

Deroutinization of Labor and Second Birth in West Germany: The Moderating Role of Childcare

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Abstract

Technological change and globalization have transformed the structure of labor markets in advanced economies, creating a divide between highly skilled workers engaged in abstract tasks—who are increasingly in demand—and those performing routine tasks, for whom demand has declined. To date, only a limited number of studies have explored the fertility implications of these long-term structural shifts. This study contributes to the literature by examining the relationship between changing labor demand and second birth rates, while also considering the moderating role of childcare availability. We draw on data from the Employment Survey of the German Federal Institute for Vocational Education and Training and the Bundesagentur für Arbeit, which provide detailed information on abstract and routine tasks performed by workers in West Germany. Using these sources, we construct measures of regional abstract and routine task intensities and track how they evolved over time to capture changes in labor demand across regional labor markets. Additionally, we develop occupation-level measures of task intensity and link them to individual fertility and employment histories derived from a 2 percent random sample of women in the German Pension Fund. Our findings show that women in routine occupations were least likely to have a second child in regions that experienced the sharpest declines in routine employment, compared to those in regions with more stable routine job availability. Women in highly abstract occupations were generally more likely to have a second child than their counterparts in routine jobs, and their likelihood of doing so was negatively linked to the degree of abstract job expansion in their region. Moreover, childcare availability did not moderate this relationship.

1 Introduction

Over the last few decades, advancements in technology and the effects of globalization have brought about significant changes in labor markets within advanced economies (Acemoglu & Johnson, 2023; World Bank, 2019). These shifts have also led to new divisions in the workforce, contributing to widening gaps in wages, job security, job flexibility, and career opportunities. A key divide now seems to exist between workers engaged in abstract (cognitive) tasks and those involved in routine tasks. The demand for abstract tasks—whether analytical or social/interpersonal—has been steadily increasing, particularly in rapidly growing high-tech industries and specialized areas like consumer services, business, and education (Acemoglu & Autor, 2011; Cortes et al., 2021). The expansion of information and communication technologies has enabled workers in abstract jobs to gain more flexibility in how and where they work, although this often comes with increased responsibility for their work outcomes (Van Echtelt et al., 2009). Meanwhile, the demand for workers performing routine work has been declining, as these tasks are more susceptible to

automation or being outsourced to countries with cheaper labor (Acemoglu & Autor, 2011; World Bank, 2019). This transition from routine tasks to more abstract ones has been termed *deroutinization* by labor economists.

These developments may not only exacerbate labor market inequalities between highly skilled and lower-skilled workers but could also influence family-related decisions, such as the timing and likelihood of becoming parents and transitioning to higher order births. Demographers widely agree that factors like earning prospects (Oppenheimer, 1997), job security (Adserà, 2011; Alderotti et al., 2021), and the ability to balance paid work and family life (Begall et al., 2014; Osiewalska et al., 2024) are crucial determinants of family behavior. The increasing demand for highly skilled workers and the greater flexibility in work schedules offer abstract workers better opportunities to earn a living, thereby enhancing their conditions for having children. However, these same labor market changes disadvantage low- and medium-skilled workers by rendering routine job tasks obsolete (Arntz et al., 2017b). *deroutinization* is likely to affect childbearing not only by reducing income sources and increasing economic uncertainty for many workers, but also because routine jobs have traditionally been more compatible with childrearing than the typically more demanding abstract occupations (Adda et al., 2017; Adsera & Querin, 2023). Since these structural shifts in the labor market are long-lasting, unlike the temporary nature of economic recessions, they may lead to enduring changes and growing disparities in fertility behavior between workers in abstract versus routine jobs. Understanding how these labor market dynamics influence childbearing is essential, not only for interpreting past fertility trends but also for anticipating future patterns.

