



# International labor market competition and wives' labor supply responses<sup>☆</sup>

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## ARTICLE INFO

### JEL classification:

J21  
J22  
J61

### Keywords:

Immigration  
Female employment  
Division of labor  
Parental leave

## ABSTRACT

We examine how the 2004 European Union (EU) enlargement to Eastern European countries affected the employment, earnings and share of home production among workers employed in the Building and Construction industry and their wives. We use licensing requirements to divide workers into two groups who are more and less exposed to labor market competition. We find that exposed workers experience a fall in labor earnings relative to sheltered workers after the EU enlargement. Increased wife labor supply and earnings compensate around one third of the loss. We do not find a similar change in the division of labor in home production measured by the share of parental leave. Having small children does not constrain the labor market responses of the wives.

## 1. Introduction

The integration of European labor markets in the European Union (EU) has substantially increased the migration of workers across borders. For high-income countries in the European Economic Area (EEA) such as Norway, the 2004 EU enlargement had especially large effects on the supply of manual workers with low reservation wages. The EU enlargement led to a rapid increase in labor immigration, and a large share of the labor immigrants entered the Building and Construction (BaC) industry. The opening of borders has been shown to narrow labor market opportunities and decrease the relative earnings of native, male, vocational skilled workers in Norway (Bratsberg and Raaum, 2012; Finseraas et al., 2019) and in Finland (Kousmanen and Meriläinen, 2019). Similar effects are found in Germany after the opening of borders to Czech cross-border workers in 1991 (Dustmann et al., 2017).

The BaC industry is heavily male dominated, and therefore, men were much more affected by the EU enlargement than women. Typical female industries, such as health, retail and education, did not experience the same increase in the share of immigrants. And although unemployment is insured through the social security system, long-term declines in relative wages due to labor market competition are typically not covered. For the household, therefore, adjusting female employment could potentially play a role as insurance against the decline in household earnings. In this paper, we analyze how wives' labor supply responds to their husbands' decrease in earnings. We estimate the effect of the EU enlargement on employment and earnings for men employed

in the BaC industry and their wives. To compare the role of wives' labor supply relative to public insurance through the social security system, we also measure the effect of the EU enlargement on the probability of receiving unemployment benefits, sick leave benefits and disability insurance.

An important precondition for the wife's labor supply to increase is that the leisure time of husbands and wives is substitutable through home production. The substitutability of home production might, however, be constrained by norms and preferences for male and female abilities in these tasks and ideals regarding who should be the family breadwinner (Bertrand et al., 2015; Fernández and Fogli, 2009; Fernández et al., 2004). To investigate the role of substitutability in home production, we estimate the effect on the uptake of parental leave for both partners and estimate the heterogeneity of effects according to the presence of children and age of the youngest child.

To identify the effect of increased labor market competition on household outcomes, we exploit licensing requirements in parts of the BaC sector.<sup>1</sup> Mainly due to safety reasons, some occupations, such as electrician and plumber, need a license to perform their work, while other occupations, such as painter and carpenter, need not. Access to a licensed occupation is given to workers with certified vocational train-

<sup>1</sup> To identify occupational licensing, we rely on the Norwegian Occupational Regulations Database (NORD). (Alecú and Drange (2016); Bol and Drange (2017)). We are grateful to Ida Drange for sharing their data set.

<sup>☆</sup> We thank conference participants at the EALE-conference in Stockholm in September 2019 for useful comments. This paper is a part of the projects "Gender gap in sickness absence" (Grant No. 218378) and "Changing health and skills requirements in the Labour Market", (Grant No. 280307), both financed by the Norwegian Research Council. This work is also part of the research activities at CORE, Centre for Research on Gender Equality at the Institute for Social Research.

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ing (e.g., education as an electrician). The right to work in a licensed occupation can also be given to immigrant workers, but usually after a lengthy bureaucratic process for formal approval of their educational skills. Thus, the requirements give native Norwegians with the right education a competitive advantage with regard to employment in licensed occupations.<sup>2</sup>

The sample is men who were working in the BaC industry in 2003, one year before the EU enlargement, and their wives. We define a worker as “exposed” or “sheltered” (treatment and comparison groups) based on whether they have a certified vocational education that gives access to a licensed occupation.<sup>3</sup> The educational paths that qualify individuals for licensed and non-licensed occupations are similar, with two years of education in school and two years of practice to become a tradesman. Therefore, the treatment and comparison groups are similar workers with the same amount of education in the same industry but are exposed differently to the immigrant shock. We later show that the wives of exposed and sheltered workers are very similar: The wives have the same educational levels and work in similar industries. What separates the wives is whether they are married to an exposed or sheltered husband. Empirically, we analyze the questions within a difference-in-differences framework, where sheltered workers and their wives are compared to exposed workers and their wives before and after the enlargement of the EU in 2004.

This study makes contributions to two main streams of literature. First, it contributes to the broad literature analyzing the consequences of labor immigration on local labor markets. In standard models of the labor market, an increase in supply of labor immigrants, will (at least in the short term) reduce the relative earnings of workers with comparable skills. However, the empirical literature has not reached consensus with respect to the size of the effects and includes studies reporting negative and sizable effects (see e.g., [Borjas \(2003\)](#)) and studies reporting small and not statistically significant and even positive impacts (see e.g., [Ottaviano and Peri \(2012\)](#)). Part of the reason for the empirical controversy is related to differences in methodological approaches that identify parameters that are not directly comparable ([Dustmann et al., 2016](#)). However, the empirical literature seems to agree that native workers who compete most directly with immigrants are also the ones who experience the strongest downward pressure on wages.

Second, this study contributes to the literature on household optimization, household responses to income shocks and the added-worker effect (AWE) ([Ashenfelter, 1980](#); [Becker, 1973](#); [Heckman and Macurdy, 1980](#); [Lundberg, 1985](#)). These models predict that a wife responds by increasing her labor supply when her husband’s labor market opportunities deteriorate. The AWE literature often reports small effects of husbands’ unemployment on wife labor supply, measured by plant closings or mass layoffs ([Bredtmann et al., 2018](#); [Eliason, 2011](#); [Halla et al., 2020](#); [Hardoy and Schöne, 2014](#); [Stephens et al., 2002](#)).<sup>4</sup> [Bredtmann et al. \(2018\)](#) find that the AWE varies greatly between different welfare regimes, indicating that the availability of other types of insurance plays a role in the size of wives’ labor market response.

<sup>2</sup> The educational requirements for licensed occupations imply that workers with, for example, education as an electrician may work as an electrician (licensed occupation) or a painter (not licensed occupation), while a worker with education as a painter may work as a painter but not as an electrician.

<sup>3</sup> The idea of using licensing requirements in the Norwegian BaC industry to estimate the effects of immigration was developed in [Bratsberg and Raaum \(2012\)](#). We build on their idea, but base the definitions of exposed and sheltered workers on the type of education, not current employment.

<sup>4</sup> However, mass layoffs and plant closures have been shown to influence the household more broadly. They increase the probability of divorce ([Eliason, 2012](#); [Rege et al., 2007](#)), deteriorate the health of the husband and the wife ([Browning and Heinesen, 2012](#); [Eliason and Storrie, 2009](#); [Marcus, 2013](#); [Sullivan and von Wachter, 2009](#)) and negatively affect the school performance and labor market outcomes of the household’s children ([Coelli, 2011](#); [Oreopoulos et al., 2008](#); [Rege et al., 2011](#)).

In addition, there is evidence that other types of shocks to household long-term earnings, such as sharp reductions in husbands’ social insurance benefits, induce larger responses among wives ([Autor et al., 2019](#); [Fadlon and Nielsen, 2015](#)). [Halla et al. \(2020\)](#) find, consistent with constraints on the substitutability of home production, that the labor market response of a wife to her husband’s unemployment is lower in couples with children younger than two years of age. To the best of our knowledge, however, there is no direct measure of the division of home production tasks in the AWE literature.

The empirical results show that exposed workers experience a fall in their employment probability and labor earnings after the EU enlargement over the whole period 2004–2015. The negative effects stabilize at around -30,000 NOK (around 6 percent lower earnings) and around 2 percentage points lower employment probability. Only around 6 percent of the total earnings loss is compensated by public transfers. The probability of receiving unemployment benefits increases with 2 percent, while the take-up of other benefits (such as health benefits) is not affected. Increased wives’ earnings plays a comparatively larger role as insurance and compensate around one third of the husband’s earnings loss, largely driven by increases in labor supply at the intensive margin. However, we do not find that the change in the division of market work within the household affects the division of home production as measured by the sharing of parental leave. We do not find that having small children poses a constraint on the labor market response of the wives either, indicating that there are no strong norms against female labor supply when the children are small. This may contribute to the large labor supply response to the fall in husbands’ earnings.

The paper proceeds as follows: In the next section, we present the institutional setting and descriptive statistics on labor market immigration to Norway after the EU enlargement. Thereafter, we present the data and the empirical specifications. Then, we discuss the results and provide sensitivity analyses, before we provide conclusions in the final section.

## 2. Institutional context

[Fig. 1 \(a\)](#) shows the share of immigrant workers in the whole Norwegian economy, and the BaC industry especially.<sup>5</sup> The immigrant share in the Norwegian economy was low at the beginning of the 2000s, around only 5 percent. The share was lower in the BaC industry than in the rest of the economy. In 2003, the year before the 2004 EU enlargement, the share of immigrant workers in the BaC industry in Norway was only approximately 4 percent. By 2015, the share had increased to almost 20 percent.

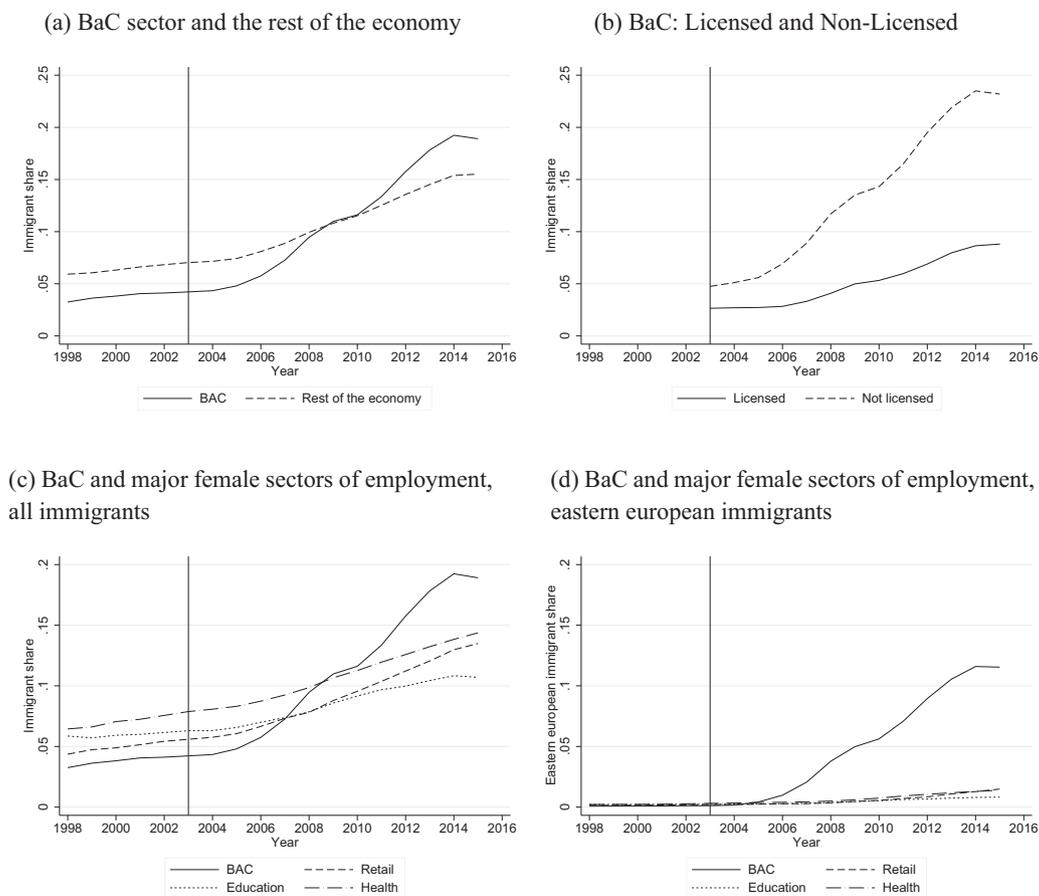
Vocational skilled workers in the BaC industry have upper secondary education in different trades (electrician, plumber, carpenter, painter etc.). Some of the occupations are subject to licensing requirements (prior authorization or certification of qualifications). Licensing requirements have been justified by reference to safety concerns. The aim is not to protect workers as such, e.g. against competition. For example, licensing of electricians is regulated by statute and administered by The Norwegian Directorate for Civil Protection.<sup>6</sup> The statute stipulate qualification requirements to operate or participate in activities in connection with electrical installations and electrical equipment, with the aim of “developing, establishing and maintaining sound electrical safety for life and property”.<sup>7</sup>

[Fig. 1 \(b\)](#) shows that the increase in the immigrant share is especially large in occupations that do not require a license; in those occupations, the immigrant share increases to almost 25 percent. In licensed occupations, the share increases only to around 9 percent. Therefore, licensing

<sup>5</sup> Numbers in this section are based on full population register data on employees in Norwegian firms.

