PUBLISH OR PROCREATE: THE EFFECT OF MOTHERHOOD ON ACADEMIC PERFORMANCE

Women are underrepresented in science and representation deficits are even greater for more senior positions and in the STEM fields. Across career, female scientists tend to earn fewer promotions, receive less funding, and win fewer prestigious prizes than their male peers.

The dominant explanation is that male and female scientists, even within the same field, publish at unequal rates. This specific gender gap is particularly problematic as scientific productivity is one – if not the most important – key factor explaining access to funding resources, career progress, and more broadly scientific success.

Prior studies on select fields suggest that the gender gap in academic productivity reflects differential effects of childbearing on men and women, as women face tensions between the two greedy institutions of family and academia. Gaining a better understanding of the potentially differential effects of parenthood on scientists is thus central to the discussion about equality and inclusion in science.

We study the full population of STEM academics in Denmark from 1990 to 2018 and investigate parenthood penalties on scientific productivity of mothers and fathers, who are active in research prior to the birth of their first child.

We employ an event-study approach on annual research publications, an outcome especially relevant in the science domain, and rely on a unique combination of Danish registers and granular bibliometric data on publications from the database Scopus. Publications in scientific journals are recognized as a comparable, albeit imperfect, measure of productivity in the STEM fields. We measure individual changes in productivity after birth relative to own pre-birth productivity to accommodate field- and individual specific publication levels. In addition to controlling for time, age and year fixed effects in relation to first birth, we extend the model of Kleven et al. (2019) with PhD-age fixed effects to

control for any trend in scientific productivity over career. PhD age is defined as number of years before or after PhD graduation at the time of first birth.

Thanks to the combination of detailed register data on family dynamics and granular bibliometric data, we are able to precisely, identify the effect of childbirth on scientists' productivity among the universe of STEM academics employed in Denmark, thus avoiding the issues of selection or representativeness present in earlier studies.

We find that, on average, the first childbirth results in an annual penalty of 22 percent on scientific productivity of mothers in STEM fields relative to fathers in the first 5 years after birth. This reflects a drop in annual research publications of mothers relative to their own pre-birth productivity. The child penalty on mothers' productivity relative to fathers' is equivalent to a loss of close to 2 articles over the first five years after birth, when measuring the productivity penalty relative to own estimated productivity of 12 articles in the absence of children. The drop in productivity is neither explained by attrition nor by changes in publication strategy as reflected in quality-adjusted publications and citations. Annual productivity losses of mothers relative to fathers in the first years after birth result in cumulative productivity losses over time. Hence, unequal impacts of parenthood may be an important driver of gender inequality in Science.

Subgroup results indicate that choice of partner and family size play an important role for the severity of child penalties experienced by mothers. Having an academic partner tends to alleviate penalties, while having multiple children tend to aggravate penalties suffered by mothers around childbirth. In addition, the research environment of individual researchers plays an important role. We find that female academics, who depend on laboratory presence for conducting their research, experience larger child penalties relative to researchers in other fields. Female academics in laboratory-intensive fields face an average annual penalty of 31 percent in the first 5 years after birth, while female academics in other fields face a lower penalty of 16 percent. Hence, the laboratory-intensity of research field has a significant impact on the severity of penalties.

Our study contributes to the on-going debate on gender inequality in science by suggesting that the disproportionate impact of parenthood on male and female academics may be an important driver of such inequality. This is unsurprising as mothers continue to take the lion's share of parental leave and childcare responsibilities at home compared to fathers. Up until today parental leave entitlements for women have been much more generous than those for men in Denmark, substantially creating inequality in the allocation of leave between parents and reinforcing gender stereotypes on task allocation in households.

, One potential limitation of our work is that we are studying a very specific context, which may not generalize to other countries. Indeed, Scandinavian countries are often praised for their high rate of female participation in the labor force and their generous policies in support of families. However, we believe that our results are of interest to the broader scientific community for at least two reasons. First, as we are analyzing a context where families enjoy relatively generous support, we would expect our results to underestimate the actual penalty in terms of scientific productivity that academic mothers would face in countries where such support is lower or non-existent. Second, while gender norms are generally perceived to be more egalitarian in Scandinavia than elsewhere, it appears that in reality gender attitudes in Denmark are quite traditional, when it comes to the labor supply of women after having children, and in line with prevalent values in countries such as the UK or the US. This suggest that Danish female researchers face similar pressures at home in terms of disproportionate allocation of childcare duties.