Structural labor market change and fertility in Norway

Introduction

The structure of labor markets in many Western countries is polarizing as jobs involving high routine cognitive and manual tasks are automated or offshored to low-wage emerging economies, thinning out employment in routine-intensive middle-income occupations (D. H. Autor and Dorn 2013; Michaels, Natraj, and Van Reenen 2014). The process has been ongoing for the last decades, and is expected to continue as technological progress further expands the set of potentially automatable tasks (Frey and Osborne 2017; Manyika et al. 2017). Such routine-biased technological change will differentially affect career and economic prospects of occupational groups, affect their health (Bratsberg, Rogeberg and Skirbekk 2021), with potential knock-on effects on fertility patterns. In the present study, we draw on Norwegian administrative data registers with full population coverage to examine whether the routine intensity of an employee's early-career occupation is associated with fertility over a 14-year follow-up period.

We present results for four sets of analyses covering four separate outcomes. The first analyses are to verify that the occupational risk score – when measured at age 25-35 – captures persistent differences in occupational RTI scores at the worker level. We do this by testing whether the RTI of the last job held by a sample participant across the 2007-2020 period can be predicted using their baseline (2006) RTI score.

The second set of analyses are to verify that the occupational risk score is associated with long-term employment outcomes, as predicted by the theory of skill-biased technological change that motivates its use. We do this by testing whether the probability of employment in 2019 can be predicted using an individual's baseline RTI score.

The third set of analyses examines how the occupational risk score is associated with fertility, measured as the total number of children born to an individual across the 2007-2020 period.

Finally, we also examine whether baseline RTI score is associated with long-term singlehood, measured as being neither married or registered as cohabiting with another adult in the population register.

The same analyses are performed on each of these four outcomes:

A bubble scatterplot is used to show each occupation's 2006 RTI score against the average long-term outcome of those employed in the occupation at baseline. This plot allows us to visually assess the association between RTI score and outcomes, potentially uncovering non-linearities or outlier issues.

Next, four regression specifications are estimated for each outcome, with the coefficients of interest and their 95% confidence intervals shown in summary plots (full output tables for the two main outcomes of interest are included in Supplementary Materials – Tables A 1 and A 2). As we use linear least-squares regression models, the two binary outcomes (employment and singlehood) are estimated within a linear probability model.

The first specification (labelled "Raw") simply regresses the outcome on the standardized RTI score of each person's base-year occupation. A second (labelled "+ age & edu") estimates the "residual association" remaining between RTI and outcome after adjusting for age and educational differences at the individual level. A third specification adds firm fixed effects, which control for any constant differences between employees employed in different firms. This brings us closer to the association between *occupational* risk and outcomes, by comparing workers in high-RTI occupations to their within-firm colleagues in other occupations. Finally, a fourth specification adds in family fixed effects, which further controls for any time-invariant influences operating at the family level.

Note that the fixed effect specifications will tend to use smaller data samples, as they can only use workers with same-firm colleagues (in the firm FE model) and workers with employed siblings (in the family FE model).

Results

Table 1 shows descriptive characteristics of the analysis samples, separately by gender.

Table 1 – Descriptive statistics, analysis samples.

	Men		Women	
	All (1)	Restricted sample (2)	All (3)	Restricted sample (4)
Observations	214 134	87 545	190 111	78 980
Age 2006	30.4	30.4	30.4	30.4
Educational attainment 2006				
Below upper secondary (%)	18.3	15.6	14.4	12.2
Upper secondary (%)	46.0	44.9	32.5	30.1
Bachelor (%)	25.4	27.5	43.6	47.4
Post-graduate (%)	10.4	12.0	9.5	10.2
RTI 2006	0.228	0.193	-0.257	-0.306
RTI last observed job	-0.071	-0.100	-0.486	-0.519
Employment 2019	0.929	0.941	0.905	0.916
Single 2020	0.270	0.257	0.257	0.247
Children born 2007-2020	1.012	1.060	0.894	0.931

Note: Samples are drawn from the November 2006 employment file of the Norwegian welfare administration and are limited to wage earners age 25-35. Samples in columns (2) and (4) restricted to those with at least one sibling and one co-worker in the data extract, number of families is 78 422 and number of firms is 17 859. RTI score is standardized to have mean zero and standard deviation one in 2006 workforce.

The "raw" correlations between occupational RTI scores and average long-term outcomes are displayed as bubble scatterplots in Figure 1. This finds the standardized RTI scores to be strongly associated with all four outcomes in an approximately linear relationship.