Previous demographic research has offered substantial evidence on the relationship between unemployment, income, type of work contract, and subjective perceptions of employment and financial uncertainty with birth behavior (Adserà, 2011; Alderotti et al., 2021; Kreyenfeld, 2009; Matysiak et al., 2021). By employing well-established measures of employment and economic uncertainty, these studies have illustrated how economic vulnerability and the challenges of balancing paid work with caregiving responsibilities influence birth transitions, with patterns differing by context and gender. Recently, demographers have begun exploring the impact of these structural, rather than cyclical, labor market changes on fertility. Most studies conducted so far adopted a macro-level approach (Anelli et al., 2024; Matysiak et al., 2023; Seltzer, 2019). They indeed found fertility decline in regions with high levels of automation, in particular among less skilled workers. In a micro-level study on cognitive work and entry to parenthood in Germany, Bogusz et al. (2024) found that workers in highly abstract jobs (i.e., those in high demand) were most likely to postpone their first birth, but were overall the least likely to remain childless at the end of their reproductive age. The authors concluded that structural shifts in the labor market have exacerbated disparities between low- and high-skilled individuals, not only within the labor market but also in the realm of family formation. We believe that structural labor market changes might affect transitions to higher-order births as well, because they result in a growing class divide between workers with abstract jobs and those with routine jobs. While the debate on the education-fertility nexus is lively (Ciganda et al., 2024; Neels et al., 2024), recent studies have shown a positive relationship between (occupation-based) social class and second birth in Germany (Kreyenfeld et al., 2023), Spain (Baizan, 2020), as well as Austria, France, Norway, and the United Kingdom (Baizan, 2021).

In this study, we contribute to the debate on how structural labor market changes affect fertility and whether they contribute to widening disparities in childbearing between high- and low-skilled workers (we focus on women since data limitations prevent studying men). More specifically, we examine how the process of *deroutinization*, reflected in a transition from routine to abstract jobs in local labor markets, affects the transition to a second birth in West Germany. In line with the past literature on the labor market situation of young adults and their fertility behaviors, we expect that *deroutinization* leads to a decline in second-birth risks among workers most exposed to the negative employment consequences of this change, namely those who perform routine jobs. We thus anticipate that routine workers will display lower second-birth probabilities in regions where the *deroutinization* process is most advanced (i.e., regions with a low

prevalence of routine jobs and/or high availability of abstract jobs), and higher probabilities in regions with a greater availability of routine jobs (**Hypothesis 1**). We also expect the expansion of abstract jobs, which benefit the employment and earning opportunities of abstract workers, to affect their second-birth risks; though this relationship is more complex, as attractive employment opportunities may also conflict with childrearing. As a result, we hypothesize that abstract workers will have higher second-birth probabilities in regions which experienced stronger expansion of abstract job opportunities, provided that the region offers good childcare opportunities (**Hypothesis 2**). In contrast, in regions where abstract workers face strong employment opportunities but limited childcare provision, we expect their second-birth probabilities to be similar to—or even lower than—those of comparable workers in regions where job opportunities have not expanded as significantly.

This study is situated in West Germany, where structural changes in the labor market are particularly pronounced, as evidenced by the widespread adoption of industrial robots (Dauth et al., 2021; Deng et al., 2023) and the increasing demand for cognitive labor (Bogusz et al., 2024; Rohrbach-Schmidt & Tiemann, 2013; Spitz-Oener, 2006). Germany is also one of the few European countries that maintains modernized manufacturing and competes in production processes (Dauth et al., 2017; Thelen, 2019), rendering it potentially susceptible to import competition. Additionally, West Germany is characterized by a conservative welfare regime, where many women transition to part-time employment upon becoming parents (Arntz et al., 2017a). Historically, cohort fertility rates in Germany were among the lowest in Europe, with high rates of childlessness (Sobotka, 2017). For instance, the cohort fertility rate dropped from 1.72 for women born in 1950 to 1.56 for those born in 1965 (Human Fertility Database, 2024). In recent years, the link between employment characteristics and fertility has become less gendered, with both men’s and women’s unemployment and low wages contributing to lower fertility rates (Lambert & Kreyenfeld, 2023). Finally, it is important to note that East–West differences in fertility behavior have largely converged since unification (Goldstein & Kreyenfeld, 2011). However, childcare use remains much lower in West Germany than in East Germany (Statistisches Bundesamt, 2024).