<sup>6</sup> Direktoratet for samfunnssikkerhet og beredskap.

<sup>7</sup> See also descriptions in [Alecú and Drange \(2016\)](#); [Bratsberg and Raaum \(2012\)](#).



**Fig. 1.** Share of immigrant workers, 2000–2015. Notes: Industry is defined by the industry standard classification system used in the European Union, NACE. There is a break in the time-series in 2008, when the classification was revised, and in 2015 when the employer-employee register changed reporting routines. Data on occupations is only available from 2003.

requirements seem to have effectively sheltered some manual workers from labor market competition although they are not completely sheltered.

The degree to which licensed occupations are also affected by the EU enlargement depends among other things on how easy it is for immigrants to get the right certifications and enter licenced occupations, the substitutability of licensed and non-licenced occupations in production, and general equilibrium effects such as increased demand for all types of products and services when the population grows. Fig. 1(b) shows that immigrants do enter licensed occupations as well, but to a much smaller degree. In Section 5.2, we estimate substitution elasticities between licenced and non-licenced occupations in production and find that they are not perfect substitutes. We assume the general equilibrium effects to be common across groups, and thereby accounted for in the difference-in-differences framework.

Because licenced occupations are also affected by the EU enlargement, we do not have an unaffected comparison group in our difference-in-differences framework. There are, however, clearly some groups that are more affected by the EU enlargement than others, and this forms the basis of our definition of treatment and comparison groups. The allocation of workers into treatment and comparison groups are explained in detail in Section 3.1.

The period around the EU enlargement was a booming period in Norway, and labor immigration from Eastern Europe contributed to facilitate high activity. The booming economy reduces the potential for correlated shocks within the household, as most of the wives in the affected households work in other sectors of the economy that rather experienced higher demand.

Fig. 1 (c) shows the development in the immigrant share in some of the major female industries of employment: Retail trade, Education and Health.<sup>8</sup> In these industries, the immigrant share is increasing, but more continuously, and the growth rate does not change after the EU enlargement in 2004. Fig. 1(d) shows only the Eastern European immigrant share, and almost none of the immigration that can be attributed to the EU enlargement entered the major female employment sectors. The increase was huge, however, in the BaC sector, and more than 50 percent of the total increase in the immigrant share in the BaC sector came from an increase in the immigrant share from Eastern European countries.

The measures of immigrant shares in these graphs are based on total population register data on employees in Norwegian firms, collected by Statistics Norway. In addition, however, there is a high number of “posted” workers from Eastern European firms.<sup>9</sup> Estimates show that there were around 46,000 posted workers in Norway in 2016, around 2 percent of the total workforce (Labour force survey, Statistics Norway) including a large number of workers who are employed via Norwegian staffing agencies. After the EU enlargement, the share of workers in the economy employed via a staffing agency grew from 0.8 percent in 2000 to 1.4 percent in 2014, and the growth is almost entirely driven by immigrant workers from the new EU member countries (Strøm and von Simson, 2020). There is no data on which industry these posted workers actually work in, but the occupation data shows that a large share

<sup>8</sup> See Table A.2 for descriptive statistics on wives’ industry of employment.

<sup>9</sup> A “posted worker” is an employee who is sent by his employer to carry out a service in another EU Member State on a temporary basis.

work as craftsmen. Therefore, we might expect that the actual immigrant share in the BaC sector is even higher than is shown in Fig. 1. The problems of measuring the real immigrant share in the BaC sector make an instrumental variables approach difficult to employ. Instead, we measure the reduced form effect of the EU enlargement on labor market outcomes, a strategy similar to that of Kousmanen and Meriläinen (2019).

The BaC industry constitutes a non-trivial part of the Norwegian labor market. In 2003, the year preceding the EU enlargement, approximately 20 percent of all private-sector employed men without a university or college degree worked in the BaC industry. The steep growth in labor immigration had negative consequences for employment opportunities and the wages of native workers in the most exposed occupations (Bratsberg and Raaum, 2012; Finseraas et al., 2019). Combined with low wages for immigrant workers, these developments triggered public debates about “social dumping”<sup>10</sup>. Policy responses, such as the introduction of minimum wages in the most immigrant-intensive industries were partly in place in the BaC industry already in 2005–2006. The labor market effects of immigration on native workers, however, is not the main question of this study, but serves as the background for examining the role of wives’ labor market responses in the preservation of household earnings levels.

### 3. Data and identification strategy

#### 3.1. Data and the definitions of the treatment and comparison groups

We use high-quality individual register data with a panel dimension, enabling us to follow individuals over time, between different statuses within and outside the labor market. The data is collected and organized by Statistics Norway.

The starting point is a sample that consists of all married or cohabiting men (age 25–55 years) who are vocationally skilled workers at the upper secondary school level and employed in the BaC industry in 2003, that is, the year before the EU enlargement. We follow these workers and their wives year by year until 2015. The key register input data is a linked panel employer–employee database with detailed information on individuals’ employment periods, wages, occupation, industry and work hours. With this data, we can follow workers over time, within and between firms. Information from the employer–employee data is linked via unique personal identifiers to other registers containing information on individuals’ educational attainment, marital status, children, annual labor earnings and uptake of different welfare benefits. This information is updated annually.

The definition of the treatment and comparison group is based on three sources of data. 1) The first data source is the Norwegian educational register which records the highest completed level of education of all individuals in Norway yearly. The education code is a six-digit code from the Norwegian Standard of Educational Classification (NUS), and among vocational education, there are 406 unique education types. 2) The second data source is the employer–employee register which includes the occupations of all workers with a seven-digit code of the Norwegian standard of occupational classification (STYRK). Occupational codes are available from 2003. 3) The third data source is the Norwegian Occupational Regulations Database (NORD) which registers the prevalence of occupational licensure and certifications. In this database, “[a]n occupation is classified as licensed if the right to practise is regulated by the authorities by law or by regulations of the law.” (Alecú and Drange, 2016; Bol and Drange, 2017). The regulations determine the educational requirements, which must be fulfilled to practice within an occupation.

<sup>10</sup> “Social dumping” is a practice of employers to pay lower wages than what is usual at their site of production or sale. In Norway the term is linked to labor immigration where the immigrants get lower wages and less favourable working conditions than what is usual for native workers.

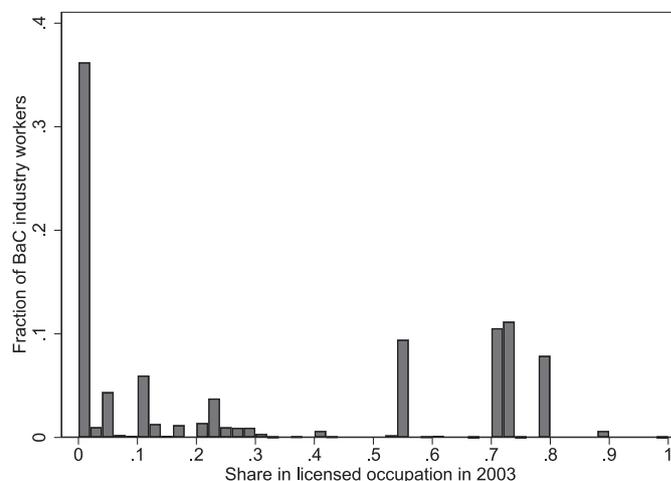


Fig. 2. Distribution of workers across BaC education groups. Education groups are ordered by the share of workers within each education group that worked in a licensed occupation in 2003. Notes: The histogram shows the distribution of workers across BaC education groups. For each of the 406 education groups, we have calculated the share of workers that worked in a licensed occupation in 2003, and education groups are ordered by this share on the x-axis. In the figure, the x-axis shares are discretized into 2 percentage points bins. The biggest educational groups with a share in licensed occupations below 10%, are educations as carpenter (NUS: 457129), formwork carpenter (NUS: 457108) and painter (NUS: 457118). The biggest educational groups with a share in licensed occupations above 10%, are educations as electrician (NUS: 455103), power-supply operator (NUS: 455107) and plumber (NUS: 457121).

We define the treatment group according to the educational skills (education type) of the individual, as educational skills are the formal requirements to work in a licensed occupation. To capture which type of education fulfills the license requirements, we exploit information about occupational codes (STYRK) for all individuals in the 406 education groups. For each education group, we calculate the share of workers who are employed in a licensed occupation (according to the NORD database). The correspondence between the education group and the probability of working in a licensed occupation is not one-to-one. An electrician, for example, does not have to work in a licensed occupation, although a high share does. Fig. 2 shows the distribution of workers across education groups, ordered by the share that is licensed in each education group. There are some big groups with very low shares in licensed occupations; these are education paths such as carpenter (1.1 percent), formwork carpenter (2.1 percent) and painter (0.2 percent). There are also some big groups with shares of around 55–80 percent in a licensed occupation. These are typically education paths such as electricians (70.5 percent) and plumbers (77.8 percent). As we see, the major part of the sample lies in these two ends of the scale. The majority of education groups are very small, and the main variation in the data is driven by the most common educations as electricians and plumbers, and carpenters and painters.

We classify individual workers as exposed (treatment group) or sheltered (comparison group) according to whether less or more than 10 percent of workers with the same type of education work in a licensed occupation. We do not set the level lower than 10 percent to capture education groups for whom there are no license requirements in the main employment occupations but for whom there may exist license requirements for specific tasks. These extra certificates usually require short-term courses and are not as costly for an individual to take as full education as a tradesman. In Fig. A.1, we test other threshold levels (5, 7 and 12 percent), and the main results on earnings effects are similar. The maximum threshold we test is 12 percent as setting the threshold higher would include workers with education in telecommunications installation (NUS 455132) where 12.1 percent work in a licensed occupation,

but who have a basis education as electrician and thus have access to licensed occupations.<sup>11</sup>

### 3.2. Empirical model

We estimate a difference-in-differences model of the following form:

$$y_{it} = \gamma_t \mathbf{Year} + \delta \text{Exposed}_i + \sum_{t=1998}^{2015} \beta_t \text{Exposed}_i \mathbf{Year}_t + \mathbf{X}_i + \epsilon_{it} \quad (1)$$

where  $y_{it}$  are the outcome variables measured in year  $t$  (1998–2015) for individual  $i$  (the husband or wife).  $\text{Exposed}_i$  is the treatment dummy equal to 1 if the husband has an education that makes him exposed to competition from labor immigration, and 0 if he has an education that makes him sheltered.  $\mathbf{Year}$  is a vector of year indicators from 1998 to 2015; 2003 is omitted as the reference year.  $\mathbf{X}_i$  is a vector of age dummies for the husband and the wife in 2003, and the work experience of the husband with the 2003 employer.

