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Parenthood premium but fatherhood super-premium in academic productivity? A matter of partner's employment

Giulia Tattarini ^a, Olga Gorodetskaja^b and Agnese Vitali ^b

^aDepartment of Socioeconomics, University of Hamburg, Hamburg, Germany; ^bDepartment of Sociology and Social Research, University of Trento, Trento, Italy

ABSTRACT

While the discourse about work-family balance in academia (and elsewhere) is generally framed as a woman's issue, this study focuses on the association between childbirth and the scholarly productivity of both academic women and men. In particular, the authors examine whether the association between parenthood and scholarly productivity is contingent on gender and partner's employment status. Using German longitudinal data and addressing self-selection, results indicate the existence of a 'parenthood premium': scholarly productivity is higher for both fathers and mothers compared to their childless counterparts. Yet, academic fathers publish more than childless men and more than academic mothers, giving rise to a 'fatherhood super-premium'. Additionally, the study reveals that the fatherhood super-premium is influenced by the employment status of the female partner, while this is not the case for academic mothers. Overall, the research highlights the importance of considering the division of labour within couples in understanding the gender gap in scholarly productivity and, ultimately, gender disparities in academia.

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Academia; fatherhood; gender; partner's employment; scholarly productivity

1. Introduction

One of the most puzzling findings of research on gender inequalities in academia is that women publish less than men, on average (Huang et al., 2020; Mairesse & Pezzoni, 2015; Cole & Zuckerman, 1984; Abramo et al., 2009; Misra et al., 2012; Abramo & D'Angelo, 2015; Nielsen, 2016; Jappelli et al., 2017; Uhly et al., 2017; Filandri & Pasqua, 2019; Ooms et al., 2019). As domestic and child-care responsibilities tend to be gendered also among the academic elite (e.g. Suito et al., 2001; Bianchi et al., 2000; Derrick et al., 2022), female academics' 'double burden' has been heralded as one of the central explanations for gender disparities in – among others – scholarly productivity (e.g. Ahmad, 2017; Mason et al., 2013; Castaneda & Isgro, 2013; Ward & Wolf-Wendel, 2004, 2012; Perna, 2001, 2005; Suito et al., 2001). Gender-role specialisation theories (e.g. Becker, 1991) suggest that

CONTACT Giulia Tattarini  giulia.tattarini@uni-hamburg.de  Department of Socioeconomics, University of Hamburg, Welckerstrasse 8, 20354 Hamburg, Germany

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women reduce their work-related commitments upon becoming mothers while men intensify it, leading to decreased scholarly productivity for mothers compared to fathers and childless women. However, empirical findings challenge this assumption. Qualitative studies suggest that both mothers and fathers publish fewer scholarly works and dedicate less time to research activities than non-parents (Sallee, 2014; Sallee et al., 2016; Reddick et al., 2012). Quantitative analyses have produced mixed results regarding the existence of a ‘motherhood penalty’ (i.e. mothers have lower scholarly productivity than childless women) and the few existing studies on fathers suggest, contrary to what found in qualitative work, that a ‘fatherhood premium’ (i.e. fathers have greater scholarly productivity than childless men) may exist (Zheng et al., 2022; Hunter & Leahey, 2010; Morgan et al., 2021; Kim & Moser, 2021; Krapf et al., 2017; Lutter & Schröder, 2020).

Overall, academic fathers have received limited attention, partly because work-life balance is perceived as primarily a woman’s issue (Moreau & Wheeler, 2023). Neglecting the impact of fatherhood on academic outputs and careers carries two risks. Firstly, it overlooks the emergence of a new generation of ‘involved’, ‘engaged’ fathers and ‘egalitarian partners’ redefining cultural norms surrounding fatherhood (LaRossa, 2004; Grau Grau et al., 2022), including within academia (Sallee, 2014; Sallee et al., 2016; Damaske et al., 2014). Secondly, it reinforces the assumption that caregiving responsibilities, predominantly borne by women, are the sole impediment to achieving the ‘right’ level of scholarly productivity (Mason et al., 2013; Corbera et al., 2020; Pereira, 2021; Utoft, 2020). This neglects other family-related factors such as partnership status, partner’s employment status and occupation (Jacobs & Winslow, 2004; Liebig, 2010; Damaske et al., 2014), and parenting style (Derrick et al., 2022). Therefore, our research has two key aims: (1) to empirically assess the extent to which parenthood is associated with a penalty and/or premium in scholarly productivity comparing fathers, mothers and childless men and women, and (2) to assess whether the association between parenthood and scholarly productivity varies by gender, parenthood status and by the partner’s employment status.

This paper addresses the gender-productivity gap by examining a longitudinal study of German Ph.D. holders across all disciplines who pursued academic careers. Our focus is on early scholarly productivity, measured by publications. We explore how childbirth impacts scholarly productivity, by comparing academic fathers to childless academics and academic mothers. This approach clarifies whether the gender gap in scholarly publications is due to a motherhood penalty, a fatherhood premium, or both. Furthermore, while past research has delved into the heterogeneity of academic mothers, this paper sheds light on the diversity among academic fathers.

2. Background

Numerous studies confirm a gender-productivity gap in academia, with women generally publishing less than men (Huang et al., 2020; Cole & Zuckerman, 1984; Abramo et al., 2009; Misra et al., 2012; Abramo & D’Angelo, 2015; Nielsen, 2016; Jappelli et al., 2017; Uhly et al., 2017; Filandri & Pasqua, 2019; Ooms et al., 2019). Childbearing and childrearing, still a prerogative of mothers, are often assumed as explanations for the observed gender-productivity gap in academia (e.g. Ahmad, 2017; Mason et al., 2013; Castaneda & Isgro, 2013; Ward & Wolf-Wendel, 2004; Ward & Wolf-Wendel, 2012; Suitor et al., 2001). Mairesse and

Pezzoni's (2015) provide a useful literature review on the association between parenthood and the gender-productivity gap in academia. We update their contribution with the most recent quantitative results (available in Appendix, Table 1a). Overall, studies of the association between parenthood and scholarly productivity focus primarily on mothers and show mixed results. While some studies (e.g. Cole & Zuckerman, 1984; Krapf et al., 2017; Sax et al., 2002) find that having children is not associated with women's productivity, others reveal either negative (Mason & Goulden, 2002; Kyvik, 1990; Stack, 2004) or positive correlations (Joecks et al., 2014; Fox, 2005). For instance, in two samples of American STEM scientists, Stack (2004) finds lower scholarly productivity among academic mothers with young children compared to childless women or women with school-age children, while Fox (2005) reports the opposite results. Hunter and Leahey (2010), in a sample of sociologists and linguists in US research universities, find that mothers significantly increase scholarly productivity in the year after childbirth and that parenthood has no effect on citation counts but has a negative effect on productivity growth over time.

Such inconsistent findings are partly explained by the fact that academic mothers do not represent a homogeneous group. Indeed, the association between parenthood and productivity varies according to productivity and achievements before childbirth (Lutter & Schröder, 2020), career stage (Joecks et al., 2014) and number of collaborations (Li et al., 2022). Family-related factors such as the number of children, the child's age, marital status, and the partner's employment status and occupation (Jacobs & Winslow, 2004; Stack, 2004; Fox, 2005; Sax et al., 2002; Derrick et al., 2022) are also associated with mothers' scholarly productivity: peer-reviewed publications are lower among single mothers, mothers with pre-school children, or partnered with a non-academic man.

