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# Short-Run and Long-Term Effects of Childbirth on Mothers' Employment and Working Hours across Institutional Regimes

## An Empirical Analysis Based on the European Community Household Panel

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**Abstract: The** employment behavior of mothers is strongly influenced by labor market regulations and certain institutional arrangements, which both vary greatly across European countries. Using the European Community Household Panel (ECHP) 1994-2001 for Denmark, Germany, Italy and the United Kingdom, which represent four distinct 'institutional regimes', we estimate the short-run and long-term effects of childbirth on married women's employment and working hours. Estimation results show that these effects vary across the four countries in accordance with prevailing institutional regulations.

**JEL Classification**: J22, J13, D12

**Keywords:** employment and working hours, labor supply, childbirth, European Community Household Panel, panel data models.

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# 1 Introduction

During the past few decades most industrialized countries have experienced a sharp increase in female labor force participation. In particular, maternal employment has risen in almost all European countries. Despite the common trend of rising female employment rates, their labor market participation is still lower than that of men. Women's employment patterns also differ enormously across countries, regarding both the level of labor force participation and average working hours. Recent empirical research based on comparable data for various countries of the European Union has established some important factors contributing to persistent country differences in female labor market behavior. These factors include labor market regulations and public policies related to childbirth and caring for children (for summaries see, e.g., OECD 2001, Jaumotte 2003). The relationship between childbirth and mothers' employment is considered to be of substantial policy relevance in several European countries with ageing societies because of relatively low fertility rates and low employment rates of mothers.

We empirically analyze the short-run and long-term effects of childbirth on married (or cohabitating) mothers' employment and working hours in four European countries. These countries are selected to represent distinct "institutional regimes" regarding family policy and labor market institutions, namely Denmark, Germany, Italy, and the United Kingdom. The empirical analysis is based on the European Community Household Panel (ECHP) which provides comparable panel data for these four countries over the period 1994 to 2001. We focus on married mothers because labor market behavior of this group is much more affected by childbirth than that of lone mothers, and country differences are also more pronounced for the former group.

An important feature of our analysis is that we distinguish between the short- and long-term effects of a birth of a child on women's labor supply, both on the extensive (participation) and intensive (working hours) labor supply margins. These effects may differ due to "state dependence" in individual labor market behavior, which implies that a woman's employment during the current period affects, for structural reasons, her employment in future periods (Heckman and Willis 1977, Heckman and MaCurdy 1980, Altug and Miller 1998). This structural dependence may be related to the accumulation of human capital while working or arise because continuous employment acts as a positive signal to firms screening job applicants. Due to state dependence, there may also be a trade-off between the short-run and long-term effects of policies aimed at increasing employment of mothers. For example, while paid maternity leave may increase employment rates of mothers after childbirth (see, e.g., Ruhm 1998), extended periods of leave may reduce mothers' future employment rates (see, e.g., Ondrich et al. 1999, Voicu and Buddelmeyer 2003).

Recent empirical research on the effects of childbirth on mothers' labor market behavior has focused on the labor force participation decision, i.e. the extensive labor supply margin (see, e.g.,

Hyslop 1999, Michaud and Tatsiramos 2005 for six European countries, Voicu and Buddelmeyer 2003 and Croda and Kyriazidou 2004 for Germany). We contribute to the literature by analyzing the effects of childbirth on mothers' working hours, i.e. the intensive margin, as well as on the extensive labor supply margin. As in Michaud and Tatsiramos (2005), we use a panel data set with comparable information for various countries, the European Community Household Panel, but select countries to represent the four "institutional regimes" prevailing in Europe and try to link country differences in estimated short-run and long-term effects of childbirth on mothers' employment and working hours to differing combinations of labor market flexibility and family policies in these countries.

The remainder of the paper is organized as follows. In the next section, we motivate the choice of countries for the analysis representing different "institutional regimes" in the European Union. In the next section, we describe the data and present some descriptive evidence on the relationship between married women's labor market behavior and the presence of children in the household. Section 4 contains the specification and estimation of the empirical employment and hours equations used to analyze the short-run and long-term effects of childbirth on married mothers' labor market behavior. Estimation results, summarized and discussed in section 5, show that both short-run and long-run effects differ significantly across the four countries analyzed here, that state dependence effects within countries are also markedly different between the two labor supply margins, and that these effects seem compatible with the prevailing combinations of labor market flexibility and family policies in the four countries analyzed in this study. Section 6 summarizes the main results of the study and concludes.

## 2 Institutional Regimes

Empirical literature has identified various factors related to both labor market regulation and public policies affecting employment rates and working hours of married mothers (see, e.g., Esping-Andersen 1990, Gauthier 2002, Jaumotte 2003). In the European Union various "institutional regimes" can be identified which differ in terms of these factors. Simplifying somewhat, one can define four institutional regimes:

- The first regime, which includes Denmark and the Scandinavian countries, represents the *universal welfare state* with relatively flexible labor markets and high employment rates, especially of married mothers. The universal welfare state is financed by relatively high taxes on labor income and/or social security contributions.
- The *conservative welfare state* regime, which includes Germany, Austria, France, Belgium, and the Netherlands, differs from the first group in that social transfers are related to previous earnings, in principle, with means-tested social transfers acting as a residual safety net. These

countries, also impose, although to a varying degree, relatively high income taxes and especially social security contributions. Labor markets in these countries tend to be more regulated than in the first group, with relatively low employment rates and short average working hours of married mothers ("secondary earners"). The male "bread-winner model" still dominates.