$\beta_t$  are the coefficients of interest. They are the coefficients on the interaction term  $\text{Exposed}_i \times \mathbf{Year}_t$ ; the estimated difference between the treatment and comparison groups in all the years 1998–2015 (omitting 2003 as the reference year). The pre-treatment estimates (1998–2002) serve as tests of similar pre-trends. The post-treatment estimates are the reduced form yearly effects of the EU enlargement on labor market outcomes of exposed workers relative to sheltered workers.

A household is defined as the household was in 2003. When we estimate the effect of the EU enlargement on the wife's labor market outcomes, etc., it is the wife in 2003, regardless of whether the relationship later dissolved. This is because marital dissolution may be a direct effect of poorer labor market opportunities, and conditioning on the couple staying together is an endogenous conditioning of the sample.

The main labor market outcomes are annual labor earnings and employment. Information about labor earnings is taken from the tax registry and is of high quality. To adjust earnings for general price and wage growth, we use the Norwegian welfare authorities' measures of "base amount" (BA) in the social security system. The BA is adjusted each year to ensure that recipients of welfare benefits have the same purchasing power as wage earners. In 2015, the amount was equal to 90,068 Norwegian kroner (NOK), or approximately 9,500 Euro. We adjust the annual earnings by dividing the earnings by each year's BA and then multiply by the 2015 BA to get everything in 2015 prices. Individuals with no annual labor earnings are included with zero earnings. We define employment at the extensive margin as having positive earnings. We also adjust unemployment benefits and other social benefits for price and wage growth in the same way as for earnings.

We construct two other dependent variables, measuring labour market outcomes, these are weekly work hours and hourly wages. The information on work hours is coarse in the register data. There are only three work hours categories for the full period of observation: i) short part-time (4-14 hours per week), ii) long part-time (15-29 hours per week), and full-time (30 hours or more per week). We construct a measure of work hours per week by setting a reference value within each category to which they belong (12.5 hours, 25 hours and 37.5 hours). Hourly wages is constructed from information on total wages in the job, number of days the job spell covers, and the measure of weekly work hours, mentioned above. As the hours are measured with error, the hourly wage is also measured with error. As both are outcome variables, however, the measurement error is less severe. It may reduce the precision but not bias the estimates.

<sup>11</sup> In Fig. A.1, we also test a definition based on employment in a licensed occupation in 2003, similar to the strategy of Bratsberg and Raaum (2012). Using this definition, the pre-trends are not parallel before the EU enlargement, and therefore, we keep the definition that is based on skills rather than occupation in 2003.

The home production variables are the number of children and the probability of staying married or cohabiting in addition to days of parental leave. Parental leave is measured only for those who become parents and is conditional on work the year before the child is born. Therefore, the results for this measure should be interpreted with caution and in relation to the effects on fertility and employment. In addition, there have been several changes in the parental leave period over the years that we investigate.<sup>12</sup> To avoid comparing parents who are subject to different rules, we put all the parental leave days associated with a child to the year the child is born, although the period stretches over additional years. The year the child is born determines the length of the total parental leave period and the mandatory daddy quota. Full parental leave periods are not registered for children born within the two last observational years; therefore, we remove 2014 and 2015 from this analysis. In addition, we have to condition on having worked the year before to be eligible for parental leave and have no estimate for the first year of observation, 2000, either.

The key assumption for this difference-in-differences approach to identify causal relationships is that the two groups would have had similar post-2004 trajectories if the EU enlargement had not happened. The similarity of the observable characteristics and the parallel pre-trends are reassuring for this assumption to hold. Table A.1 in the Appendix presents descriptive statistics for the exposed and sheltered workers and their wives, measured in the pre-period year 2003. The mean values show that the two groups are partly unbalanced in the observed characteristics during the pre-period. There are statistically significant differences in mean age for husbands and wives, and the length of work experience for the husband, but the sizes of the differences are not large. There are also some significant differences in the outcomes measured in 2003 when we do not condition on any characteristics. In the regressions, we adjust for initial differences between the treatment and comparison groups by including controls for husbands' and wives' ages in 2003 (dummy variables), and the husband's work experience (measured in years) at the plant he was employed in 2003. In the figures shown in the next section, we find no significantly different pre-trends in the results, which supports the assumption of parallel post-trends conditional on these controls.<sup>13</sup>

The difference-in-differences identification strategy relies on a change in immigrant share in the treatment group relative to the comparison group, but does not rely on zero changes in the immigrant share in the comparison group. What we use for identification is that some groups are *more* affected by the EU enlargement than other groups. As we saw in Fig. 1, labor immigrants enter not only non-licensed occupations but also licensed occupations. The analysis of substitution elasticities between licensed and non-licensed occupations in production in Section 5.2 shows that licensed occupations are probably also affected

<sup>12</sup> Over the period, there have been changes in the rules for parental leave. From 2014, parents are entitled to up to 49 weeks of fully compensated parental leave (or 59 weeks with 80 percent compensation) until the child is three years old. Eligibility is tied to previous employment: A minimum of six months of employment during the previous ten months before the expected delivery is required. Parental leave is split into three separate parts. Mothers are entitled to three weeks of leave before they give birth and 10 weeks of maternity leave, while the daddy quota is 10 weeks. These weeks are not transferable between parents. In 1998, the total period was 42 weeks (with 4 weeks daddy quota). This changed in 2005 to 43 (5) weeks, in 2006 to 44 (6) weeks, in 2009 to 46 (10) weeks, in 2011 to 47 (12) weeks and in 2012 to 49 (14) weeks.

<sup>13</sup> The post-2003 estimates are similar without these controls, but the pre-trends are statistically significantly different (Fig. A.2(a) and A.2(b)). There are also some significant differences in parental background. Our data do not include a date for the measurement of parental income (we only have a mean over the years when the individual was 7-16 years old). We can therefore not price-adjust parental incomes, and the differences in nominal incomes may partly be due to the younger age of the treatment group. Including parental background variables as controls in addition to age and seniority do not, however, change the estimates (Fig. A.2(c) and A.2(d)).

by the EU enlargement through changes to the mix of input factors in production. This does not, however, affect a causal interpretation that the differences between the treatment and comparison groups after the EU enlargement are due to the EU enlargement and not something else. It does not either affect the interpretation that changes in wives' labor supply are due to the detrimental effect of the EU-enlargement on husbands' earnings.

#### 4. Results

We first present the results for husbands' and wives' labor supply at the extensive margin and the intensive margin. We also estimate the effect of the EU enlargement on the receipt of public transfers. These estimates provide evidence for the relative role of social insurance versus wife's labor supply as insurance in this type of long-term deterioration of the husband's earnings. Second, we present the results for the sharing of parental leave, which provides indications of the substitutability of home production. Third, we present evidence for constraints on labor supply responses and estimate heterogeneity of the effects according to the presence of children and age of the youngest child.

##### 4.1. Household employment and earnings

Fig. 3 shows the difference-in-differences results for estimations of Equation (1) on labor market outcomes of husbands and wives. The results are also displayed in Table A.3 and Table A.4 in the Appendix. There is no significant difference in labor market trajectories between the treatment and comparison groups before 2003. After the EU enlargement, exposed workers lag behind sheltered workers. Their labor earnings fall gradually relative to the comparison group, by an amount that stabilizes at around 30,000 NOK (around 9 percent of the worker's 2003 earnings). The negative earnings effect is driven, in part, by negative effects on employment, weekly hours and hourly wages. The employment gap between exposed and sheltered workers increases gradually by 0.35 percentage points in 2004, by 2.3 percentage points in 2009, and the increase in the gap stabilizes at 2.0-2.5 percentage points. Hours per week are also negatively affected, but the sizes of the effects are small. Around 2012 and 2013, the effect on weekly hours is largest, and the hours gap has increased by 0.16 hours (around 0.4 percent of 2003 hours). This effect is only temporary. Hourly wages are also negatively affected by around 4-5 percent. The results indicate that the fall in earnings is driven by both decreasing hourly wages and decreasing labor supply.

The right figures show the labor market outcomes for wives. The results show that increased wives' labor earnings to a large extent compensate for husbands' earnings losses. Mirroring the husbands' gradual earnings decline, the wives gradually increase their earnings after 2004 before they stabilize at around 10,000 NOK (around 3.3 percent of the wives' 2003 earnings) a year. A wife's increased earnings compensate around one third of her husband's earnings loss. Wives' increased earnings are as persistent in the long run as husbands' decreased earnings, which indicates that the household division of labor is profoundly altered as a consequence of the change in relative wages and job opportunities following the EU enlargement.

As presented in Section 2, there is a much smaller increase in the share of immigrants in women-dominated industries such as health compared to the development in the BaC industry. Furthermore, a large share of the wives work part-time (almost 40 percent) before the EU enlargement. Therefore, there is a large potential for these women to compensate their households' earnings losses by increasing their own labor supply and the results for labor supply suggest that they did.<sup>14</sup> Employment rates increase by around 1 percentage points in the long run, and

<sup>14</sup> A very small share (4.6 percent) of the women in the sample also work in the construction sector which was most affected by the inflow of labor immigrants. We estimate the model without these households, and the effects are almost identical, just more precisely estimated.

weekly hours increase by up to 0.606 hours extra at the most (around 2 percent of 2003 hours). Interestingly, the small growth in men's hours by the end of the period is mirrored in a small decline in wives' hours. This strengthens the interpretation that husbands' and wives' hours are dependent on each other, and that wives' changing labor supply reflects compensatory behavior within the family. Wives' hourly wages are not affected. The effect on wives' earnings therefore works entirely through the effects on labor supply.<sup>15</sup>

Compared to the AWE literature following wives' labor market responses after plant closures and mass layoffs at their husbands' workplaces, these effects are large. Based on the earnings results of the husbands and wives' earnings responses in Fig. 3, we can compute a semi-cross-earnings elasticity similarly to Halla et al. (2020). Cross-elasticity refers to the change in wives' earnings to a 1 percent change in husbands' earnings. The husbands' change in earnings and the wives' responses are measured relative to a baseline mean, measured in 2003.<sup>16</sup> We get a measure of the elasticity equal to approximately 0.5; that is, when the husband's earnings are reduced by 1 percent, the wife's earnings increase by 0.5 percent. Overviews of cross-elasticities in the literature in e.g., Devereux (2004); Halla et al. (2020) report average cross elasticities equal to approximately 0.4, which confirms that our estimates are quite large. The large effects may be because the shock to household earnings is more long-term than the instant effect on unemployment in AWE literature, as the EU enlargement includes a shock to long-term wage development.<sup>17</sup> The large effects may also be connected to low coverage by public insurance to negative wage-effects and/or few practical constraints (like kindergarten coverage) on high female labor supply in Norway.

Fig. 4 shows the effect of the EU enlargement on the probability of receiving unemployment, sick leave and disability benefits. We see that the probability of receiving unemployment benefits increases gradually to 2-3 percent. The increase mirrors exactly the fall in employment rates in Fig. 3 (which are based on the probability of having positive earnings). This indicates that the effect of the EU enlargement on unemployment is covered by public insurance. Unemployment is, however, only a part of the reason for the earnings loss. Fig. A.4 in the Appendix shows the effect on the amount of social security benefits in Norwegian kroner. The recipient of unemployment benefits increases by around 2000 NOK, while other benefits are not affected. 2000 NOK is only around 6 percent of the total earnings loss, which underlines the importance of wives' earnings as insurance for these long-term earnings losses.