Further inconsistencies emerge in the few existing studies on academic fathers. Qualitative scholars have shown that a growing share of academic fathers are eager to be equal partners in parenting and to spend time nurturing and rearing their children, especially among the younger generations (Liebig, 2010; Damaske et al., 2014). Accordingly, egalitarian, 'involved fathers' would like to spend more time at home and value both bread-winning and caregiving as appropriate roles for men (Sallee, 2014). By performing a role that is deemed to be feminine (Rotundo, 1985), involved fathers, in academia and as well as in other work places, face many of the same challenges as mothers do (Reddick et al., 2012; Sallee, 2012, 2014; Dickson & Dickson, 2021), including being stigmatised by other colleagues or superiors for their family-oriented choices (Coltrane et al., 2013; Tanquerel & Grau-Grau, 2020) so that they may prefer to hide their caring identity at work (França et al., 2023). Most importantly, the experience of fatherhood for academic men is often perceived and narrated as a drag to one's productivity, especially compared to childless male colleagues (Reddick et al., 2012; Sallee, 2012). Therefore, qualitative results seem to support the idea that having a child will reduce the time for research ('negative resource effect'), leading to lower research productivity also for fathers ('fatherhood penalty'), especially compared to childless men.

On the contrary, new quantitative evidence identified a productivity 'fatherhood premium' in academia. Specifically, recent studies found significant gender gaps among parents in different indicators of academic achievement – such as scientific productivity, number of citations, size of collaboration networks (Zheng et al., 2022; Hunter & Leahey, 2010), wage (Kelly & Grant, 2012), self-reported satisfaction with one's research and career, and perceived recognition by scholarly communities (Zheng et al.,

2022) – with academic fathers performing systematically better than academic mothers and childless men on all indicators, while childless women and men performing similarly. Even when the difference in productivity between academic mothers and their childless counterpart is, on average, modest or null, fathers are consistently found to publish more (on average) than mothers and non-fathers after childbirth (Morgan et al., 2021; Kim & Moser, 2021; Krapf et al., 2017) – i.e. the ‘Fatherhood super-premium’. This result is also robust when unobserved constant characteristics are controlled for in longitudinal analyses. For instance, the study by Lutter and Schröder (2020) compared individual productivity over time before and after the transitions to parenthood, finding a more significant increase in productivity for sociologist fathers than mothers. Hence, quantitative evidence points to a gendered pattern of parenthood. Indeed, some scholars have argued that the observed gender gaps in academic achievement are, in fact, ‘parenthood gender gaps’ (Zheng et al., 2022; Carr et al., 1998).

Previous studies’ contrasting findings on the gender-productivity gap and the motherhood penalty may be due to the period, country, and discipline studied. Different research designs and sample selection may also contribute to the abovementioned inconsistencies (i.e. Lutter & Schröder, 2020). The inconsistencies between academic fathers’ narratives and behaviours emerging from the comparison between quantitative and qualitative studies may, however, reflect that the cultural ideals of fatherhood are changing among the new generations of academic fathers in that their opinions and desires lean towards involved fatherhood, whereas the actual social practices of fathering lag behind, i.e. behaviours are such that men continue to prioritise work over family (LaRossa, 2004; Derrick et al., 2022). As suggested by Oechsle and colleagues (2012, p. 15), there may be a latency phase in changing fatherhood practices that is difficult to observe and can only be (quantitatively) detected in retrospect.

A reconciliation of previous literature would be only possible by surveying the whole longitudinal, disciplinary, and geographical landscape to capture the complete publishing careers and family histories of all scientists across disciplinary and national boundaries (Huang et al., 2020). Although this is beyond the scope of our contribution, we take up most recent theoretical and methodological insights from the literature (i.e. Lutter & Schröder, 2020) to shed light on the relationship between gender, parenthood and research output in the German academia. By accounting for different sources of selection and relevant controls, our paper should clarify whether the productivity gap is driven by parental-gendered disadvantages rather than gender alone (Zheng et al., 2022; Lutter & Schröder, 2020; Carr et al., 1998). Moreover, as the reasons for the fatherhood premium remain unclear (Zheng et al., 2022), we extend on previous research by delving into the heterogeneity of academic fathers, as extensively done for academic mothers (Kim & Moser, 2021; Hunter & Leahey, 2010; Zheng et al., 2022; Lutter & Schröder, 2020). Herein, our main contribution consists in shifting the focus from the academic realm to the family realm, investigating whether family-related conditions – that are known to influence the motherhood penalty (e.g. Jacobs & Winslow, 2004; Damaske et al., 2014; Derrick et al., 2022; Zheng et al., 2022) – might be significantly associated with the fatherhood premium in career achievements. It is crucial to consider these family-related factors to gain a more comprehensive understanding of the gender productivity gap in academia.

3. Theoretical considerations and hypotheses

3.1. Parenthood and academic productivity

On the one side, raising children may reduce the time resources that can be used for the research process. Additionally, academics may have reduced opportunities to grow their human and/or social capital – such as attending conferences and other academic events – during pregnancy, periods of parental leave and, subsequently, for caregiving responsibilities. Therefore, having a child may bring along a ‘negative resource effect’ (Joecks et al., 2014), leading to lower research productivity for academic parents (‘parenthood penalty’). On the other side, becoming parents may incentivise academic productivity (‘parenthood premium’), as more publications are required to ensure the economic security and stability of a tenure to care for their children. Moreover, balancing an academic career with family responsibilities could potentially help academic researchers in better planning their academic journey and approaching their research more efficiently (Ward & Wolf-Wendel, 2004; Joecks et al., 2014). Finally, the benefits from suspending teaching and other non-research tasks during parental leave should outweigh the potentially stressful effects of having to combine work and family, thus incentivising papers publication. This is particularly true in Germany – the context of our study – where the 2007 reform made available for parents an extensive and generous parental leave scheme that better support work-family balance and foster a more equal distribution of childcaring responsibilities within the couple (Spieß & Wrohlich, 2008). Following the year 2007, parents can receive approximately 65% of their previous earnings during the initial 12 months of parental leave, with the option to take unpaid leave for an additional 24 months thereafter. Additionally, parents are entitled to paid leave for an extra two months if both partners each take a minimum of two months off. Notably, two months of well-compensated parental leave are designated specifically for fathers (known as ‘daddy months’) and are forfeited if not utilised. As a result of this policy change, for instance, the percentage of fathers taking parental leave rose from 3.5% in 2006 to around 30% in 2013 (Statistisches Bundesamt, 2013). Among them, especially high-educated fathers scored the higher increase between 1999 and 2012 (Geisler & Kreyenfeld, 2019).

Albeit both theoretical explanations sound logical and have yielded competing evidence over the past decades, recent quantitative research (Huang et al., 2020; Hunter & Leahey, 2010), especially on the German academia (Lutter & Schröder, 2020; Joecks et al., 2014) seems to validate the idea of parenthood as a positive incentive for scholarly productivity. Hence, given the specificity of our context, we assume that:

H1 (‘Parenthood premium’): *There is a positive relationship between becoming parents and the number of peer-reviewed published papers.*

3.2. Gender, parenthood and academic productivity

In theory, the ‘incentive effect’ (and the ‘negative resource effect’) of parenthood could apply to mothers and fathers alike (with respect to childless counterparts). However, empirical results on the division of labour within households show that academic mothers typically invest more time in childrearing and household activities than academic fathers (see, e.g. Sutor et al., 2001; Jacobs & Winslow, 2004; Derrick et al., 2022), with repercussions on their objective career achievements, including scholarly productivity