2 Data and Methods

In order to address our research objectives, we make use of several data sources. First, we use micro-level high quality administrative data from the German Pension Fund (2 percent random sample) covering the years 2012–2019 (i.e., those for which occupational codes are available; Forschungsdatenzentrum der Rentenversicherung (FDZ-RV), 2024a, 2024b). We focus on women, as the data do not contain information about births for men. Linking partners is impossible and data on educational level is of poor quality. However, the data contain employment histories of women and regional codes corresponding to the region (Landkreise—the third level of administrative territorial division in Germany) in which a person lives. We leverage this information to link data on the share of children aged below three in daycare in a region (Statistisches Bundesamt, 2024).

Second, in order to characterize the abstract / routine task intensity of the occupation a woman works in we make use of the detailed data on the task content of occupations using data from the 2006 Employment Survey conducted by the German Federal Institute for Vocational Education and Training (Hall & Tiemann, 2020). This data covers West Germany only and enables us to create measures of abstract and routine task intensity at the three-digit occupational level (Rohrbach-Schmidt & Tiemann, 2013). We then merge these occupation-specific contextual data with the individual data from the German Pension Fund. This is possible thanks to the fact that the German Pension Fund data provides detailed information on occupational codes for each job a woman works in.

Finally, we construct indicators of long-term changes in the task content of jobs within regional labor markets (*Kreise*–NUTS-3) to capture the extent of deroutinization and the shift toward greater abstract task

intensity. To this end, we use data on regional employment structures by occupation from Bundesagentur für Arbeit linked to the Employment Survey to compute long-term changes in regional task intensities. Our focus on long-term change reflects the fact that structural labor market transformations in West Germany began as early as the 1980s. To adequately assess the decline in routine jobs and the rise of abstract tasks, it is essential to include the early stages of this process. We are lucky to have access to regional occupational structures from 1987, i.e. the oldest point of time for which we could merge the two datasets, and 2010—before the start of the fertility data. The computed relative (in percentage points) changes in regional routine and abstract task intensity between 1987 and 2010 capture regional trends in deroutinization and the increasing prevalence of abstract tasks (see Figure 1). We link them to individual fertility histories based on the region of residence which allows us to model how the changes in the regional labor market conditions affect women’s fertility behaviors.

To analyze transitions to the second birth, we employ discrete event-history models with a cloglog link and duration measured in months in a piecewise constant fashion. We start observing mothers in the month they had their first child and stop observing them once they transition to the second child or end their reproductive life (we observe the last births at age 49). The data are right-censored for women who have neither reached age 49 nor had a second birth. The total number of women in our sample is 69,297, while the total number of person-months is 2,280,568. Around 75 percent of women who gave birth to their first child between 2012 and 2019 transitioned to a second birth within that period. Most second births occur in the second year following the first birth.

The abstract and routine task intensities are the primary covariates of interest. In the first step, we interact the task intensities - first those at the occupational level (lagged by one year) and next the regional ones - with the process time (duration since the first birth). We do so to examine whether the effects of explanatory covariates on the hazard rates are constant over time. After testing whether the proportionality assumptions are met, we move to the core steps of the analysis. We thus interact the occupation task intensities with those expressed as changes at the regional level (separately for the abstract and routine measures) to see to what extent the impact of occupational-level task intensity on the transition to the second birth depends on what jobs are available in the region. It also allows us for testing Hypothesis 1. In the second step, we estimate models including a three-way interaction between regional abstract task growth, occupational abstract task intensity, and regional childcare availability. This specification allows us to test the hypotheses 2a and 2b that childcare availability moderates the relationship between abstract task growth and second birth risks, conditional on a woman’s occupational profile.