##### 4.2. Home production

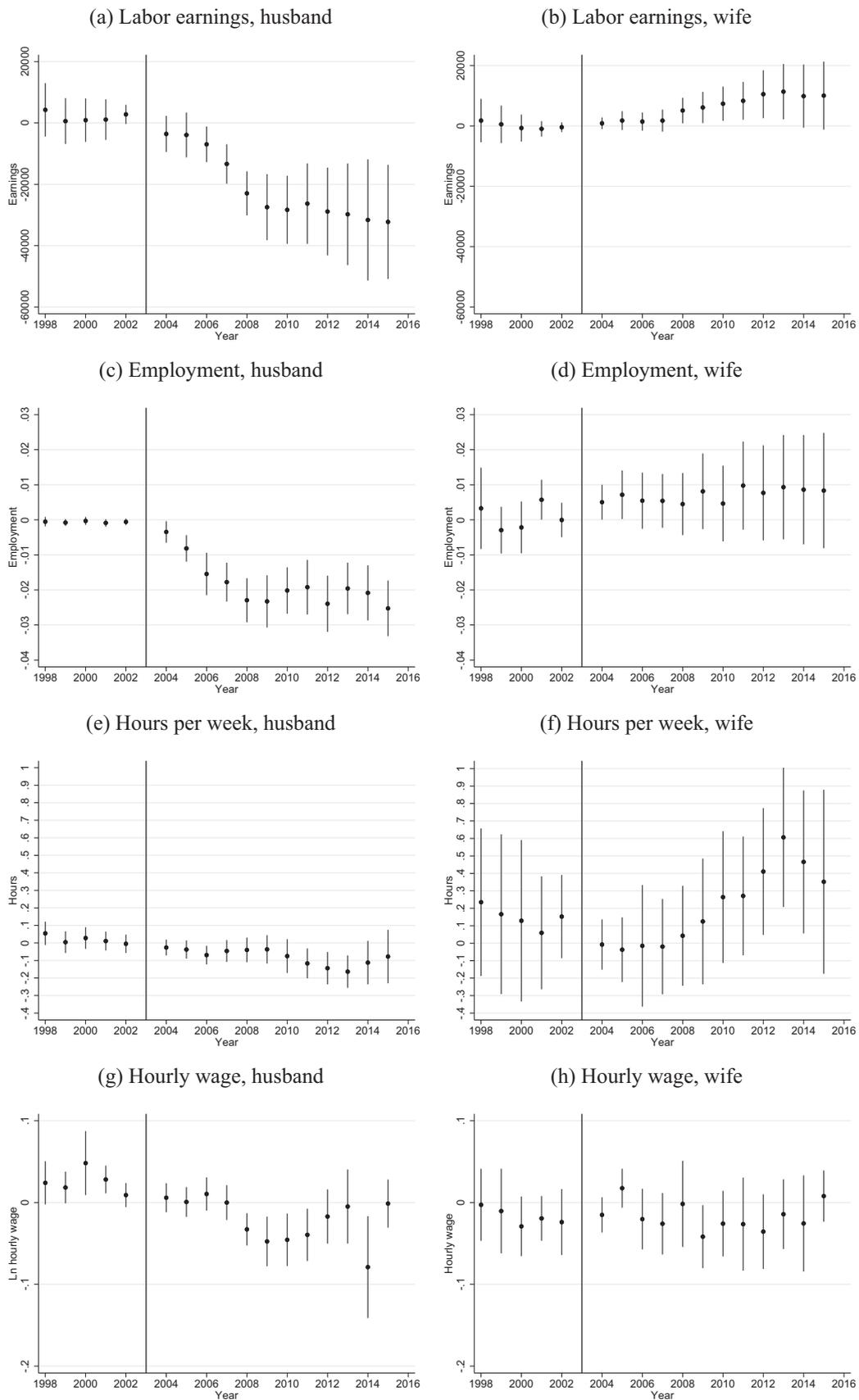
Does the change in the relative improvement in wives' labor market position also affect the level and the sharing of home production? One of the largest shifts in the level of home production is when the family has (more) children. There is extensive evidence in the literature that the birth of children affects women's labor supply negatively, while children have minimal impact on men's labor supply (for evidence from Norway, see e.g. Cools et al. (2017); Markussen and Strøm (2020)). In this section, we measure the effect of the EU enlargement on marital stability, the level of home production (measured by the number of children) and the sharing of parental leave. The results are reported in Fig. 5 (and Table A.5 in the Appendix).

<sup>15</sup> We also estimate the effect on the probability of changing employers, for both couples, based on yearly unique employer identification; see Fig. A.3 in the Appendix. In general, we find small effects using this measure, indicating that when these women increase their labor supply, it is possible to do so in their present job.

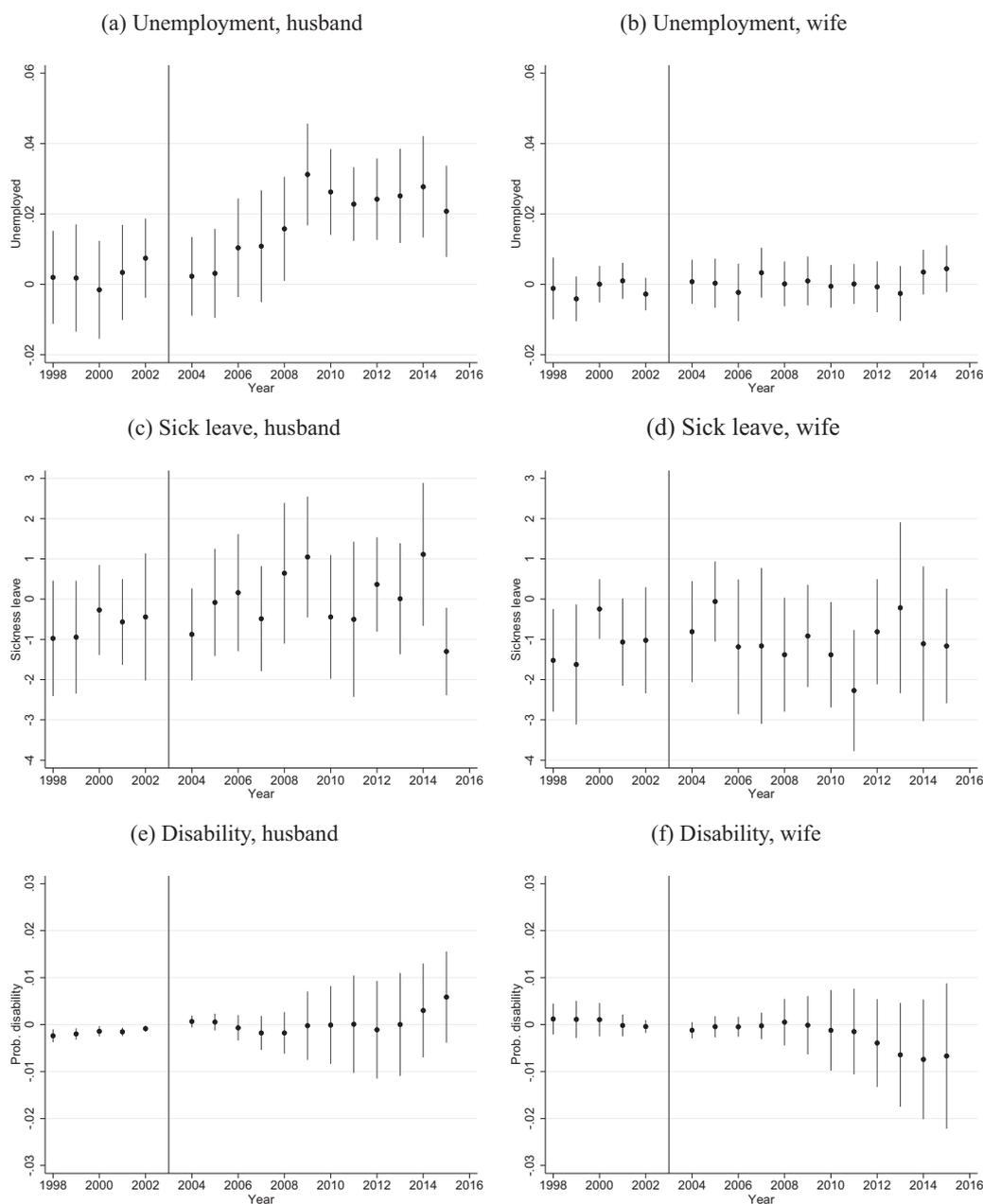
<sup>16</sup> The formula we use as input is as follows:  

$$\frac{\text{average change in earnings for the wife/wife's level of earnings in 2003}}{\text{average change in earnings for the husband/husband's level of earnings in 2003}}$$

<sup>17</sup> Unemployment may also have long-term effects, but this should be equal for plant closings and for unemployment in our setting.



**Fig. 3.** The impact of the 2004 EU enlargement on employment and labor earnings. Notes: The figure shows the difference-in-differences estimates of the effect of the EU enlargement on labor market outcomes for exposed workers and their wives relative to sheltered workers. Control variables are dummies for husbands' and wives' age in 2003, as well as the husbands' work experience with the 2003 employer. Standard errors are clustered at the 2003 education group level. Spikes show the 95% significance level.



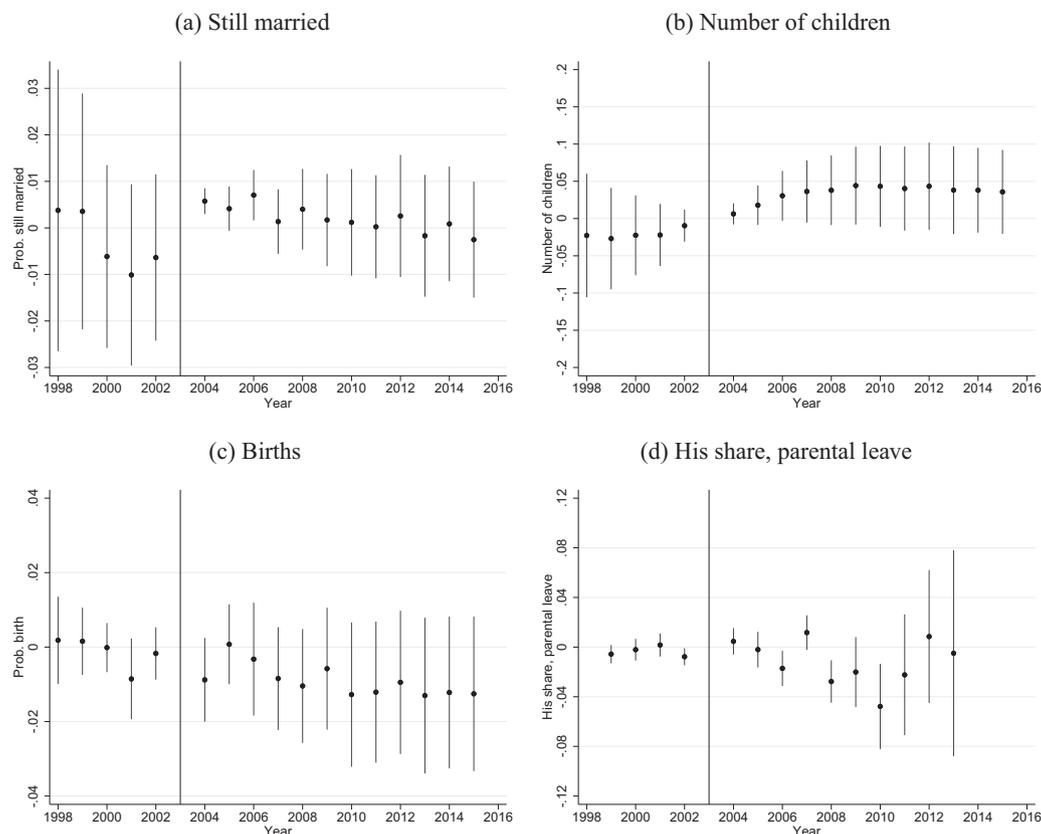
**Fig. 4.** The impact of the 2004 EU enlargement on the probability of receiving unemployment, sickness absence and disability benefits. Notes: The figure shows the difference-in-differences estimates of the effect of the EU enlargement on labor market outcomes for exposed workers and their wives relative to sheltered workers. Control variables are dummies for husbands’ and wives’ age in 2003, as well as the husbands’ work experience with the 2003 employer. Standard errors are clustered at the 2003 education group level. Spikes show the 95% confidence intervals.

For parental leave, in Norway, there is a "daddy quota" reserved for the father, but a very small share of fathers stay at home with their child longer than this quota. Because not every family has a child (or more) during the period, and parental leave benefits are also contingent on employment, the sample for parental leave take-up is a selected sample and the results should be interpreted with caution. However, it indicates to what extent spouses’ hours in home production are substitutable in families who have children during the period investigated.