(Zheng et al., 2022). Indeed, pregnancy and parental leave are gendered for what concerns the availability of time and the level of concentration that can be dedicated to scholarly productivity (Derrick et al., 2022), as at least some responsibilities (e.g. breastfeeding) cannot be delegated to fathers. Additionally, the ‘ideal worker’ norm, which persists in the organisational structures and culture of many research institutions (Sallee, 2012, 2014) as well as in the broader society, prescribes that successful careers entail prioritising work over other spheres of life, e.g. by spending long hours at work or attending work events outside of working hours. On the other hand, conservative gender-roles and ‘intensive mothering’ norms in Germany prescribe that mothers prioritise their children over other spheres of life (Hays, 1996; Gangl & Ziefle, 2015; Sieverding et al., 2018). As a result, German male and female academics are subject to different gendered expectations regarding parenting and work: mothers may feel entitled (or obliged) to take time off for childrearing, while for men, being a good father means being a ‘good provider’ – of an acceptably high income, for instance (Bernard, 1981; Kaufman, 2013). Remarkably, academic mothers are more likely to be the lead parent for their children compared to academic fathers (Derrick et al., 2022). German National statistics show that at the time our data was collected, fathers who took paid parental leave did so on average for 3 months (Statistisches Bundesamt, 2013), while the average duration of paid leave for mothers whose partners also took parental leave was 11 months (Statistisches Bundesamt, 2012). Due to the fact that parental leave was collected not per child, but as retrospective calendar data, the exact parental leave per child cannot be determined clearly with our data. However, academic mothers in the sample took a total average of 17 months (SD = 10) of parental leave since the Ph.D. while fathers only took 3 months (SD = 2.5, own calculation), mirroring the general population. This confirms the idea expressed by Oechsle and colleagues (2012) that academic fathers’ behaviours may lag behind their preferences. Finally, parental leave might have different meaning for mothers and fathers in academia – and elsewhere. While academic fathers may benefit from conservative gender roles and norms, using parental leave to continue publishing (Antecol et al., 2018), for mothers, generous leave entitlements may signify a decline in work commitment as a result of role exposure and norm setting effects (e.g. Gangl & Ziefle, 2015). Against this background, we expect the parenthood premium being shaped by gender in a way that:

H2 (‘Fatherhood super-premium’): *Academic fathers publish more than academic mothers (between-gender comparison) and than their respective childless counterparts (within-gender comparison).*

3.3. The role of partnership and partner’s employment

Previous research suggested that change in time devoted to scientific production in the years following childbirth may be contingent upon partner’s employment status and job-related flexibility (Jacobs & Winslow, 2004; Fox, 2005; Reddick et al., 2012; Sallee, 2012, 2014; Sallee et al., 2016; Ahmad, 2017; Dickson & Dickson, 2021; Derrick et al., 2022). Academic fathers – just like academic mothers – are, indeed, a heterogeneous group (Damaske et al., 2014; Sallee, 2014; Derrick et al., 2022). The extent to which academics prioritise work over family might vary considerably depending on the family situation, spanning from individuals in dual-earner couples to individuals with stay-at-home

partners (Damaske et al., 2014). Indeed, New Household Economics theory posits that the division of paid and unpaid work within the couple – especially if children are present – is jointly determined by partners (Lundberg, 1988; Blossfeld & Drobnic, 2001) and that the investment of one partner in the labour market will reduce the time that the other partner devotes to work (Verbakel & De Graaf, 2009). The main idea behind the ‘negative partner effect’ is that by acting out of the household’s interest, partners make labour market decisions considering within-couple economic and material resources – such as money and time. For instance, the allocation of paid and unpaid work among partners may depend on specialisation incentives (Becker, 1991), relative (Lundberg & Pollak, 1996) or absolute (Brines, 1994) resources (i.e. the partner who contributes less to the household income does more housework/child-care) and time availability (i.e. the partner who spends less time in paid work or who has the more flexible job does more unpaid work; Presser, 1994).

Regardless of the driving force behind the couples’ division of labour, all theories have in common the idea that partners’ parenting and work are inter-dependent. Previous research supports these expectations by showing that men’s labour supply is negatively affected by their partners’ working hours (Kanji, 2013), particularly in couples with children (Paull, 2008; Pollmann-Schult & Reynolds, 2017) and that mothers are more likely to re-enter the labour market after childbirth when their male partners’ work is flexible (Buchler & Lutz, 2021). Moreover, a typical pattern observed in the literature is that men’s involvement in domestic work increases with the female partners’ contribution to the household income, while women’s domestic work declines (Bianchi et al., 2000). Also, men’s unemployment positively correlates with female breadwinning (Vitali & Arpino, 2016; Kowalewska & Vitali, 2021). In short, there is substantial evidence that couples develop strategies to manage their division of paid and unpaid work, which respond to changes in each partner’s employment status and working time (Buchler & Lutz, 2021). In accordance with the theory, our expectation is that:

H3a (‘Partner’s employment’): *The parenthood premium (parents vs. childless) will be higher when the partner is employed part-time or not employed than when the partner is full-time employed, for both male and female academics.*

The New Household Economic theory is, in principle, agendered, as it focuses on couples’ incentives and resources: both fathers and mothers have a maximum incentive to be productive and provide for their family in case their partners reduce their work hours or become inactive to be the primary carer of the new-born. Nevertheless, in a context like Germany, characterised by the abovementioned ideals of ‘intensive mothering’ and ‘breadwinning fathering’, it is less likely for a man than for a woman to become the primary caregiver upon childbirth. When women are the sole or main income provider for their families, they still contribute more to housework activities (Aassve et al., 2014) and childcare (Pinho & Gaunt, 2021) than primary-earner men, doing gender to restore gender-deviating behaviour in the public sphere of life (West & Zimmerman, 1987; Tichenor, 2005). Hence, it is plausible that academic mothers will spend more time on housework and childcare than academic fathers, even when they have a non-employed or part-time employed partner. These gendered dynamics are reinforced by persisting structural gender inequalities (i.e. gender pay gap and gender care gap) in the German labour markets and broader society (Schäper et al., 2023; European Commission, 2018;

Directorate-General for Research and Innovation [European Commission], 2021) as well as existing mating preferences according to which women tend to partner with slightly older men who are, on average, more experienced and better paid in the labour market. Hence, more academic women than men tend to have older, full-employed partners, whereas a substantial share of academic men will have non-employed or part-time employed partners. Indeed, in our sample, the share of academic women with a full-time employed male partner is 4 percentage points higher than the corresponding share for men, while the share of academic men coupled with a part-time or non-working female partner is 13 points higher than the corresponding share of academic women (Table 1). Against this background, our alternative hypothesis assumes that:

H3b (Gendered partner's employment): *The parenthood premium (parents vs. childless) will be higher when the partner is employed part-time or not employed than when the partner is full-time employed, only for academic men. For women, the parenthood premium will be independent from the partner's employment status.*

3.4. Alternative explanations

3.4.1. Self-selection

Self-selection is a social process that excludes individuals from the sample – in our case, the academic labour market – consequently leading to a distorted representation of the population we want to study (e.g. Heckman, 1990). Several mechanisms can contribute to sample selection bias: (1) *Reverse causation and path dependence*: highly productive and career-oriented academics might be more likely to have children and produce greater scholarly output after their Ph.D. than less productive academics (i.e. Lutter & Schröder, 2020). (2) *Unobserved heterogeneity*: Childless academics might differ from academic parents for some unobserved (constant) factors that also affect productivity and parenthood (e.g. high stamina and commitment to research). (3) *Sample selection*: scholarly productivity is only observed for those who pursue an academic career but the choice of leaving or staying is not random. For instance, German female academics are more likely to drop out of academia than their male colleagues, both at the early stages and in more advanced positions (Expertenkommission Forschung und Innovation, 2013, p. 109) – a phenomenon called ‘leaky pipeline’ (e.g. Picardi, 2020). Similarly, research has highlighted how ‘involved fathers’ strive to make their identity visible and safeguarded in their workplaces (Kaufman, 2013), including universities (Ahmad, 2017; Reddick et al., 2012; Drago et al., 2005; Sallee et al., 2016). Contrary to childless male academics, ‘involved fathers’ may perceive academia – especially in STEM disciplines (e.g. Utoft, 2020) – as unwelcoming toward parents and thus seek careers outside academia.

If selection is at play, the higher productivity of parents compared to non-parents found in previous quantitative studies might be an artefact of sample-selection biases: those staying may be a highly selected group with a solid commitment to research (Kim & Moser, 2021) who choose parenthood believing they can maintain their publishing productivity even while raising children. Indeed, the academics in our sample who combine parenthood and an academic career have above-average productivity (see Appendix, Table 2a). Our study is designed in a way to rule out different sources of selection via proper analytical strategies and robustness checks to obtain unbiased productivity estimates among academic parents (see Analytical strategy and Appendix).