The occupation-level continuous task measures are transferred into the following four categories: low [0, 33), medium[33, 66), high [66, 100], and the residual category (inactive, unemployed, occupation missing). We do not use them as continuous variables, to account for individuals without valid task measures in the sample (however, we do not show results for the "residual" category). In all models, we control for the Bundesland in which a woman lives, age (in years), duration (from the first birth, in years), as well as calendar year and month fixed effects. We do not control for education for the following reasons. First, data on educational attainment are incomplete in the register of the German Pension Fund—information for 30 percent of people is missing in a non-random way. Second, education can be characterized as a bad control in our setting (Cinelli et al., 2022), as having a highly abstract job almost perfectly predicts being highly educated (but not the other way around). We present model results as average predicted probabilities.

3 Results

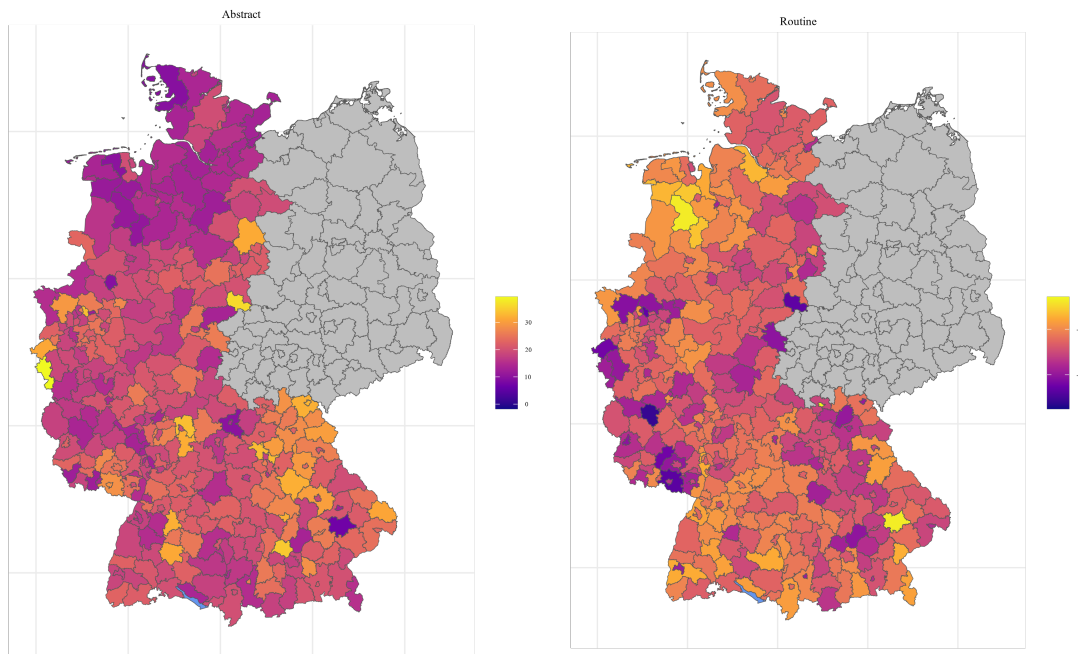
3.1 Descriptives

First, we present descriptive evidence on changes in regional task content of jobs. In general, over the period 1987 and 2010 West Germany experienced the major increases in the abstract content of jobs in and around

major cities (see Figure 1). In regions such as Dachau or Aschaffenburg near Munich, the proportion of abstract jobs increased by 35 pp, around the highest values observed in the data. In contrast, in other regions there was virtually no increase in abstract jobs. It is noteworthy, that jobs became more abstract all over West Germany and no decline in that respect was observed. By contrast, almost all of the country experienced a decline in routine tasks (deroutinization). The process was clearly the strongest in traditionally industrial regions of West Germany, such as Saarland and Ruhrgebiet, where the prevalence of routine jobs shrank by more than 10 pp.

We then used this information on the regional variation in the changes in abstract and routine task intensity as a covariate in second birth hazard models in order to test our hypotheses. Because they may not only affect the second birth probabilities but also the timing of births, we first interacted the changes in regional task intensities with the duration since the first birth (in years; see Figure 2) to test for the proportionality assumption. In our models, we observed mothers for up to seven years after the first birth, during which 75% of the women in our sample have a second child.