First, we examine whether affected households stay together and whether there is an effect on the number of children born to the household. We find positive effects on marital stability immediately after the EU enlargement, but after that point in time, there is no consistent effect on this measure. This is important also for the previous results on wives’ labor supply responses, as continued marriage is a prerequisite

for spouse labor supply to play a role as insurance. We do not find any effects on the number of children (which is a cumulative measure) or the probability of having a child (which is a yearly measure). Therefore, the EU enlargement does not significantly affect the level of these measures of home production. The zero effect on fertility also indicates that the EU enlargement does not affect selection into parenthood in the treatment group relative to the comparison group.

Next, we investigate the effect on the sharing of home production as measured by the sharing of the parental leave period. As described in the data section, we allocate the full parental leave to the year the child is born, because this date determines which rules apply regarding the parental leave length and the daddy quota. Equation (1) includes year dummies, and these dummies adjust for general increases in the parental leave period, and the daddy quota. Within this sample of parents, the



**Fig. 5.** The impact of the 2004 EU enlargement on home production. Notes: The figure shows the difference-in-differences estimates of the effect of the EU enlargement on home production outcomes for exposed workers and their wives relative to sheltered workers. Control variables are dummies for husbands' and wives' age in 2003, as well as the husbands' work experience with the 2003 employer. Standard errors are clustered at the 2003 education group level. Spikes show the 95% confidence intervals.

husband's share of the parental leave period is slightly lower for exposed husbands compared to sheltered husbands. However, the estimates vary a lot between years, and the EU enlargement does not seem to involve a clear change in the division of home production in these households. Parental leave is only one measure of home production, however, and if mechanisms work differently for other types of household chores, this measure does not pick this up. Taking parental leave means taking time off work, and the exposed workers may be more reluctant to take time off work because they fear the career effects. Other household chores that do not require time off work (but that we do not observe) may still change.

Halla et al. (2020) find that wives' responses to their husbands' unemployment is smallest in the group that has young children, indicating that there is little room for intra-family substitution of home production hours when the children are young. We investigate whether wives' labor supply changes equally much for exposed and sheltered wives according to whether they have children in 2003 or not, and according to the age of the youngest child. The results are presented in Fig. 6 (and Table A.6 in the Appendix). The main picture is that there is no significant difference in response to having a child or not, or according to the age of the youngest child. The coefficient estimates are not significantly different from the full sample estimates in either group. The only exception is a larger labor market response among those who have children who are 13 to 18 years old, compared to younger and older children.

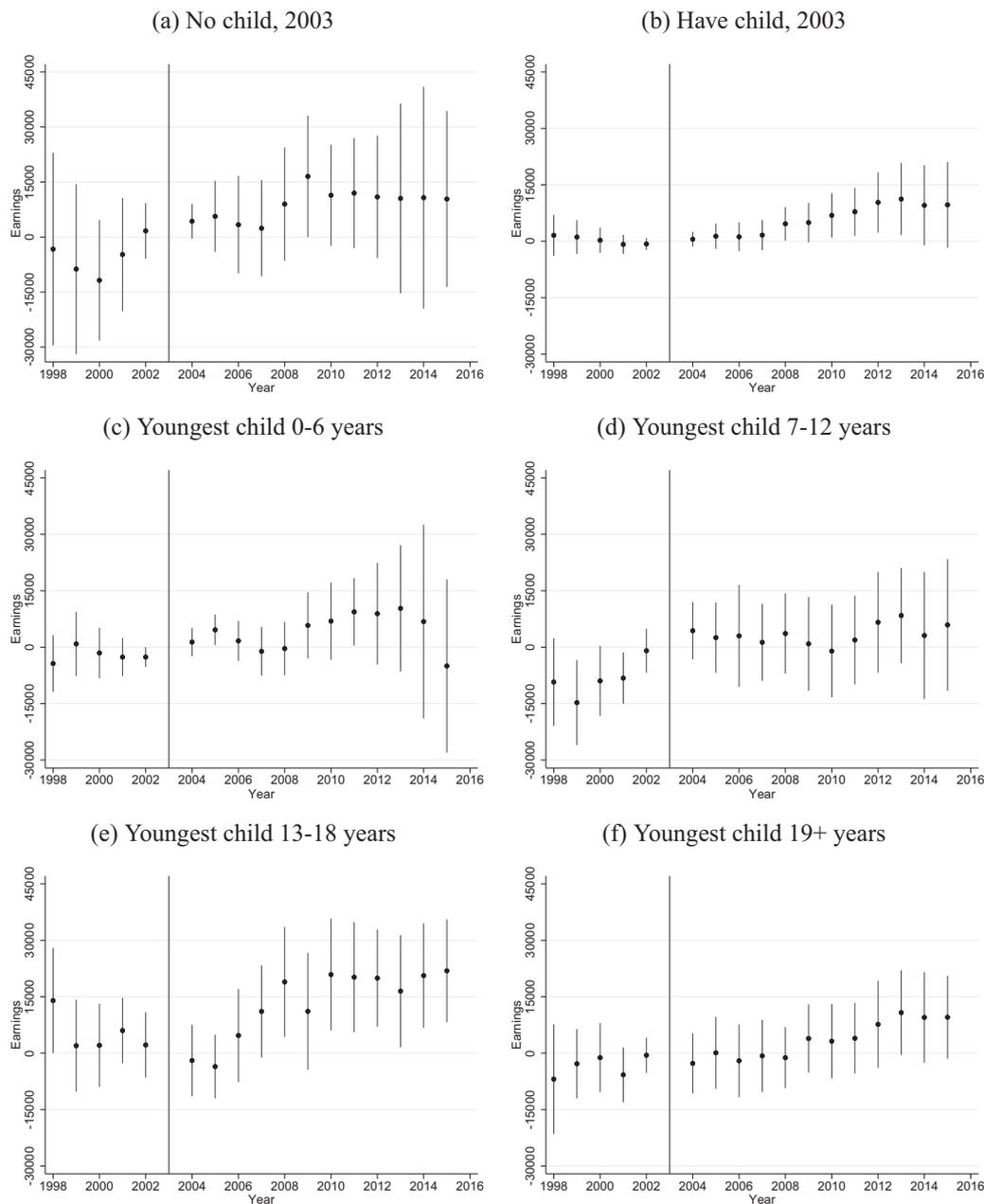
The results suggest that having a (young) child is not an important constraint on women's labor supply responses in Norway. This, in turn, may be due to the high availability of high quality, subsidised child-care services. In Norway, kindergarten coverage is good, as well as child-care coverage for the youngest children from one to three years old. Schools have after-school programs for children up to 10 years old. If there are

constraints on the substitutability of spouses' hours in home production, the household may easily take advantage of the child-care services available. Other housekeeping services are relatively higher priced, because they are not publicly subsidized. With this data, we cannot know whether households make changes in the division of home production hours that are not observed in the data, or whether the children, for example, spend more time in kindergarten and after-school programs.

## 5. Sensitivity

### 5.1. Moving out of the treatment group?

Some in the treatment group may react to increased labor market competition by reeducating themselves so that they can get a job in a more protected industry where earnings are less negatively affected by immigration. If this is common, the labor market effects of the EU enlargement on the treatment group may be smaller than if they had no opportunity of moving into "safe havens". In our data, more workers in the comparison group than in the treatment group take more education during the period: 11 percent in the comparison group and 3 percent in the treatment group are registered with more education in 2015. In both groups, however, they upskill or specialize within their own trade. There are more opportunities for specialization within the sheltered education group than within the exposed education group which may explain why more individuals in the comparison group attain more education during their careers. No one in the exposed group attains education that belongs in the sheltered education group according to our definition of treatment and comparison group education types. This means that the groups are stable over the period, and that there is little dampening of effects due to some in the treatment group acquiring skills that are similar to those in



**Fig. 6.** The impact of the 2004 EU enlargement on labor earnings. Heterogeneity according to presence of children and youngest child age. Notes: The table shows the difference-in-differences estimates of the effect of the EU enlargement on labor earnings for exposed workers and their wives relative to sheltered workers, in samples split by the presence of children, and the age of the youngest child. Control variables are dummies for husbands' and wives' age in 2003, as well as the husbands' work experience with the 2003 employer. Standard errors are clustered at the 2003 education group level. Spikes show the 95% confidence intervals.

the comparison group. This is not unnatural, as such education requires two years in upper secondary education and two years in practice. It is a large investment for an individual, and costly to make midcareer.

### 5.2. Substitution

In the production process, there may be some substitutability between licensed and non-licensed workers; that is, firms may be able to combine different combinations of licensed and non-licensed workers to produce the output. When the supply of cheap non-licensed workers increases, firms may change their demand for licensed workers. Either because they are able to produce the same amount using more non-licensed and fewer licensed workers (e.g. they are substitutes), or be-

cause the fall in input-factor prices allows them to increase the production and demand for both input factors (if they are complements). Regardless of whether licensed and non-licensed workers are substitutes or complements, the EU enlargement may affect licensed workers indirectly through the firms relative demand for licensed and non-licensed workers as inputs.

Inspired by the empirical literature concerned with estimating substitution elasticities between different groups of workers (see, e.g., Manacorda et al. (2012)), we construct a running data set for 1998–2015, including all workers in the building and construction sector, each year. We aggregate this data set to the *firm × year* level and use the following equation to estimate the two groups' elasticity of substitution, which is given by minus the inverse of the estimated parameter  $\alpha$ , be-

**Table 1**  
Substitution between licensed and not-licensed workers.

	Whole period	Pre-period
$Ln\left(\frac{N_{ft}^l}{N_{ft}^n}\right)$	-0.020***	-0.032***
	(0.005)	(0.012)
Observations	301755	29604

Notes: Regression of relative labor input of licenced and non-licenced workers  $Ln\left(\frac{N_{ft}^l}{N_{ft}^n}\right)$  on relative wages  $Ln\left(\frac{W_{ft}^l}{W_{ft}^n}\right)$ . Standard errors are clustered at the municipality level. Level of significance: \*\*\* 1%, \*\* 5%, \* 10%.

low:

$$Ln\left(\frac{W_{ft}^l}{W_{ft}^n}\right) = \alpha Ln\left(\frac{N_{ft}^l}{N_{ft}^n}\right) + Firm_f + Year_t + \epsilon_{ft} \tag{2}$$

The dependent variable is relative wages between licensed and non-licensed workers and we control for firm-fixed effects and year fixed effects. Equation (2) shows how wages of licensed workers relative to those of non-licensed workers depend on their relative supply. The key coefficient to be estimated is  $\alpha$ . If  $\alpha$  equals zero, it is perfect substitution between the two input factors. If the coefficient is negative but smaller than 1, there are varying degrees of not-perfect substitution between the defined groups of workers. Note, that the coefficient of  $\alpha$  should never be positive in such a model. If it is negative but bigger than 1 in absolute value, this would suggest an elasticity of substitution of less than 1 (but bigger than 0), which would make the two inputs gross complements. Table 1 presents the results from estimating Equation (2).

The results show that the  $\alpha$  coefficient is smaller than 1 and significant, suggesting that relative wages of licensed workers are reduced when their relative input increases. The coefficient is -0.02, meaning that increasing the relative employment of licensed workers by 1 percent reduces their relative wage by 0.02 percent. This suggests two things: i) Licensed and non-licensed workers are not perfect substitutes in production. This is reassuring, as a zero coefficient would suggest that the firm could easily switch between the two input groups in production and licenced workers would be equally much affected by the EU enlargement as the non-licenced workers. ii) The small coefficient suggests a fairly high degree of substitutability between the two groups. This indicates that the increased supply of low-wage workers into non-licensed occu-

pations also affects the demand for licenced occupations. The sheltered group in our estimations are therefore not a pure control group. Instead, this group should be considered a comparison group, which is what we do.<sup>18</sup>

5.3. Driver of the differences between the treatment and comparison groups

Because the comparison group is not unaffected by the EU enlargement, there is a question of whether the labor market effects for husbands are driven by worse labor market conditions for the treatment group or improved labor market conditions for the comparison group. The difference between the groups may be driven by increased competition from labor immigrants in the treatment group (with following deterioration of earnings opportunities), or it may be driven by increased demand for the unexposed group (with following increased earnings opportunities). We present some suggestive evidence on which causal channel is the most important by plotting the regression-adjusted earnings trajectories separately for treatment and comparison group. From these regressions, we may see whether there was a clearer break in one of the groups, or whether both causal channels are present.