3.4.2. Preferences and attitudes

A vast literature documents that attitudes and preferences may drive decisions on mothers' allocation of time between family and work (Hakim, 2000), while little variation is expected for fathers. Coherently with the cohort replacement hypothesis (Kiley & Vaisey, 2020; Scarborough et al., 2019), research has highlighted that in several European countries, including Germany, men devote considerably more time to housework and childcare compared to the past and the forerunners of such change are the younger and tertiary-educated fathers (Altintas & Sullivan, 2016; Sullivan et al., 2014). Moreover, older cohorts of men with traditional gender attitudes prefer to increase their work hours when they are fathers, while younger men are more egalitarian and tend to prefer a reduction in work hours (Pollmann-Schult & Reynolds, 2017). In academia, academic fathers' gender-role attitudes were found to be heterogeneous: some academic fathers structure their lives around notions of 'involved fatherhood' (e.g. Kaufman, 2013; Ruspini & Crespi, 2016), others around notions of 'breadwinning fatherhood', i.e. they prioritise their career, especially if they are the sole or primary breadwinner for their families, and make minor change to their work schedule after parenthood.

The context also plays a role in gender roles and attitudes (Esping-Andersen, 1999; Pfau-Effinger, 1998). This contribution focuses on Germany, characterised by internal differences in gender-role attitudes and behaviours (Ebner et al., 2020). Western Germany, with its conservative gender roles is a standard example of the male-breadwinner model (Bauernschuster & Rainer, 2012), while in the former German Democratic Republic (GDR), a dual-earner model with a strong female labour force participation promoted an egalitarian model. The importance of gender for cultural ideals and practices of parenthood, therefore, might differ between the two regions because of different primary and secondary socialisation (e.g. Carter, 2014). For men socialised in Western Germany, an involved and caring fatherhood identity should reflect a stronger deviation from the breadwinner norm than for men socialised in Eastern Germany.

Our sample refers to a cohort of Ph.D. holders who completed their Ph.D. degree quite recently and in the same year (2013/2014). Given their young age (90% of women and 80% of men are below 34 years old), we expect gender-role attitudes to be relatively homogeneous and more egalitarian than in the general population. Moreover, although the legacy of the more egalitarian model of the former GDR can still be observed today (Ebner et al., 2020), this relatively young cohort of Ph.D. graduates was mainly socialised after 1989, when Germany had already reunified, gender ideologies began to converge (Ebner et al., 2020), and significant mobility for education and work between East and West Germany occurred (especially in 1989–1990 and 2000–2010). Indeed, further analysis does not show any significant difference in fathers' parenthood-productivity gap between Eastern and Western Germany and between age groups (see Figure 1a in the Appendix).

4. Research design and method

4.1. Data source and analytical sample

We use the DZHW Ph.D. Panel 'Careers of Ph.D. Holders' (2014–2019) (Brandt et al., 2020a), a panel designed as a cohort study of German Ph.D. graduates who completed their Ph.D. in the winter semester of the academic year 2013/2014 or in the summer semester of 2014

in Germany (first wave $N. = 5,408$). Four additional yearly follow-ups collect both retrospective information and prospective information about the career path of Ph.D. holders after graduation up to 2019. The dataset counts in total 17,533 person-year observations distributed in five waves spanning from 2014 to 2019 (Brandt et al., 2020b). While Wave 1 (collected between December 2014 and February 2016) contains only information on the scholarly publications relative to the doctoral dissertation, Wave 2 (collected between March and April 2016) collects retrospective information on the cumulative number of publications from the first tertiary education degree to the interview date. Waves 3, 4 and 5 (collected between March and May 2017, 2018, and 2019) contain information on the number of publications in the year prior to interview. In other words, by starting from the third year after Ph.D. completion, i.e. Wave 3 collected in 2017, the survey collects prospective longitudinal information on the number of publications. We use this panel component as our dependent variable, scholarly productivity (i.e. the number of publications from wave 3–5) and the retrospective cumulative information reported in Wave 2 as a control variable (i.e. productivity at baseline). Measuring scholarly productivity in the first phases of one's academic career helps to account for potential nonlinear effects of career stage, assuming relative homogeneity among doctoral students in the years following Ph.D. completion.

Our analytical sample includes Ph.D. graduates who have complete information on scholarly productivity, measured by the number of publications (remaining $N. = 9,504$ person-years, excluded $N = 8,029$), are childless before Ph.D. completion ($N. = 6,529$, excluded 1,500) and work in academia after having obtained their Ph.D. ($N. = 2,369$, excluded 4160). We retain individuals with at least 2 observation-years ($N. = 1,049$, excluded 1,320) to apply random effects models. We use list-wise deletion of missing information on the dependent variable and covariates (excluded 161 observation-years, see Appendix, Table 3a). The final unbalanced sample counts 300 individuals and 888 observations-year. In detail, 387 observation-years are female academics, and 501 are male academics.

We exclude respondents who become parents before or during their Ph.D. to concentrate on new parents for several reasons. Firstly, substantial evidence indicates that the birth of a first child significantly impacts the diverging labour market outcomes of men and women (Tamm, 2018). New-borns and toddlers demand more time and supervision, likely leading to greater reductions in scholarly productivity. Additionally, our data does not allow us to assess transitions into parenthood for children born before the Ph.D., as this information is collected retrospectively and would remain constant in our longitudinal analysis. Secondly, it is well-documented that mothers often leave the labour market immediately after childbirth and tend to spend more time on childcare and housework compared to fathers, even years later (Bianchi et al., 2000). Hence, the first child may boost (re-)traditionalization, which is particularly relevant to our analysis on the role of gender and partner's employment status on the parenthood premium. Thirdly, since our data do not clearly determine exact parental leave per child, we assume that after the birth of a child, parents – especially mothers – take significant parental leave. Our variable 'having a child after the Ph.D.' captures these parental leave periods. Finally, as women tend to be younger than men at childbirth, female academics may be more likely to enter parenthood during their Ph.D., leading to earlier research output gaps that widen over time compared to academic fathers. Therefore, to avoid biases from differences in productivity trends between moms and dads who have children

before or during their Ph.D., our study focuses solely on ‘new’ parents – specifically, those who become parents after completing their Ph.D.

4.2. Measures

4.2.1. Dependent variable

Analogous to existing research (e.g. Lutter & Schröder, 2020; Fox, 2005; Hunter & Leahey, 2010), our dependent variable is *scholarly productivity*, measured as the number of articles published in peer-reviewed journals between each interview. It is self-reported and includes first-authored and co-authored German- and English-language publications. We correct for extreme outliers by truncating the distribution at the 99% percentile and recoding the outliers therein. The variable ranges between 0 and 24 articles and has a sample mean of 1.84 published yearly (see Appendix, Table 2a).

4.2.2. Independent variables

In the first set of models, we investigate the association between gender, parenthood and scholarly productivity and how becoming parents affects productivity differently for male and female academics. Here, our main explanatory variables are a dummy variable for *gender* (being male = 1, being female = 0) and a dummy for *having a child after Ph.D. completion* (= 1). The latter captures only people who become parents after the Ph.D., without further distinguish, however, between the first and the second/third child (second or higher-order births in the three-year observational window are $N = 22$) to not undermine statistical power.

4.2.3. Moderator

To investigate the heterogeneous effect of parenthood on mothers’ and fathers’ productivity, in a second step we focus on the two samples of academic men and women separately. We study the association between scholarly productivity, parenthood, and the *partner’s employment status*, including information on partnership status (single vs. married/in partnership) and the partner’s employment situation (not working, employed full-time, employed part-time). We assume that not working (unemployed or inactive) and having a part-time job offer more time availability for childcare than full-time employment. Therefore, our recoding for this variable results in the following: ‘Single’, ‘Partner full-time’, and ‘Partner not working or part-time’.