Figure 1: Regional task measure change (1987-2010; Landkreise).

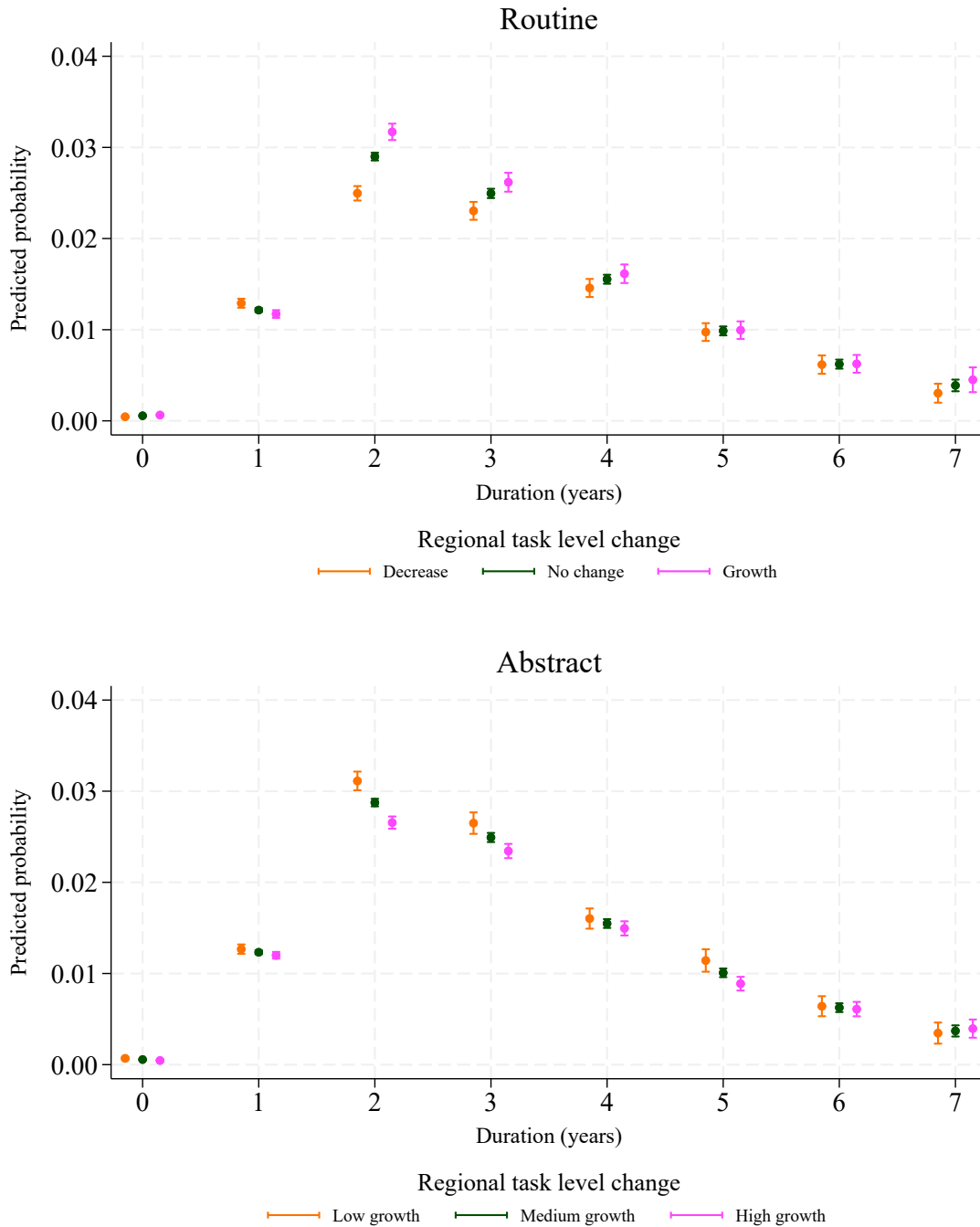


Note: The changes are relative and expressed as percentage points.

