – OLS, pseudo – Pois/NB)	0.951	0.812	0.131
Chi^2 (Pois./NB); F-statistic (OLS)	186.244	865.802	636.487
Chi^2 (alpha≠0 – overdispersion)			2342.999
N	121	121	121
*p<0.1, **p<0.05, ***p<0.01; Robust White SEs in Parentheses			

Interestingly, the generosity of maternity pay has no effect whatsoever on the career paths of male professors (as expected), but childcare provisions do. This seems to support the

expectations, that fathers also have to carry some of the childcare burden at a later stage and will benefit from institutionally provided childcare.

As mentioned before, with a high probability, though, the empirical models suffer from endogeneity bias and identification issues. In a next step, we will collect data on maternity benefits in place before universities implemented the current maternity packages. Since time series data on composition of academic staff is available from the HESA we can exploit the change in maternity benefits in a difference-in-difference approach – which we have successfully done here. We also will treat the timing of the introduction of more generous maternity leave provisions across British HEIs as a quasi-natural experiment which will allow identifying the causal effect more cleanly.

The next steps of the project involves moving away from university specific aggregate data to individual data on career paths, productivity and performance as well as childrearing decisions and job satisfaction of female academics. We hope that richer information at the individual level will also solve possible problems of ecological fallacy and allow testing theoretical arguments more directly.

Conclusion

More to come…

Generous maternity schemes impose a cost on universities' budgetary allocation. The costly nature of maternity benefits induces academic institutions to differentiate between maternity recipients by offering two types of contracts: broadly speaking, women can choose between shorter but fully paid provisions and longer but less well paid maternity leaves. We have argued that the choice of either of the maternity arrangements signals the

type of research commitment of academic women and (accordingly) affect their probability of getting permanent contracts rather than temporary positions. Our findings support these theoretical speculations. First, more generous maternity benefits are associated with a higher percentage of female professors (regardless of departmental sizes). Second, and accordingly, childcare provisions positively affect the number of women at professorship level. Finally, the generosity of maternity pay exerts a significant effect on the number of permanent contracts suggesting that more generous pay packages also offer relatively fewer permanent contracts to female academics. These are preliminary findings and more research and data are required to solve probable endogeneity problems in the empirical analysis and to assess the impact of maternity provisions on career performances in the academic field – a task we will embark on in the next step of this research project.

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