4.2.4. Control variables

All models include the following control variables. First, the dissertation’s discipline distinguishes between Social Sciences and Humanities (SSH) and Science, Technology, Engineering and Math (STEM). Despite most existing studies failing to account for individual motivation and organisational ability, such factors are essential controls in the association between childbearing and scholarly productivity (e.g. Stack, 2004). Childbearing may have a weaker effect on scholarly productivity among academics with strong motivation. As we do not have a direct measure for motivation, we use as proxy *academic intentions*, i.e. the intention to pursue an academic career after Ph.D. completion. The variable takes value one – ‘High intentions’ – when individuals classify their response in the two top categories on the scale ranging from 1 = ‘No, in any case’ to 5 = ‘Yes, in any case’ and takes value zero

otherwise ('Low intentions'). Moreover, childbearing may have a weaker effect on scholarly productivity among academics with strong organisational skills, as Ph.D. holders who can better manage family – and academia-related commitments may be more likely to have children during the early phases of their careers. Organisational skills are, however, difficult to measure and a direct indicator is not present in our data. Following Stack (2004), we assume that people with stronger organisational abilities may be able to complete their doctoral qualification faster. Thus, we use *Ph.D. duration* as a proxy, taking values: 'Up to 3 years', '4–6 years', '7–10 years', '11 years or more'. As our sample excludes respondents who had children before/during their Ph.D., we rule out cases of longer Ph.D. lengths due to maternity and paternity leaves. Nevertheless, the Ph.D. duration may be much dependent on supervisors and may also capture part time employment, sickness leaves and other family circumstances (i.e. caring for older parents) during the Ph.D. phase, which cannot be accounted for. Thus, Ph.D. duration is an imperfect proxy for organisational ability and results should be interpreted with caution.

Also, previous productivity levels may affect both future levels of productivity – i.e. path dependence – and the probability of having a child – i.e. reverse causality. Indeed, highly-productive Ph.D. candidates are more likely to secure the best jobs and, in the future, tenure, hence perceiving their careers as less uncertain compared to less-productive peers. Highly-productive academics may anticipate the transition to parenthood compared to lower-productive peers. Therefore, we control for *baseline productivity*, measured as the number of articles in peer-reviewed journals published before entering the academic labour market, including Ph.D. publications. The variable is measured in standard deviations from the mean number of articles published until the Ph.D. by the disciplinary area.

We finally control for *Ph.D. grade* (in ascending order: 'Cum laude', 'Magna cum laude', 'Summa cum laude' (although lower grades are possible, such cases are not present in our analytical sample)) and *Age* measured at Wave 1 (Up to 30; 31/34; 35 or older).

4.3. Analytical strategy

Table 1 presents a descriptive overview followed by different types of panel regression. Table 2 shows five random-effects models where the sample is pooled by gender: from models 1 to model 4, we estimate how gender and parenthood are related to publications independently to each other and whether parenthood mediates the gender-gap (Models 1 and 2); further, we add relevant controls, including baseline levels of productivity, to account for observed differences in career stages and prior accomplishment between parents and non-parents (Models 3 and 4). Finally, in Model 5, we add an interaction term between gender and parenthood to test whether there exists a motherhood penalty and/or a fatherhood premium in publications. The estimates interpretation is eased by plotting the Average Marginal Effects (AME) in Figure 1. Overall, Table 2 mainly serves as a baseline for our core contribution to be developed – i.e. the role of partner's employment – and to assess whether our results are in line with previous evidence for Germany (Lutter & Schröder, 2020; Joecks et al., 2014). Our main contribution is reported in Table 3 (and following Figures 2 and 3), which includes separate models for women and men. Herein, estimates show how parenthood and the partner's employment status (single, with a full-time employed partner – reference category – and with part-time or not employed partner) interact to shape scholarly productivity by gender.

Since our dependent variable counts the number of papers published in each wave and follows a non-normal, skewed distribution, we rely on Poisson regressions. For our longitudinal analysis, we use random-effects models. The advantage of such a modelling approach is that it enables us to estimate the gendered effect of parenthood on scholarly productivity, whereas the alternative fixed-effect modelling approach would estimate the effect of parenthood on scholarly productivity removing the effect of gender (time-constant characteristics). Nevertheless, to evaluate whether our baseline models are robust to unobserved characteristics, we replicate the analysis of Model 4 (Table 2) by using fixed-effects, that remove the influence of time-invariant covariates. Finally, scholarly productivity might also be related to unobserved factors influencing whether academics leave academia or not after completing the Ph.D. Thus, to avoid biases generated by the sample selection (Heckman, 1990), we also replicated the baseline analyses (Model 4) by using a random-effects Heckman selection model (xheckman). Robustness checks confirm the pattern of our main analysis based on random-effects models. Robustness checks full models can be found in the appendix.

5. Results

5.1 Descriptive analyses

Table 1 shows descriptive statistics of our analytical sample (pooled by wave). Men represent 56% of our sample of graduates who continue their academic career for at least five years after the Ph.D. completion. The gender distribution in our sample is in line

Table 1. Description of the analytical sample.

	Women	Men	Total
N. (Share)	137 (43.58%)	163 (56.42%)	300 (100%)
N. person-years	387	501	888
Productivity (standardised)	1.62 (1.92)	2.01 (2.81)	1.84 (2.47)
Children after Ph.D. (%)			
Yes	17.05	19.36	18.36
Partner's employment status			
Single	25.58	17.37	20.95
Partner in part-time/Not-working	16.02	28.74	23.20
Partner in full-time employment	58.40	53.89	55.86
Age at Ph.D. completion (%)			
Up to 30	55.30	31.34	41.78
31–34	37.98	50.90	45.27
35 or older	6.72	17.76	12.95
Disciplinary area (%)			
SSH	35.66	30.14	32.55
STEM	64.34	69.86	67.45
Ph.D. grade (%)			
Cum Laude	4.13	5.39	4.84
Magna cum Laude	61.76	45.91	52.82
Summa cum Laude	34.11	48.70	42.34
Ph.D. duration (%)			
Up to 3 years	27.13	22.55	24.55
4–6 years	67.70	71.46	69.82
7–10 years	4.13	5.59	4.95
11 or more years	1.03	0.40	0.68
Intention to pursue academic career after Ph.D. (%)			
High vs. low intention	65.63	73.65	70.16
Baseline Productivity (standardised)	0.21 (1.02)	0.34 (1.09)	0.28 (1.06)

with official statistics showing that in Germany in 2010 and the following years, around 56% of researchers who obtained a doctorate were male (She Figure, 2018). Men (70%) tend to be more represented than women (65%) in STEM disciplines. Although completing a Ph.D. might take longer for men than for women (23% of men complete their Ph.D. within the first three years vs. 27% of women), men tend to graduate with better grades than women, in line with other studies (e.g. Mastekaasa, 2005). The 19% of men and the 17% of women have children after completing the Ph.D. Almost 90% of men and 80% of women are below 35 years old. Male academics start their career with better (cumulative) performance (i.e. productivity at baseline), have higher intention of pursuing an academic career and tend to publish 0.4 papers per year in peer-reviewed journals more than women. The gender difference in average productivity is statistically significant in a mean-comparison test ($\Pr(T < t) = 0.0094$).

5.2. Baseline analysis

Models 1–4 in Table 2 present our findings on the relationship between gender ('Men'), parenthood ('Having children after the Ph.D.'), and scholarly productivity. Consistent with previous research, we identify a productivity gender gap, with men publishing 0.17 more papers than women after adjusting for age and discipline (Model 1). In Model 2, including the variable *Having children after the Ph.D.* shows that parenthood is associated with a significant increase of 0.67 papers for parents compared to childless academics, indicating a substantial 'incentive effect.' However, parenthood has a minimal impact on the gender-productivity gap. Model 3 adds controls like *Organizational abilities*, *Academic intentions*, and *Ph.D. grade*, which significantly influence the gender-productivity relationship. With these controls, the gender gap becomes statistically insignificant, and the parenthood gap diminishes slightly. In Model 4, we address potential biases

Table 2. Number of papers in peer-reviewed journals. Random effects models. Sample pooled by gender.