Second birth rates appear to be clearly linked to structural changes in the labor markets (see Figure 2). Regions that experienced the most significant decline in routine jobs show the lowest second birth rates, while those with only a slight increase in routine jobs display the highest birth rates. However, the timing of second births does not appear to differ across regions with different levels of deroutinization.

The differences are somewhat less pronounced when considering the expansion of abstract jobs. Regions with stronger growth in abstract tasks tend to have slightly lower second birth rates than those with only modest increases, and women in the latter regions also tend to have their second child slightly earlier, though these differences are relatively minor.

Figure 2: Average predicted probabilities from second-birth models (with 95 per cent confidence intervals): Interaction of regional task measure change with **duration**, West Germany. N = 2,280,568.



3.2 Has the structural change in the labor market affected childbearing of all female workers equally?

Deroutinization did not affect all women's childbearing in the same way. Figure 3 presents average predicted probabilities of a second birth based on models that interact occupational-level task intensities with regional-level changes in task measures. The upper panel illustrates how predicted second birth probabilities vary among women with differing levels of occupational routine task intensity, depending on the degree of deroutinization in regional labor markets. The lower panel presents parallel findings for women employed in occupations with varying levels of abstract task intensity across regions with different rates of abstract job expansion.

Women employed in occupations that are intensive in routine tasks were least likely to give birth to the second child if they resided in regions that experienced strong deroutinization. These women were likely the most exposed to the adverse consequences of deroutinization, such as layoffs or stagnating wages among routine workers. In contrast, women in routine occupations living in regions with limited deroutinization showed higher second birth risks, particularly in areas where routine jobs even increased slightly. These findings are fully consistent with our expectations (Hypothesis 1). In addition, second birth probabilities among women in less routine-intensive occupations appeared largely unaffected by the degree of deroutinization in regional labor markets. These women either performed highly abstract or manual jobs and avoided the negative consequences of the structural labor market change.

The findings related to abstract tasks are more ambiguous. Predicted second birth probabilities are generally higher for women employed in more abstract occupations, provided that the region experienced an expansion of abstract job opportunities. However, women in highly abstract occupations did not exhibit higher second birth probabilities in regions that experienced the strongest expansion of jobs intense in abstract tasks compared to similar women in regions with only modest growth in this type of jobs. This suggests that women in abstract occupations were not more likely to have a second child in regions where they could have seized the employment opportunities adequate for their skill set. A likely explanation for this finding is the persistent work–family incompatibility associated with abstract occupations, which are often demanding and less conducive to combining paid work with family life. This raises an important question: would highly skilled women in abstract jobs residing in regions which offer them good career prospects be more likely to have children if they had access to better childcare support? We explore this question in the next section.

3.3 Expansion of employment opportunities for women in abstract jobs and childcare availability

In this section, we focus on women performing abstract occupations and residing in regions which experienced strong expansion of abstract jobs. We examine whether they would be more likely to give birth where there is a higher fraction of daycare usage on regional level. To this end, we performed a three-way interaction between regional childcare availability, regional abstract task growth and occupational abstract task level (see the right panel of Figure 4).

Our findings demonstrate that regional childcare availability is indeed positively, though insignificantly, related to second birth probabilities among women performing highly abstract jobs —except in regions experiencing the highest levels of abstract task growth ($abstract_diff = 0.3$). It thus appears that better childcare availability may help subsequent childbearing of women in highly abstract jobs but not in regions where employment opportunities for these women expanded particularly strongly. These findings are not consistent with out Hypothesis 2.

Figure 3: Average predicted probabilities from second-birth models (with 95 per cent confidence intervals): Interaction of regional task measure change with **occupational task level**, West Germany. N = 2,280,568.