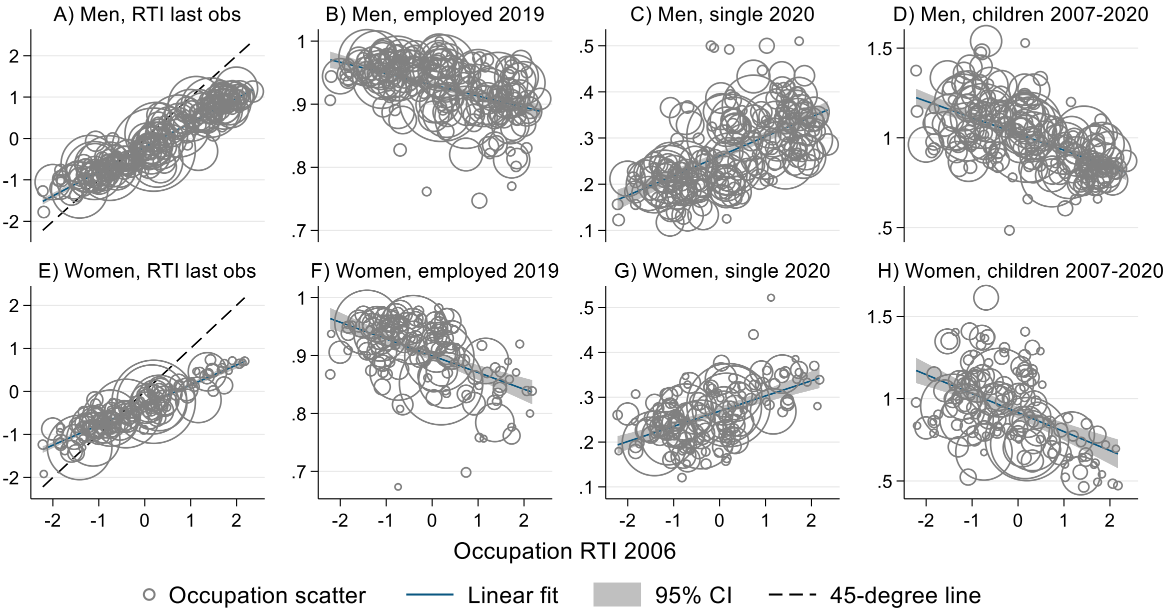

Figure 1 - Occupation-level bubble scatterplot of standardized base-year RTI score and average employee outcomes

Note: Scatter points show the mean outcome in 2019/2020 versus the occupation RTI score in 2006 for workers in each of 209 (men) and 147 (women) occupations. Occupations with fewer than 100 workers in the sample age range (25-35) in 2006 are omitted from the figure. Scatter points are weighted by the observation count in 2006. RTI score is standardized to have mean zero and standard deviation one in the 2006 workforce.

Discussion

Using an analysis sample covering all Norwegian employees aged 25-35 in 2006, we find that occupational structural risk at baseline covaries with long-term fertility outcomes, with similar coefficient sizes for men and women. The association is markedly attenuated in analyses adjusting for individual age and education at baseline, but no further attenuation was observed in models additionally adjusting for time-invariant differences between firms and families. Although statistically significant, the magnitude is small to moderate – with a 1 standard deviation increase in baseline occupational RTI score associated with an expected reduction of 0.04 (95 CI: 0.03-0.06 for men and 0.02-0.06 for women) children born within the observational window. In percentage terms relative to sample means, this is a fertility reduction for both men and women of about 4%.

These results from the main analysis are consistent with a causal effect of structural economic risk on fertility. Our exposure measure (baseline occupational RTI) predicts occupational RTI 15 years later, indicating that it captures long-term exposure to structural economic risk. This exposure measure is derived from a theory of skill-biased technological change, which asserts that high-routine jobs are automated and gradually disappearing from the labor market. In line with this, we find occupational baseline RTI-score (negatively) associated with the probability of being employed 13 years later. We find fertility of both men and women to be robustly associated with baseline occupational RTI scores, and having a high RTI occupation at baseline is further associated with an increased likelihood of being without a registered spouse or cohabitant 14 years later.

Although coefficients were estimated separately for men and women, we found both the sign and magnitude of the estimates to be similar with no indications of substantial sex-related differences.

While our pattern of results is consistent with a causal story, our research design cannot rule out residual confounding as an alternative explanation. Selection into occupation systematically sorts people into high and low RTI occupations based on their interests and aptitudes, which would create a fertility-RTI gradient if these sorting factors are themselves correlated with fertility. If selection effects were important, however, we would have expected to see increased attenuation of coefficient sizes as we expanded the model to adjust for family and firm fixed effects. There is no sign of this happening for the fertility coefficient.

A key strength of our study is the use of administrative data registers with full population coverage. This allows us to construct attrition-free panel data samples that are representative of the population, and ensures that we have sufficient statistical power to estimate even data-demanding models with firm and family fixed effects. The study also benefits from the use of an already established and theory-derived measure of structural economic risk.

The generalizability of the results to other national contexts is hard to assess. The qualitative result that fertility is reduced by structural economic risk is in line with the existing literature using trade- or automation shocks at the regional level (e.g., Seltzer 2019; Kearney and Wilson 2018; D. Autor, Dorn, and Hanson 2019). The magnitude of the coefficients, however, may be expected to differ. The exposure measure captures differences in occupational task content, making it at best an indicator of the *potential* for automation or offshoring. The extent to which this potential is realized through, e.g., restructuring of production processes, will also depend on the costs and benefits involved, which may differ across countries and periods. Norway is characterized by low social and economic inequality, strong unions, and a relatively generous welfare system, which may dampen both the risk and consequences of employment loss.