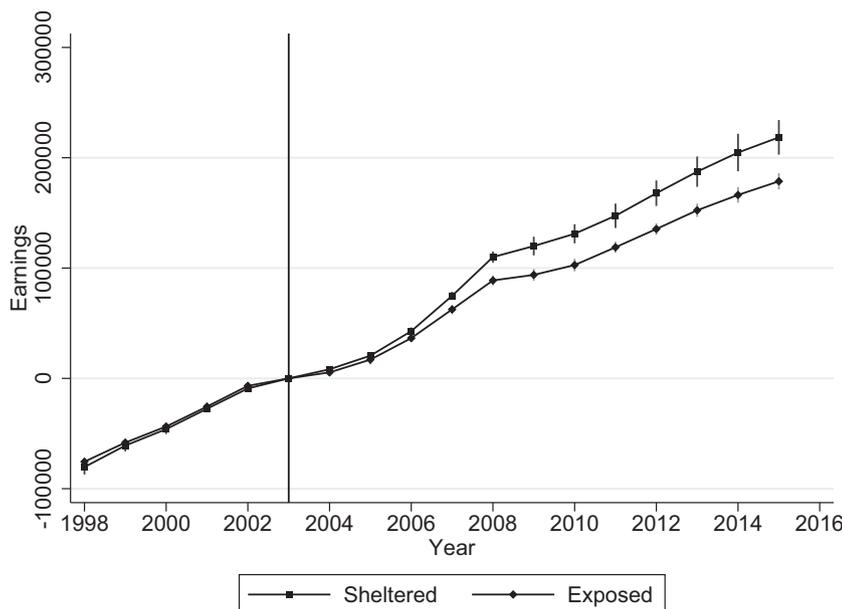
The estimated equation is as follows:

$$Y_{it} = \gamma_t Year + X_i + \epsilon_{it} \tag{3}$$

The equation is similar to Equation (1) but is estimated separately for the treatment and comparison groups, and therefore, does not include the interaction terms Exposed,  $\times Year_t$ . In this way, the year effects are estimated with full flexibility within the treatment and comparison groups Fig. 7.

The results, displayed in Fig. 7, show, reassuringly, that the treatment and comparison groups are on very similar tracks before the EU enlargement and diverge afterward also with this set-up. Earnings in both groups flatten out right after the financial crisis in 2008. It is not clear, however, that one of the groups totally changes paths after 2004; the divergence between them is gradual. Therefore, it is still not clear

<sup>18</sup> We also estimated Eq. (2) for native workers only, and only for the pre-period 1998–2003, which provides evidence for the degree of substitution between the two groups of workers, before the inflow of immigrants. The estimated elasticity is equal to 0.03, which is highly significant, suggesting that native licensed and non-licensed workers are not perfect substitutes before the inflow of immigrants, either.



**Fig. 7.** Earnings trajectories of treatment and comparison groups relative to 2003. Notes: The graph shows the results from estimating the earnings - year trajectory within treatment and comparison groups. 2003 is the reference year. Control variables are dummies for husbands' and wives' age in 2003, as well as the husbands' work experience with the 2003 employer. Standard errors are clustered at the 2003 education group level. Spikes show the 95% confidence intervals.

whether the divergence is due to negative earnings shocks in the treatment group, positive earnings shocks in the comparison group or both.

## 6. Conclusion

The EU enlargement in 2004 to Eastern European countries led to a sharp increase in labor immigrants coming to countries such as Norway. The BaC industry was especially affected, and the immigrant share rose from 4 percent to 20 percent during the period 2004–2015. This paper investigates the role of wives' labor supply as insurance against this type of long-term shock to their husbands earnings in the BaC industry. We identify the effects by comparing households where husbands are "sheltered" (have vocational education that allows him to work in a licensed occupation, e.g., electrician or plumber) to households where husbands are "exposed" (have vocational education that does not allow him to work in a licensed occupation, e.g., carpenter or painter). We show that these households are very similar before the EU enlargement in 2004, but their earnings paths diverge after 2004.

The results show that exposed husbands who work in the BaC industry in 2003 experience a negative earnings development during the post-2003 period, compared to sheltered husbands who work in the BaC industry. The negative development is observed in the short- and long-term. The long-term effect on annual earnings stabilizes at around

-30,000 NOK (around 6 percent of the 2003 earnings) a year. Wives of the exposed men compensate for a sizeable part of the earnings loss by increasing their own labor supply. Results show that wives' increased labor supply compensates around one third of the loss in their husbands earnings. The findings imply a cross earnings elasticity of -0.5. We do not find that the relative change in work hours is met by opposite changes in home production hours, measured by the sharing of parental leave. Having small children does not, however, impose a constraint on female labor supply responses. There is no heterogeneity of effects according to the presence of (young) children in the family.

Wives' labor supply response to their husbands declining earnings is large compared to previous literature studying wives' responses to husbands' unemployment (using plant closings and mass layoffs as exogenous variations in husband unemployment). The large average effects are consistent with the prolonged period of the shock and the low compensation by social insurance against long-term wage declines. The large average effects are also consistent with the few external constraints on the labor supply of women in Norway, such as by norms against female labor supply or the availability of high-quality, low-cost child-care services.

## Appendix A

**Table A.1**  
Descriptive statistics.

	Exposed (treatment)		Sheltered (comparison)		<i>p</i> value
	Mean	SD	Mean	SD	
<i>Individual characteristics</i>					
Age	38.31	(7.48)	39.61	(7.74)	0.00
Labor earnings	523086	(144601)	546418	(149308)	0.00
Hours per week	37.31	(2.06)	37.29	(2.19)	0.45
Work experience	5.93	(5.37)	5.82	(5.88)	0.15
In licensed occupation	0.02	(0.13)	0.52	(0.50)	0.00
Sickness absence	14.41	(46.76)	12.51	(43.52)	0.00
Number of children	1.99	(1.09)	1.97	(1.06)	0.18
<i>Partner characteristics</i>					
Age	36.23	(7.51)	37.44	(7.83)	0.00
Labor earnings	292047	(173716)	296448	(179395)	0.06
Employment	0.92	(0.27)	0.91	(0.28)	0.12
Hours per week	30.35	(9.77)	30.60	(9.64)	0.08
Sickness absence	17.44	(49.85)	16.15	(47.93)	0.04
Disability	0.04	(0.20)	0.05	(0.21)	0.04
Lower secondary schooling	0.41	(0.49)	0.43	(0.49)	0.06
Upper secondary schooling	0.37	(0.48)	0.36	(0.48)	0.33
University	0.22	(0.41)	0.21	(0.41)	0.18
<i>Family background</i>					
Mean income, father	86526	(69953)	78974	(71823)	0.00
Mean income, mother	30775	(38987)	27129	(38144)	0.00
Master level, one or both parents	0.01	(0.09)	0.01	(0.09)	0.64
Bachelor level, one or both parents	0.06	(0.24)	0.07	(0.26)	0.00
Upper secondary, one or both parents	0.57	(0.50)	0.58	(0.49)	0.15
Lower secondary, one or both parents	0.36	(0.48)	0.34	(0.47)	0.00
N	10245		14258		

Notes: The table shows descriptive statistics of husbands' and wives' characteristics and outcome variables measured in 2003. The last column shows the *p* values from a *t*-test of whether the means are statistically significantly different.

**Table A.2**  
Wife industry.

	Exposed		Sheltered	
	Mean	SD	Mean	SD
Agriculture, forestry, fishing	0.00	(0.07)	0.01	(0.07)
Mining and quarrying	0.00	(0.05)	0.00	(0.06)
Manufacturing	0.05	(0.22)	0.06	(0.23)
Electricity, gas and water supply	0.00	(0.05)	0.00	(0.06)
Construction	0.03	(0.18)	0.03	(0.18)
Wholesale and retail trade, motor repair	0.13	(0.34)	0.13	(0.33)
Hotels and restaurants	0.02	(0.15)	0.02	(0.14)
Transport, storage and communication	0.03	(0.16)	0.03	(0.17)
Financial intermediation	0.01	(0.12)	0.02	(0.14)
Real estate, renting and business activities	0.05	(0.22)	0.05	(0.23)
Public administration and defence	0.05	(0.22)	0.05	(0.22)
Education	0.08	(0.27)	0.08	(0.27)
Health and social work	0.32	(0.47)	0.31	(0.46)
Other community, social and personal service activities	0.02	(0.15)	0.02	(0.16)
Unknown	0.18	(0.38)	0.18	(0.39)
N	10245		14258	

Notes: The table shows the distribution of wives across different industries, measured in 2003.

**Table A.3**

DD estimates, all outcomes, husbands.

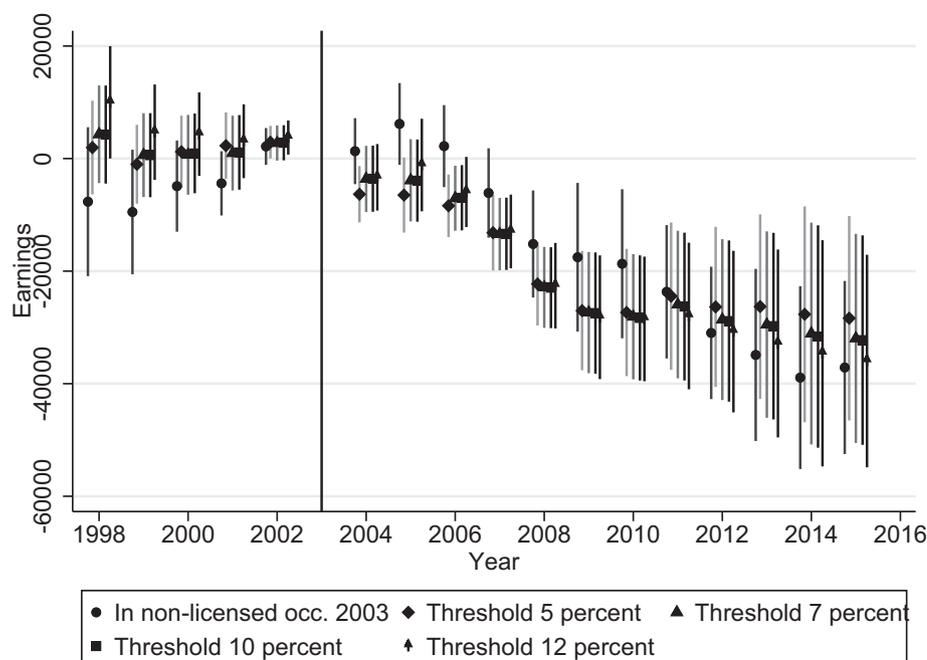
	Labor earnings	Employment	Hours	Hourly wage	Unemployment	Sickn. abs	Disability	Change job	Unempl. ben.	Other benefits
DD 1998	4270 (5294)	-0.001 (0.001)	0.055 (0.041)	0.024 (0.016)	0.002 (0.008)	-0.975 (0.871)	-0.002*** (0.001)	0.051 (0.040)	470 (470)	-223 (647)
DD 1999	604 (4543)	-0.001 (0.001)	0.004 (0.038)	0.018 (0.012)	0.002 (0.009)	-0.945 (0.852)	-0.002*** (0.001)	0.018 (0.035)	302 (582)	-169 (400)
DD 2000	919 (4305)	-0.000 (0.001)	0.028 (0.038)	0.048** (0.024)	-0.002 (0.008)	-0.270 (0.680)	-0.001** (0.001)	-0.011 (0.044)	89 (532)	72 (380)
DD 2001	1097 (4030)	-0.001 (0.001)	0.011 (0.033)	0.028*** (0.010)	0.003 (0.008)	-0.566 (0.647)	-0.002*** (0.001)	-0.010 (0.047)	600 (474)	541* (314)
DD 2002	2808 (1897)	-0.001 (0.001)	-0.005 (0.032)	0.009 (0.009)	0.007 (0.007)	-0.443 (0.960)	-0.001** (0.000)	0.017 (0.043)	567 (413)	41 (254)
DD 2004	-3576 (3571)	-0.003* (0.002)	-0.026 (0.027)	0.006 (0.011)	0.002 (0.007)	-0.875 (0.695)	0.001 (0.001)	0.003 (0.042)	-333 (346)	578 (549)
DD 2005	-3914 (4437)	-0.008*** (0.002)	-0.038 (0.032)	0.001 (0.011)	0.003 (0.008)	-0.082 (0.809)	0.001 (0.001)	0.018 (0.011)	290 (373)	-425 (1131)
DD 2006	-6961* (3525)	-0.015*** (0.004)	-0.069** (0.032)	0.010 (0.012)	0.010 (0.009)	0.161 (0.884)	-0.001 (0.002)	0.037 (0.033)	897* (459)	-570 (1722)
DD 2007	-13361*** (3905)	-0.018*** (0.003)	-0.046 (0.038)	-0.000 (0.013)	0.011 (0.010)	-0.486 (0.793)	-0.002 (0.002)	0.025 (0.033)	928* (516)	-280 (1661)
DD 2008	-22938*** (4371)	-0.023*** (0.004)	-0.040 (0.043)	-0.033*** (0.012)	0.016* (0.009)	0.644 (1.063)	-0.002 (0.003)	0.027 (0.029)	1084** (525)	227 (1683)
DD 2009	-27448*** (6548)	-0.023*** (0.005)	-0.037 (0.049)	-0.048** (0.018)	0.031*** (0.009)	1.047 (0.911)	-0.000 (0.004)	0.030 (0.027)	2070*** (524)	1529 (1978)
DD 2010	-28316*** (6758)	-0.020*** (0.004)	-0.075 (0.059)	-0.046** (0.020)	0.026*** (0.007)	-0.443 (0.934)	-0.000 (0.005)	0.008 (0.031)	1273*** (437)	1528 (2248)
DD 2011	-26295*** (7979)	-0.019*** (0.005)	-0.117** (0.052)	-0.040** (0.019)	0.023*** (0.006)	-0.502 (1.171)	0.000 (0.006)	0.030 (0.034)	1434*** (410)	616 (3309)
DD 2012	-28869*** (8703)	-0.024*** (0.005)	-0.144** (0.056)	-0.017 (0.020)	0.024*** (0.007)	0.366 (0.713)	-0.001 (0.006)	0.026 (0.034)	1563*** (437)	-944 (4567)
DD 2013	-29769*** (10079)	-0.020*** (0.004)	-0.164*** (0.056)	-0.005 (0.028)	0.025*** (0.008)	0.010 (0.837)	0.000 (0.007)	0.040 (0.030)	1988*** (451)	-877 (5998)
DD 2014	-31615*** (12014)	-0.021*** (0.005)	-0.112 (0.075)	-0.079** (0.038)	0.028*** (0.009)	1.112 (1.080)	0.003 (0.006)	0.031 (0.038)	2028*** (478)	1727 (6111)
DD 2015	-32254*** (11314)	-0.025*** (0.005)	-0.078 (0.093)	-0.001 (0.018)	0.021*** (0.008)	-1.300* (0.660)	0.006 (0.006)	0.033 (0.036)	1481*** (429)	-292 (6442)
N	301755	301755	286800	286773	301755	301755	301755	283157	301755	301755