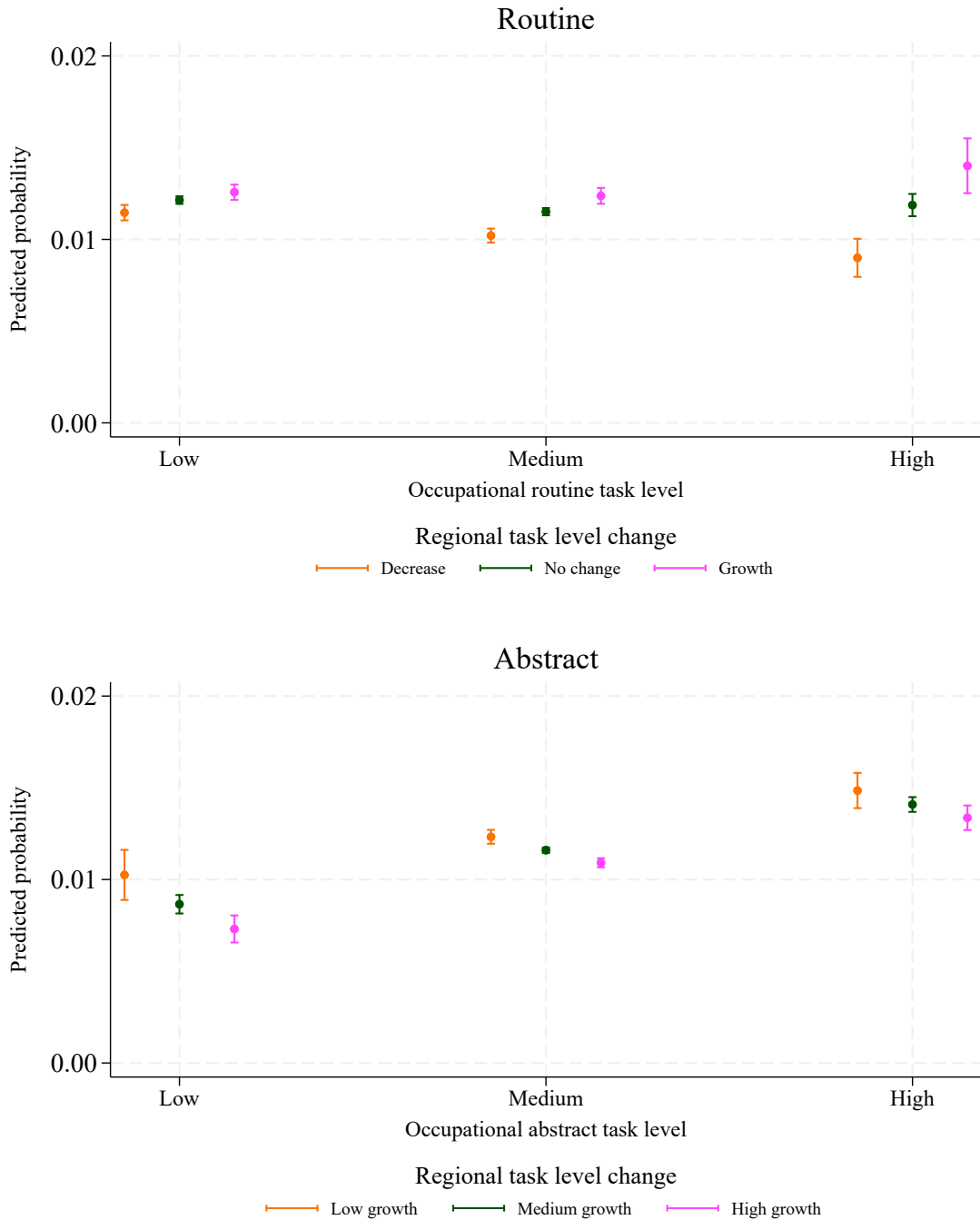
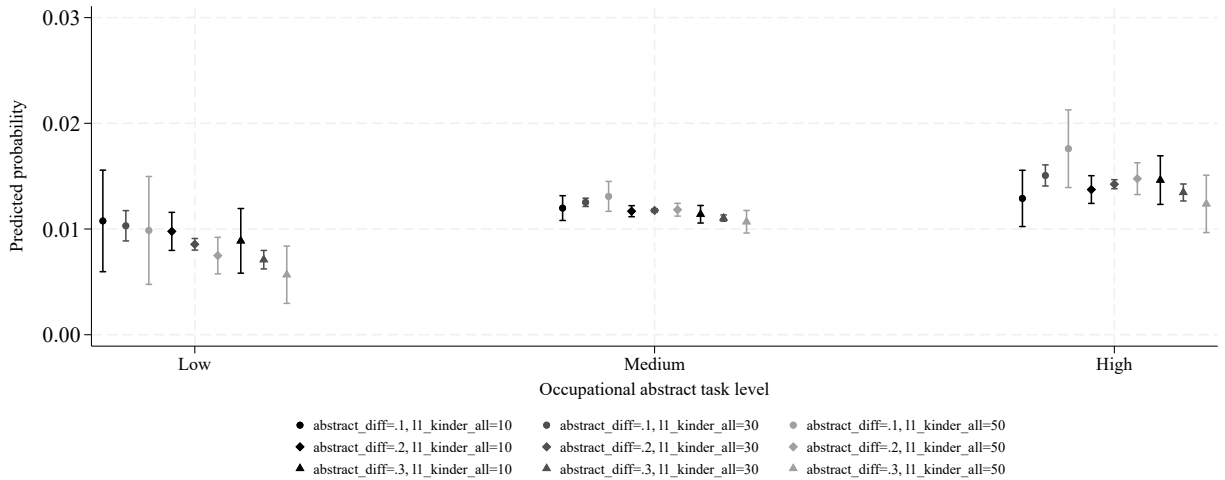