	Model 1	Model 2	Model 3	Model 4	Model 5
Men (ref. Women)	0.17**	0.16*	0.12	0.09	0.04
Children after Ph.D. (ref. No children)		0.67***	0.66***	0.54***	0.38***
Men#Children after Ph.D.					0.26
Age at Ph.D. (ref. 31-34)					
Up to 30	0.03	0.09	0.03	0.03	0.02
35 or older	0.05	0.14	0.18	0.11	0.11
Discipline area (ref. STEM)					
SSH	-0.22***	-0.23***	-0.26***	-0.24***	-0.24***
Ph.D. Duration (ref. 4–6 years)					
Up to 3 years			0.07	0.05	0.05
7–10 years			-0.11	-0.14	-0.14
11 or more years			0.11	0.14	0.12
Ph.D. grade (ref. Magna cum laude)					
Cum laude			-0.24	-0.13	-0.14
Summa cum laude			0.18**	0.1	0.09
High academic intentions (ref. Low intention)			0.02	0.03	0.04
Baseline productivity (standardised)				0.26***	0.25***
Constant	0.36***	0.19*	0.15	0.15	0.19*
Observations	888	888	888	888	888
Number of groups	300	300	300	300	300

Note: Robust standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

from reverse causation and path dependence by controlling for *baseline productivity*, yielding coefficients of 0.09 for men (not significant) and 0.54 for parenthood ($p < 0.01$). All in all, female and male academics show similar average productivity when accounting for parenthood and prior accomplishments. Moreover, having children appears to incentivize productivity rather than hinder it, supporting our H1 and prior findings on the parenthood premium among German academics (Lutter & Schröder, 2020; Joecks et al., 2014).

In Model 5, we introduce an interaction term between gender and parenthood to test H2 on the ‘Fatherhood super-premium.’ For clarity, Figure 1 illustrates the average marginal effects (AME) of the interaction based on Model 5. *Within genders*, academic fathers publish nearly 1.4 more articles than non-fathers, while the parenthood premium is half for academic mothers – i.e. 0.7 additional articles over non-mothers – but nonetheless significant. In the *between-gender comparison*, the productivity gap among childless academics is small (AME = 0.06) and not statistically significant, indicating similar scholarly productivity between childless men and women. However, among academic parents, the gender-productivity gap is notable and statistically significant ($p < 0.1$), with fathers publishing 0.8 more papers than mothers. The results from Model 5 support our hypothesis 2: the parenthood premium differs by gender, leading to a super-premium for fathers, who publish more than mothers in both within – and between-gender comparisons.

5.3. Robustness analysis

Results from our random-effects models are robust to a series of different model specifications described in the ‘Analytical Strategy’ section, in particular they are robust to

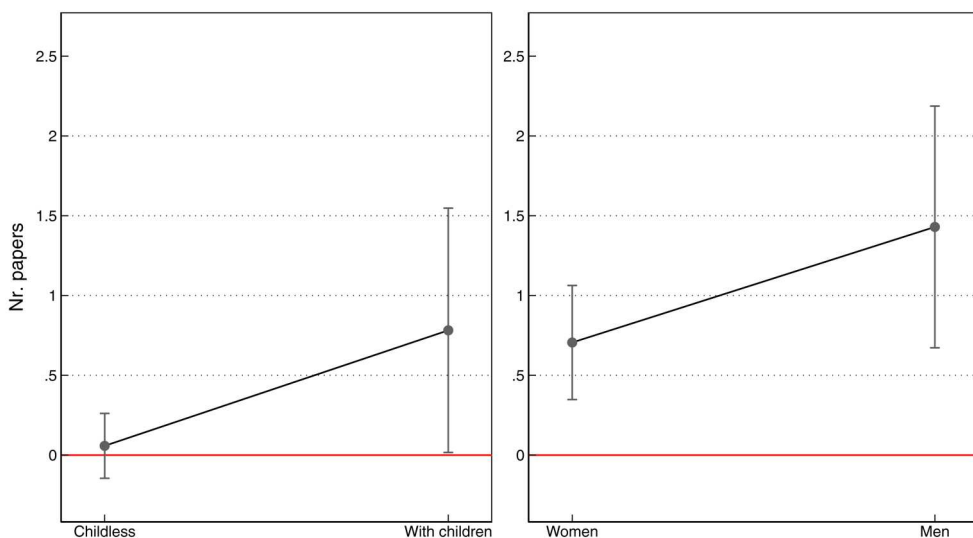


Figure 1. Number of articles published in peer-reviewed journals between 2017 and 2019 (measured in waves 3–5) by gender and parenthood status. Left panel: Average Marginal Effect of being male (vs. female) by parenthood status. Right panel: Average Marginal Effect of being a parent (vs. childless) by gender. 90% Confidence Intervals.

Note: The sample refers to a cohort of German Ph.D. holders who completed their Ph.D. between the winter semester of 2013/2014 and the summer semester of 2014. Estimates are based on Model 5 in Table 2.

possible selection into parenthood as shown by fixed-effects models (Table 4a in Appendix), which eliminate the influence of time-invariant unobserved factors that correlate with both fertility and productivity. Herein, we compare academic mothers' and fathers' pre- and post-childbirth productivity (i.e. within-individual comparison). Also, results are robust to possible selection mechanisms tested via the Heckman selection model that simultaneously estimates two equations, one for the association between parenthood and scholarly productivity for those who stay in academia, and the other for the association between parenthood and the probability of staying in vs. leaving academia after Ph.D. completion (Table 5a in Appendix).

5.4. Partner's employment for academic fathers and mothers

Table 3 provides the results for testing H3a and H3b on the role of partner employment on academic productivity of academic parents. It shows how parenthood interacts with partnership status and the partner's employment to shape scholarly productivity of academic men and women, separately. To ease the interpretation, Figures 2 (men) and 3 (women) graphically represent the main results. The left panel in the figures shows the predicted number of articles for academics with different partner employment statuses by childless and with-children academics. The right panels show whether the difference in productivity between parents and non-parents changes and is statistically significant for different partner employment statuses.

Table 3. Number of papers in peer review journals. Random effects models with interaction between partner's employment status and having children. Models are separated by gender.

	Men	Women
Children after Ph.D. (ref. No children)	0.28	0.42***
Partner's employment status (ref. partner full-time)		
Single	-0.03	0.16
Partner PT/Not working	-0.24	0.07
Children after Ph.D.#Partner's employment status		
Yes#Single	-	-
Yes#Partner Part-time/Not working	0.74**	-0.18
Age at Ph.D. (ref. 31-34)		
Up to 30	-0.13	0.18
35 or older	0.13	0.28
Discipline area (ref. STEM)		
SSH	-0.36***	-0.18
Ph.D. Duration (ref. 4-6 years)		
Up to 3 years	0.18	-0.03
7-10 years	-0.12	-0.17
11 or more years	0.42*	-0.44*
Ph.D. grade (ref. Magna cum laude)		
Cum laude	-0.41*	0.27
Summa cum laude	0.15	0.06
High academic intentions (ref. Low intention)	-0.06	0.23**
Baseline productivity (standardised)	0.29***	0.20***
Constant	0.35**	-0.04
Observations	501	387
Number of groups	163	137

Note: Robust standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The left panel in [Figure 2](#) (men) shows no substantial difference in (predicted) scholarly productivity among childless men who are single, partnered with full-time employed women, or men partnered with part-time employed/non-working women. On the contrary, among male academics with children after the Ph.D., those partnered with unemployed/inactive or part-time employed women tend to have significantly higher scholarly productivity than those partnered with full-time employed women (cases of single men with children are absent in the sample).

The right panel in [Figure 2](#) further shows that the fatherhood premium (differences between fathers and non-fathers) in scholarly productivity is larger (and statistically significant) among men partnered with a part-time employed or non-working woman – i.e. when the female partner has greater availability of time to care for the new-born – than among men partnered with a full-time employed woman. The fatherhood premium among the latter group is also present but statistically insignificant, albeit this might be due to the low numerosity of fathers in this group ($N. = 34$). Thus, the fatherhood premium is contingent on the partner's employment condition (and time availability).