Notes: The table shows the difference-in-differences estimates of the effect of the EU enlargement on labor market outcomes for exposed workers relative to sheltered workers. 2003 is the reference year. Control variables are dummies for husbands' and wives' age in 2003, as well as the husbands' work experience with the 2003 employer. Standard errors are clustered at the 2003 education group level. Level of significance: \*\*\* 1%, \*\* 5%, \* 10%.

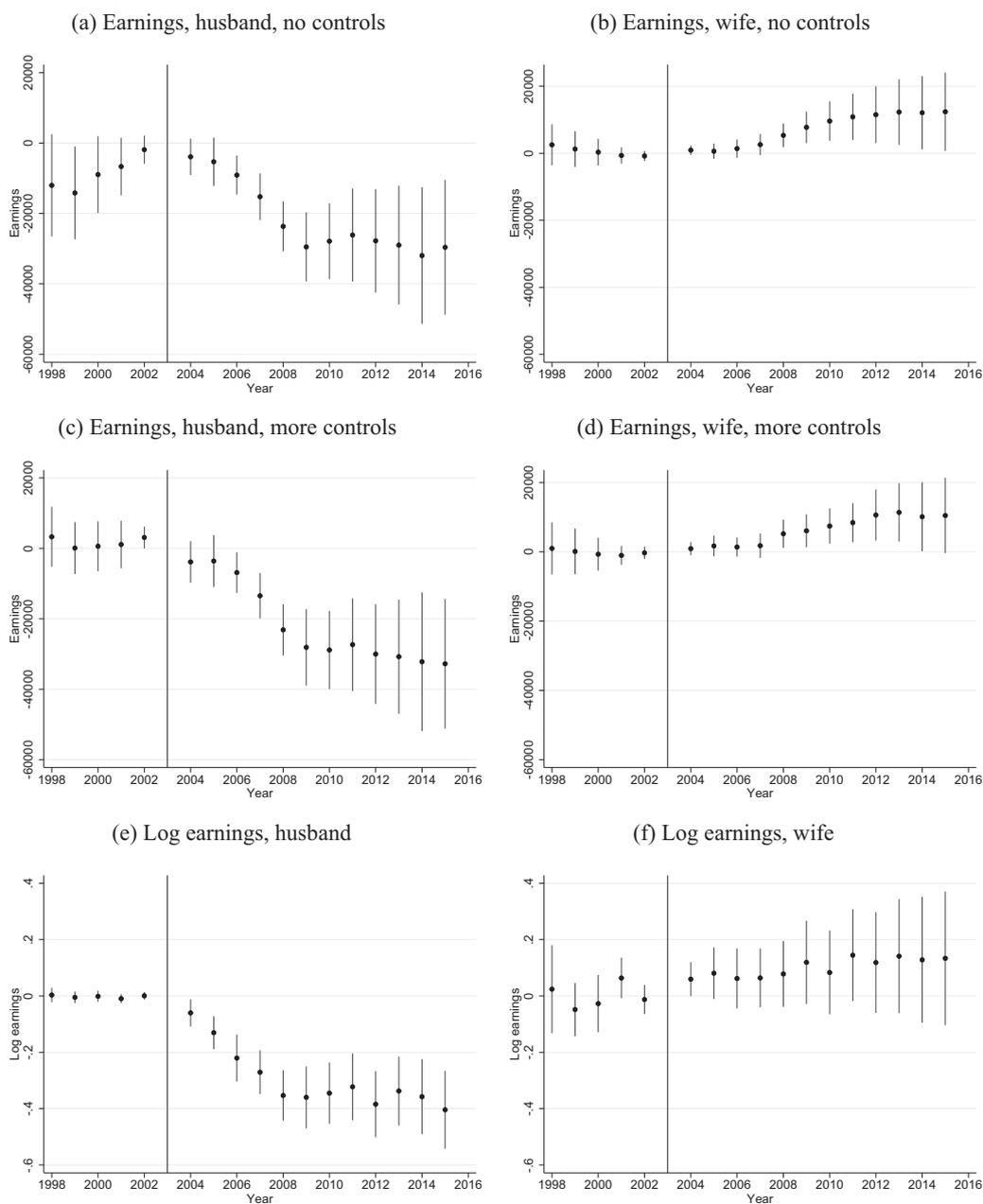
**Table A.4**  
DD estimates, all outcomes, wife.

	Labor earnings	Employment	Hours	Hourly wage	Unemployment	Sickn. abs	Disability	Change job	Unempl. ben.	Other benefits
DD 1998	1764 (4377)	0.003 (0.007)	0.235 (0.257)	-0.003 (0.027)	-0.001 (0.005)	-1.521* (0.776)	0.001 (0.002)	-0.012 (0.008)	-596 (531)	10 (2431)
DD 1999	540 (3781)	-0.003 (0.004)	0.166 (0.278)	-0.010 (0.031)	-0.004 (0.004)	-1.624* (0.908)	0.001 (0.002)	-0.008 (0.007)	-676 (496)	251 (1555)
DD 2000	-706 (2721)	-0.002 (0.004)	0.129 (0.281)	-0.029 (0.022)	0.000 (0.003)	-0.245 (0.451)	0.001 (0.002)	-0.014 (0.014)	-626 (478)	1272 (837)
DD 2001	-978 (1555)	0.006 (0.003)	0.059 (0.197)	-0.019 (0.017)	0.001 (0.003)	-1.067 (0.659)	-0.000 (0.001)	0.001 (0.009)	-422 (425)	537 (669)
DD 2002	-426 (974)	-0.000 (0.003)	0.153 (0.145)	-0.024 (0.025)	-0.003 (0.003)	-1.023 (0.801)	-0.000 (0.001)	-0.008 (0.007)	-283 (246)	1251** (553)
DD 2004	859 (1173)	0.005* (0.003)	-0.008 (0.088)	-0.015 (0.013)	0.001 (0.004)	-0.809 (0.763)	-0.001 (0.001)	-0.013* (0.007)	75 (456)	748 (1004)
DD 2005	1767 (1895)	0.007* (0.004)	-0.037 (0.113)	0.017 (0.014)	0.000 (0.004)	-0.059 (0.605)	-0.000 (0.001)	-0.006 (0.005)	-280 (540)	1100 (1280)
DD 2006	1443 (1815)	0.005 (0.005)	-0.015 (0.212)	-0.020 (0.023)	-0.002 (0.005)	-1.185 (1.017)	-0.000 (0.001)	-0.006 (0.007)	-412 (483)	1061 (1499)
DD 2007	1754 (2226)	0.005 (0.005)	-0.019 (0.166)	-0.026 (0.023)	0.003 (0.004)	-1.163 (1.176)	-0.000 (0.002)	-0.008 (0.007)	-274 (454)	275 (1446)
DD 2008	5101** (2566)	0.004 (0.005)	0.043 (0.174)	-0.002 (0.032)	0.000 (0.004)	-1.381 (0.861)	0.001 (0.003)	-0.007 (0.009)	-309 (447)	-409 (1678)
DD 2009	6108* (3138)	0.008 (0.007)	0.125 (0.219)	-0.042* (0.023)	0.001 (0.004)	-0.915 (0.772)	-0.000 (0.004)	-0.011 (0.007)	-231 (413)	770 (1652)
DD 2010	7358** (3450)	0.005 (0.007)	0.264 (0.229)	-0.026 (0.024)	-0.001 (0.004)	-1.382* (0.795)	-0.001 (0.005)	-0.010 (0.007)	-288 (406)	-531 (2093)
DD 2011	8316** (3809)	0.010 (0.008)	0.271 (0.207)	-0.026 (0.035)	0.000 (0.003)	-2.271** (0.915)	-0.001 (0.006)	-0.008 (0.005)	-464 (527)	-1469 (1972)
DD 2012	10511** (4826)	0.008 (0.008)	0.411* (0.221)	-0.036 (0.028)	-0.001 (0.004)	-0.810 (0.795)	-0.004 (0.006)	-0.009 (0.007)	-634 (531)	-2504 (2146)
DD 2013	11346** (5569)	0.009 (0.009)	0.606** (0.243)	-0.014 (0.026)	-0.003 (0.005)	-0.215 (1.290)	-0.006 (0.007)	-0.017*** (0.005)	-513 (499)	-3007 (2472)
DD 2014	9871 (6362)	0.009 (0.009)	0.466* (0.249)	-0.026 (0.036)	0.003 (0.004)	-1.109 (1.169)	-0.007 (0.008)	-0.012** (0.006)	124 (454)	-2253 (2747)
DD 2015	10036 (6850)	0.008 (0.010)	0.352 (0.320)	0.008 (0.019)	0.004 (0.004)	-1.165 (0.865)	-0.007 (0.009)	-0.014** (0.006)	285 (402)	-2212 (3198)
N	301755	301755	249135	249196	301755	301755	301755	236429	301755	301755

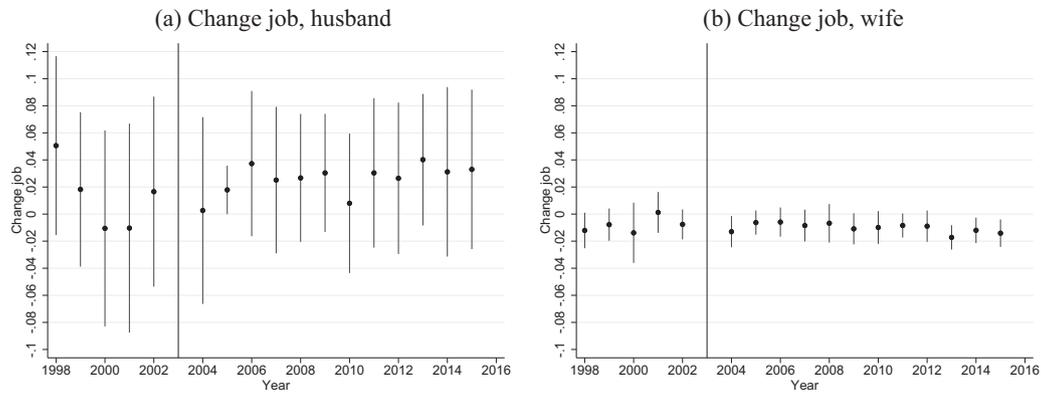
Notes: The table shows the difference-in-differences estimates of the effect of the EU enlargement on labor market outcomes for exposed workers relative to sheltered workers. 2003 is the reference year. Control variables are dummies for husbands' and wives' age in 2003, as well as the husbands' work experience with the 2003 employer. Standard errors are clustered at the 2003 education group level. Level of significance: \*\*\* 1%, \*\* 5%, \* 10%.