Figure 4: Average predicted probabilities from second-birth models (with 95 per cent confidence intervals): Interaction of abstract regional task measure change with **abstract occupational task level** and the **share of children in daycare**, West Germany. N = 2,280,568.



Note: *abstract_diff* is equal to 0.1, 0.2, and 0.3 (on a scale from 0 to 1) for low, medium, and high abstract task growth, respectively.

4 Conclusions

This study examined the relationship between changing labor demand for tasks, workers' skill sets, and second birth rates, with particular attention to the moderating role of childcare availability. We hypothesized that workers in routine occupations would have lower second birth rates in regions that experienced strong deroutinization, compared to similar workers in regions less affected by structural labor market change (Hypothesis 1). We also anticipated that workers in abstract occupations would have higher second birth rates in regions with significant expansion of abstract jobs, provided that childcare was readily available (Hypothesis 2).

Our findings offer strong support for Hypothesis 1, but more limited evidence for Hypothesis 2. Nonetheless, they indicate that women in highly abstract occupations tend to have higher second birth probabilities than those in more routine jobs—particularly in regions that experienced substantial growth in abstract employment. Taken together, these results suggest that structural labor market transformation has had a significant impact on fertility behavior in West Germany. Workers most vulnerable to the negative consequences of these changes—those in routine occupations—exhibited the lowest second birth rates, while those positioned to benefit—primarily in abstract occupations—had the highest.

Next, we plan to use mixture cure models to investigate whether these ongoing structural shifts in the labor market lead merely to the postponement of second births or also produce quantum effects. The latter seems plausible, given that structural labor market changes are long-lasting, in contrast to the more temporary fluctuations in labor demand associated with economic cycles (Pifarré i Arolas, 2017). Workers most exposed to adverse labor market conditions may delay childbearing indefinitely—until they ultimately forego it altogether. We also plan to look at third births.

A key limitation of this study is the absence of information on the male partner's labor market position. Structural labor market change affects not only women, but also their partners, making it difficult to determine whether the observed negative fertility effects of deroutinization stem solely from deteriorating employment prospects for women, or also reflect the situation of their partners. Future research should aim to disentangle the effects of male and female employment trajectories on fertility behavior.

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