[Figure 3](#) plots the results for academic women. The left panel shows no difference in predicted scholarly productivity between women whose partner is employed full-time and women whose partner is employed part-time or non-working, and this is true for both childless women and mothers (cases of single mothers are absent in the sample). Moreover, results in the right panel make evident that the parenthood premium – i.e.

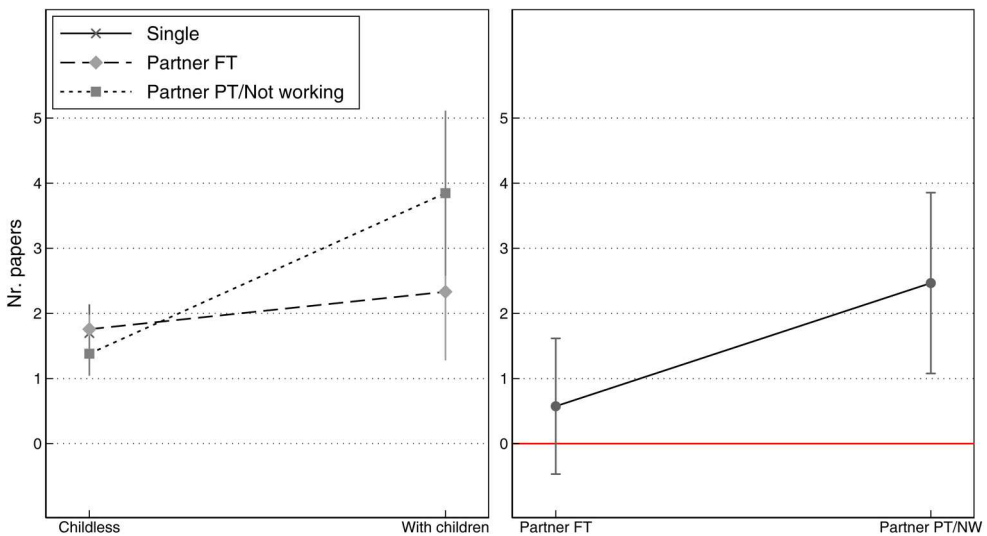


Figure 2. Number of articles published in peer-reviewed journals between 2017 and 2019 (measured in waves 3–5), sample of academic men. Left panel: Predicted number of articles published in peer-reviewed journals by academic men, by parenthood status and by the female partner's employment status. Right panel: Average Marginal Effect of being a father (vs. childless) by the female partner's employment status.

Note: The sample refers to a cohort of male German Ph.D. holders who completed their Ph.D. between the winter semester of 2013/2014 and the summer semester of 2014. Estimates are reported in [Table 3](#). FT = partner is full-time employed; PT = partner is part-time employed.

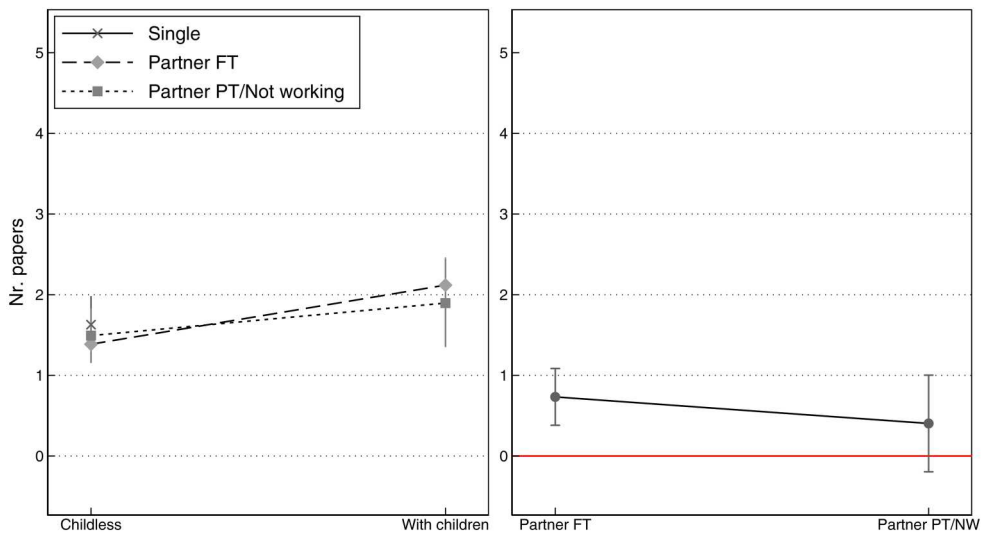


Figure 3. Number of articles published in peer-reviewed journals between 2017 and 2019 (measured in waves 3–5), sample of academic women. Left panel: Predicted number of articles published in peer-reviewed journals by academic women, by parenthood status and by the male partner’s employment status. Right panel: Average Marginal Effect of being a mother (vs. childless) by the male partner’s employment status.

Note: The sample refers to a cohort of female German Ph.D. holders who completed their Ph.D. between the winter semester of 2013/2014 and the summer semester of 2014. Estimates are reported in Table 3. FT = partner is full-time employed; PT = partner is part-time employed.

the difference between mothers and childless women – is small and almost of the same magnitude among women with a full-time employed partner and women with a part-time employed or non-working partner. Remarkably, the premium for women with part-time or non-employed partners is not significant, albeit this could be due to the very small numerosity of mothers in this group ($N = 13$). Shortly, we don’t find any substantial increase in productivity for mothers after childbirth when the male partner has greater availability of time to care for the new-born (part-time/non-working); rather, the motherhood premium seems to be independent from the partner’s employment status.

All in all, results from Table 3 show a gendered effect of partner employment status on the productivity of academic parents, supporting our H3b (gendered partner’s employment).

6. Conclusion and discussion

The discourse on work-life balance in academia is typically framed as a women’s issue, often neglecting academic fathers. While extensive literature addresses the motherhood penalty in career outcomes for academic women, little is known about how fatherhood impacts academic men. This paper fills that gap by examining the effect of parenthood on scholarly productivity – measured by the number of publications in the years following Ph.D. completion – using longitudinal data from a cohort of German graduates. We test whether academic parents experience a productivity

penalty or premium compared to childless academics, and we explore potential gender differences in this relationship. Importantly, we consider all parents, including fathers, as a heterogeneous group. We investigate whether the association between parenthood and scholarly productivity varies based on partnership and partner employment status and gender. This distinction is crucial, as family context can influence both scholarly productivity and the time dedicated to childcare and work (Jacobs & Winslow, 2004; Derrick et al., 2022).

Our baseline analysis mirrors patterns found in previous research on German academics (Lutter & Schröder, 2020; Joecks et al., 2014), showing that parenthood increases publication productivity for both academic mothers and fathers. Notably, this parental premium remains robust when controlling for baseline productivity (i.e. productivity before Ph.D. completion), unobserved constant heterogeneity (through fixed-effects estimation), and endogenous sample selection (via the Heckman selection model). Thus, our findings support prior literature viewing parenthood as a ‘positive incentive’ for publications. Newly graduated parents may enhance their productivity to secure sufficient tenure income, which is crucial for success in academia. Moreover, balancing an academic career with family life might help researchers gain perspective and work more efficiently (Ward & Wolf-Wendel, 2004; Joecks et al., 2014). However, our results could also reflect publication lags and the pressures of academia, suggesting that researchers might ramp up productivity before childbirth, with these efforts resulting in publications in subsequent years (Joecks et al., 2014). Analyzing publication dynamics around childbirth is not feasible with our data due to the lack of submission dates; hence, future research should improve data quality to disentangle these anticipatory effects.

Nevertheless, the parenthood premium varies both within and between genders. *Within-gender*, fathers publish 1.4 more papers than non-fathers, whereas mothers publish only 0.7 more than non-mothers – about half the premium. *Between-gender*, the gender gap among childless academics is minimal (AME = 0.06) and not statistically significant, indicating similar scholarly productivity between childless men and women. However, among academic parents, there is a notable and statistically significant gender-productivity gap ($p < 0.1$), with fathers publishing 0.8 more papers than mothers. This supports the concept of a ‘parenthood gender gap’ (Zheng et al., 2022), suggesting that productivity differences arise only among academic fathers and mothers, not between childless men and women. Overall, our results reveal a ‘fatherhood super-premium,’ with fathers outperforming both childless male academics and academic mothers.