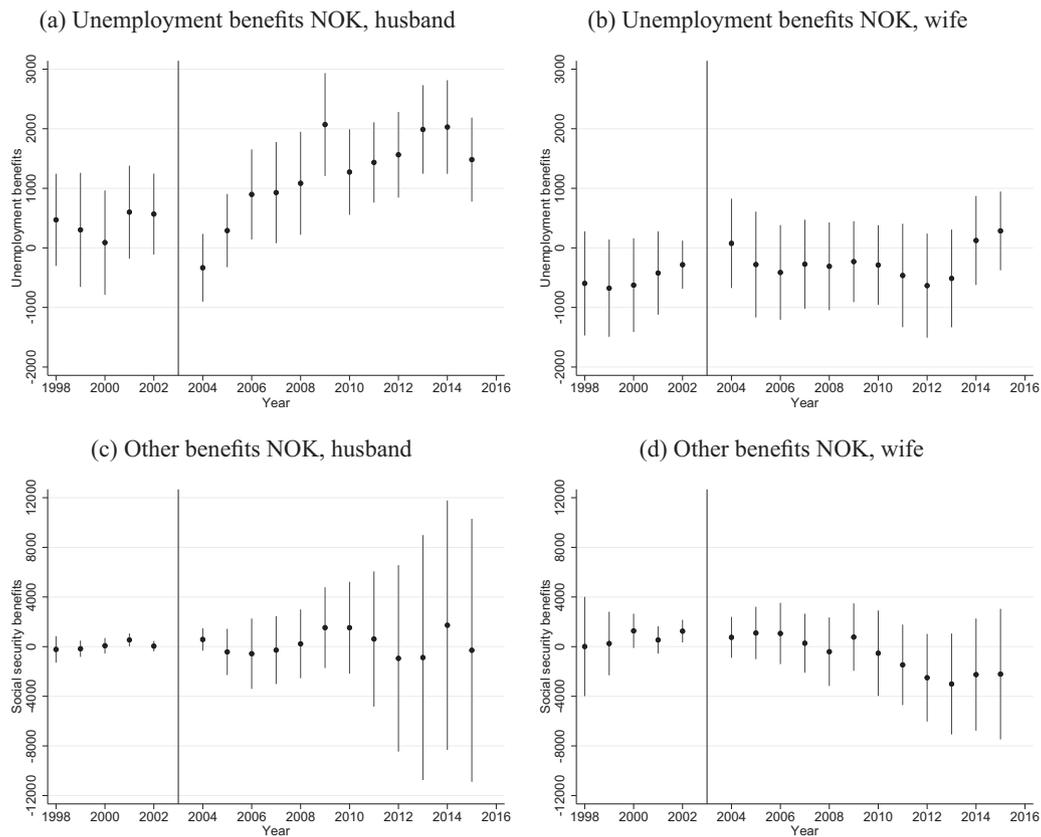
**Fig. A.1.** Alternative license definitions. Notes: The figure shows the difference-in-differences estimates of the effect of the EU enlargement on labor market outcomes for exposed workers and their wives relative to sheltered workers, for different thresholds of shares in education type that works in a licensed occupation. 2003 is the reference year. Control variables are dummies for husbands' and wives' age in 2003, as well as the husbands' work experience with the 2003 employer. Standard errors are clustered at the 2003 education group level. Spikes show the 95% confidence intervals.



**Fig. A.2.** The impact of the 2004 EU enlargement on earnings, without control variables, with more control variables and on log earnings. Notes: The figure shows the difference-in-differences estimates of the effect of the EU enlargement on labor earnings for exposed workers and their wives relative to sheltered workers, with different specifications of the control vector as well as the earnings measure. The baseline estimates in Fig. 3 includes controls for husband and wife age, and husband seniority in the pre-period. Additional controls in (c) and (d) are controls for family background of the husband: parents earnings when he was 7-16 years old, and their educational level (4 categories). Standard errors are clustered at the 2003 education group level. Spikes show the 95% confidence intervals.



**Fig. A.3.** The impact of the 2004 EU enlargement on the probability of changing workplace. Notes: The figure shows the difference-in-differences estimates of the effect of the EU enlargement on the probability of changing workplace for exposed workers and their wives relative to sheltered workers. Control variables are dummies for husbands' and wives' age in 2003, as well as the husbands' work experience with the 2003 employer. Standard errors are clustered at the 2003 education group level. Spikes show the 95% confidence intervals.



**Fig. A.4.** The impact of the 2004 EU enlargement on public insurance benefits in Norwegian Kroner. Notes: The figure shows the difference-in-differences estimates of the effect of the EU enlargement on public insurance benefits for exposed workers and their wives relative to sheltered workers. Control variables are dummies for husbands' and wives' age in 2003, as well as the husbands' work experience with the 2003 employer. Standard errors are clustered at the 2003 education group level. Spikes show the 95% confidence intervals.

**Table A.5**  
The impact of the 2004 EU enlargement on home production.

	Still married	Number of children	Births	His share parental leave
DD 1998	0.004 (0.018)	-0.010 (0.049)	0.002 (0.007)	
DD 1999	0.004 (0.015)	-0.013 (0.041)	0.002 (0.006)	-0.006 (0.004)
DD 2000	-0.006 (0.012)	-0.017 (0.032)	-0.000 (0.004)	-0.002 (0.005)
DD 2001	-0.010 (0.012)	-0.018 (0.025)	-0.008 (0.007)	0.002 (0.006)
DD 2002	-0.006 (0.011)	-0.011 (0.013)	-0.002 (0.004)	-0.008* (0.004)
DD 2004	0.006*** (0.002)	0.005 (0.009)	-0.009 (0.007)	0.005 (0.006)
DD 2005	0.004 (0.003)	0.018 (0.016)	0.001 (0.007)	-0.002 (0.009)
DD 2006	0.007** (0.003)	0.029 (0.021)	-0.003 (0.009)	-0.017** (0.009)
DD 2007	0.001 (0.004)	0.035 (0.026)	-0.008 (0.008)	0.012 (0.008)
DD 2008	0.004 (0.005)	0.035 (0.029)	-0.010 (0.009)	-0.028*** (0.010)
DD 2009	0.002 (0.006)	0.043 (0.032)	-0.006 (0.010)	-0.020 (0.017)
DD 2010	0.001 (0.007)	0.043 (0.034)	-0.013 (0.012)	-0.048** (0.021)
DD 2011	0.000 (0.007)	0.042 (0.035)	-0.012 (0.012)	-0.022 (0.030)
DD 2012	0.003 (0.008)	0.045 (0.036)	-0.009 (0.012)	0.009 (0.033)
DD 2013	-0.002 (0.008)	0.042 (0.037)	-0.013 (0.013)	-0.005 (0.050)
DD 2014	0.001 (0.007)	0.039 (0.036)	-0.012 (0.012)	
DD 2015	-0.003 (0.008)	0.035 (0.035)	-0.013 (0.013)	
N	301755	301755	301755	8033

Notes: The table shows the difference-in-differences estimates of the effect of the EU enlargement on home production outcomes for exposed workers and their wives relative to sheltered workers. Control variables are dummies for husbands' and wives' age in 2003, as well as the husbands' work experience with the 2003 employer. Standard errors are clustered at the 2003 education group level. Level of significance: \*\*\* 1%, \*\* 5%, \* 10%.

## Supplementary material

Supplementary material associated with this article can be found, in the online version, at [10.1016/j.labeco.2021.101983](https://doi.org/10.1016/j.labeco.2021.101983)

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**Table A.6**  
The impact of the 2004 EU enlargement on labor earnings. Heterogeneity according to presence of children and youngest child age.

	No child 2003	Have child 2003	0-6	7-12	13-18	19-
DD 1998	-3299 (15976)	1568 (3288)	-4335 (4561)	-9259 (7076)	13993 (8486)	-6905 (8853)
DD 1999	-8734 (14095)	1125 (2717)	874 (5195)	-14722** (6883)	1991 (7440)	-2808 (5604)
DD 2000	-11810 (10012)	268 (2048)	-1532 (4091)	-8958 (5657)	2087 (6739)	-1188 (5583)
DD 2001	-4784 (9384)	-827 (1542)	-2627 (3086)	-8222* (4156)	6015 (5296)	-5761 (4437)
DD 2002	1675 (4607)	-725 (967)	-2629 (1607)	-938 (3557)	2191 (5282)	-557 (2860)
DD 2004	4292 (2871)	528 (1197)	1361 (2273)	4385 (4623)	-1954 (5760)	-2711 (4845)
DD 2005	5633 (5872)	1326 (2039)	4611* (2470)	2544 (5689)	-3567 (5141)	106 (5817)
DD 2006	3355 (8088)	1174 (2340)	1677 (3241)	3015 (8250)	4692 (7520)	-2018 (5897)
DD 2007	2395 (7964)	1631 (2418)	-1105 (3929)	1297 (6218)	11094 (7442)	-724 (5827)
DD 2008	8970 (9379)	4629* (2721)	-365 (4309)	3638 (6461)	18936** (8881)	-1202 (4922)
DD 2009	16534 (10049)	4962 (3190)	5799 (5361)	898 (7570)	11112 (9426)	3896 (5513)
DD 2010	11375 (8376)	6867* (3585)	6932 (6241)	-1037 (7488)	20898** (9026)	3188 (6008)
DD 2011	11976 (9100)	7840** (3876)	9400* (5445)	1914 (7166)	20198** (8889)	3951 (5701)
DD 2012	10925 (10144)	10317** (4875)	8914 (8227)	6615 (8144)	19956** (7829)	7659 (7033)
DD 2013	10524 (15716)	11216* (5828)	10320 (10196)	8427 (7681)	16486* (9055)	10786 (6831)
DD 2014	10725 (18387)	9543 (6466)	6806 (15651)	3104 (10271)	20627** (8447)	9510 (7310)
DD 2015	10362 (14586)	9676 (6929)	-4984 (14001)	5925 (10630)	21891*** (8302)	9549 (6688)
N	27495	274260	95724	67935	51526	60131

Notes: The table shows the difference-in-differences estimates of the effect of the EU enlargement on labor earnings for exposed workers and their wives relative to sheltered workers, in samples split by the presence of children, and the age of the youngest child. Control variables are dummies for husbands' and wives' age in 2003, as well as the husbands' work experience with the 2003 employer. Standard errors are clustered at the 2003 education group level. Level of significance: \*\*\* 1%, \*\* 5%, \* 10%.

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