Besides, our evidence suggests that childbearing is not the sole factor contributing to the gender gap in early scholarly productivity. Our stepwise baseline analysis (Table 2, Models 1–4) indicates that the gender gap narrows and becomes statistically insignificant once we control for scholarly productivity prior to Ph.D. completion and Ph.D. grades. Since men typically have higher average productivity during their Ph.D. and better grades, our findings imply that men’s advantages in scholarly productivity may begin at the doctoral level. Understanding the mechanisms behind this advantage, such as gender bias or discrimination (Llorens et al., 2021), is crucial because early career achievements lay the groundwork for future success in academia (Horta & Santos, 2016; Danell & Hjerm, 2013) and contribute to ongoing gender disparities in scholarly productivity (Lutter & Schröder, 2020). However, our data does not allow for an evaluation of these mechanisms, which we leave to future research.

The main contribution of our paper is its focus on the heterogeneity of the parenthood premium concerning partnership and partner employment status. We explored two alternative hypotheses through a gender lens. First, based on New Household Economics theory, we posited that both mothers and fathers benefit in terms of publications from partners with more time availability, such as those employed part-time or not at all (H3a). This idea suggests that couples strategize their division of paid and unpaid work in response to changes in each partner's employment (Becker, 1991; Lundberg, 1988; Lundberg & Pollak, 1996; Brines, 1994; Verbakel & De Graaf, 2009).

Conversely, drawing on theories about breadwinner couples (Aassve et al., 2014; Pinho & Gaunt, 2021) and 'doing gender' (West & Zimmerman, 1987; Tichenor, 2005), we hypothesised that the impact of a partner's employment is gendered, with academic mothers more likely to assume primary caregiver than fathers, even with non-employed or part-time partners. This is particularly relevant in Germany, where conservative gender and strong 'intensive motherhood' norms persist (Hays, 1996; Gangl & Ziefle, 2015; Sieverding et al., 2018), alongside ongoing gender gaps in labour markets (Schäper et al., 2023; European Commission, 2018; Directorate-General for Research and Innovation [European Commission], 2021).

In summary, we suggest that the 'fatherhood super-premium' – the higher productivity of academic fathers compared to both mothers and childless men – stems from the gendered division of domestic responsibilities after becoming parents. Our results support hypothesis H3b, indicating that fathers with unemployed, inactive, or part-time employed partners have greater scholarly productivity than childless men. In contrast, academic fathers with full-time employed partners exhibit productivity levels similar to childless men, suggesting that the productivity premium is driven by those who are primary breadwinners. In terms of academic mothers, having a stay-at-home or flexible partner does not result in increased work hours or productivity compared to mothers with full-time partners; the motherhood premium remains consistent across these groups.

Overall, our results align with previous findings on the gendered meanings and experiences of unemployment and inactivity for women, men, and their partners (Rao, 2020; Kowalewska & Vitali, 2024). We suggest that future research test the hypothesis regarding partner employment using larger samples and varied contexts, as this would enhance the statistical power and generalizability of the findings. The institutional context plays a crucial role in the relationship between gender, parenthood, and partner employment (Breen & Cooke, 2005): egalitarian societies facilitate the outsourcing of family responsibilities like childcare, whereas such tasks often fall to women in contexts with low gender equality, such as Germany. Additionally, our findings on partner employment complement Derrick et al. (2022), who argue that it is parental engagement – rather than parenthood itself – that explains the gender gap in scholarly productivity. This supports Jacobs and Winslow (2004)'s assertion that understanding gender disparities in academia requires consideration of both the academics' and their partners' characteristics.

This evidence has significant policy implications that require careful consideration and action. Recognising the impact of the gendered division of work on productivity disparities is essential for designing effective policies to promote gender equality in academia. Firstly, it is important to challenge societal norms and stereotypes around gender. Policies should contest the notion that women must shoulder a disproportionate caregiving burden, especially during childbirth. Promoting shared parental duties and encouraging

fathers to engage actively in childcare can help bridge the productivity gap. Secondly, academic institutions should implement gender equality and work-life balance policies, particularly supporting female academics during childbirth and early childcare. Robust maternity leave policies and sufficient availability of daycare centers for toddlers and preschoolers within the university can alleviate challenges for mothers, allowing them to sustain productivity and career growth (Gorodetskaya et al., 2023). This approach will also assist male researchers wishing to share childrearing responsibilities and foster support for female researchers with academic partners. Moreover, institutional policies should cultivate a supportive academic environment, including family-friendly initiatives that meet diverse faculty needs. Creating a culture that values work-life balance and prioritises employee well-being can enhance productivity and job satisfaction for everyone, while enabling those who wish to have children. Addressing the gender productivity gap in academia requires a multifaceted approach to tackle the gendered division of labour within couples. By challenging societal norms, promoting shared responsibilities, and implementing supportive policies, academic institutions can create an equitable environment that allows mothers and fathers to thrive professionally. Ultimately, closing the gender productivity gap benefits individual academics and contributes to a more equitable society and the advancement of knowledge.

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Conflict of interest disclosure

The authors declare that they have no conflict of interest.

Ethics approval statement

The authors declare that they have received the ethics approval by the ethical research committees of the relative research Institutes in order to carry out this study.

Authors contributions

Dr. Giulia Tattarini: Conceptualized the research questions and hypotheses, conducted literature reviews, designed the analytical strategy and performed quantitative data

analysis, drafted and revised the manuscript, including the results section. She was responsible for acquiring funding for publication. **Dr. Olga Gorodetskaja:** conducted literature reviews, provided access to the data, edited and revised the manuscript. **Prof. Agnese Vitali:** Conceptualized the research questions, edited and revised the manuscript, ensuring clarity and coherence throughout the text, and supervised the overall project. She was responsible for acquiring funding for the project.

Notes on contributors

Giulia Tattarini is a post-doctoral researcher at the Faculty of Business, Economics and Social Sciences at the University of Hamburg (ECSR member institution) in Germany. She was a Hans Boeckler Stiftung PhD scholarship holder at the 'Gute Arbeit Kolleg' at the Wissenschaft Zentrum Berlin and received her PhD in Economics and Social Sciences (Dr. rer. pol.) from the University of Potsdam in 2021. With a life course and gender perspective, Giulia has published research on the effects of unemployment and labour market insecurity on health and the moderating role of welfare states and the family in international peer-reviewed journals. She worked in the 'Parenting Academia' project in 2022 as Post-Doc fellow of the University of Trento.

Olga Gorodetskaya is a fourth-year PhD student at the Department of Sociology and Social Research at the University of Trento. Her research delves into the intricacies of gender inequality in Academia, employing a life-course perspective. Her academic interest has involved an in-depth exploration of the societal and institutional factors shaping the experiences of academics, particularly women, in navigating parenthood and career advancement within the academic sphere. With a specific focus on the interplay between parenthood and career trajectories among academics, she seeks to unravel the mechanisms that underlie these disparities. Her methodological interests lie in quantitative data analysis, with a particular focus on event history analysis, and in the design and implementation of sociological surveys.

Agnese Vitali, based in Trento, IT, is currently an Associate Professor of Demography at Università degli Studi di Trento, bringing experience from previous roles at University of Southampton and DONDENA Centre for Research on Social Dynamics. Agnese Vitali holds a 2008–2012 Doctor of Philosophy (Ph.D.) in Statistics at the Università Commerciale 'Luigi Bocconi'. With a robust skill set that includes Statistics, Stata, Econometrics, R, SPSS and more, Agnese Vitali contributes valuable insights to the industry.

ORCID

Giulia Tattarini  <http://orcid.org/0000-0001-7618-3622>

Agnese Vitali  <http://orcid.org/0000-0003-0029-9447>

Data availability statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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