- The institutional regime prevailing in *Southern-European countries* is similar to the one of the second group along certain dimensions, but differs by its stronger reliance on family ties rather than social insurance. Compared to both the universal and the conservative welfare state regime, mandatory social security contributions are relatively low.
- Finally, the group of countries making up the *liberal welfare state* regime features relatively flexible labor markets as well as means-tested social transfers and tends to rely on the market for the provision of social services, in particular also the provision of child care. Labor market regulation is relatively weak, income taxes and social security contributions are low compared to both the universal and the conservative welfare state regime. In the European Union, the sole representative of this regime is generally considered to be the United Kingdom.

To represent these four institutional regimes, for the following empirical analysis we select Denmark, Germany[1], Italy and the United Kingdom. We limit the analysis to these four countries because, first, we consider them to appropriately represent each of the four regimes in terms of important differences in institutional factors determining women's labor market behavior across Europe.[2] In principle, other countries also could have chosen to represent particular institutional regimes. For example, Denmark and Sweden do differ somewhat in terms of institutional factors influencing mothers employment behavior (see, e.g. Pylkkänen and Smith 2004), so do Germany and France representing both belonging to the conservative welfare state regime (see, e.g., Barclet, Dell and Wrohlich 2005). To keep the empirical analysis comprehensible, we selected just one typical country to represent a particular regime on the basis of the principle of maximizing institutional differences across regimes (i.e., choosing Germany rather than France on account of the latter's more employment-friendly family policy) as well as data availability (e.g., for Sweden the ECHP only started in 1997). Details on institutional differences across these four countries are summarized in Table 1, where we differentiate between employment regulation, family policies, social security regulations, and income taxation.

[1] Although labor force participation rates and working hours of employed married women still differ significantly between east and west Germany, we do not analyse the two regions separately here because our estimation strategy is based on changes over time rather than levels information, and convergence in labour market outcomes between the two regions has virtually come to an end already in the mid-nineties (see, e.g., Franz and Steiner 2000). Our estimation approach does, however, account for time invariant differences between east and west.

[2] Nowadays, one would also have to add a group of previously Communist European countries to one or the other of the institutional regimes. Since the observation period of the subsequent empirical analysis ends in 2001, and comparable data for these countries are not available for the 1990's, we do not consider these countries here.

**Table 1 Institutional regimes compared – Denmark, Germany, Italy, and the United Kingdom**

| Country | Employment regulation | Family policies | | | | Social insurance | Income taxation |
|---|---|---|---|---|---|---|---|
| | | Maternity / child-care leave [a] | Cash support | Child care [b] | School schedules | | |
| **Denmark** | Flexible working hours, high employment rate, women work most often full-time. Low long and short term unemployment, i.e. flexible in terms of getting a new job | Maternity leave: 30 weeks<br>Maternity benefits: 100 % of average wage<br>Maximum duration of maternity/child-care leave: 82 weeks<br>Paid leave: 42 weeks | Medium level of universal cash support for families, but high level of other forms of support that result in low levels of child poverty | A very high number of childcare facilities for children age < 3 years (64% coverage), 3< aged ≤ 6 yrs.: very good coverage (91%) | Opening hours: 8:00-15.00<br>Meal provision / supervision during lunch break: Yes | Social security is mainly financed through taxes. All residents are covered by the public health insurance and have free and equal access to the services of the health insurance and to hospital aid. The government provides a basic old age pension for everyone in Denmark. | Individual taxation<br>Average tax rates second earner/single [c]:<br>50 / 41 / *1.2*<br>51 / 44 / *1.2* |
| **Germany** | Part-time employment very common, flexible working hours, in particular in the public sector<br>Relatively high long-term unemployment | Maternity leave: 14 weeks<br>Maternity benefits: 100 % of average wage<br>Total duration of leave: 162 weeks<br>Paid leave: 42 weeks | Medium to high level of cash support. | Limited childcare facilities for children age < 3 years (10%), 3< aged ≤ 6 yrs.: good coverage (78%) | Opening hours: 8:00-12.30, hours increase with age from 2.5 to 4.5 hours a day<br>Meal provision / supervision during lunch break: Very few places | Married women automatically co-insured if non-employed and spouse covered by social insurance (all employees below a relatively high income threshold); mandatory contributions to the social insurance funds at a rate of about 40% (employee and employer contributions) if employed; availability of actuarially fair private health insurance | Joint taxation<br>Average tax rates second earner/single [b]:<br>50 / 34 / *1.5*<br>53 / 42 / *1.3* |
| **Italy** | Scarcity of part-time employment and flexible working hours; high long term unemployment | Maternity leave: 21.5 weeks<br>Maternity benefits: 80 % of average wage<br>Maximum duration of maternity/child-care leave: 65 weeks<br>Paid leave: 30 weeks | Low level of cash support that results in high levels of child poverty. | Very limited childcare facilities for children age < 3 years (6%), 3< aged ≤ 6 yrs.: very good coverage (95%) | Opening hours: 8:00-12.30, min. 27 hours/week 8:00-16:30, max. 30 hours/week<br>Meal provision / supervision during lunch break: For maximum hours/week only | National Insurance contributions are payable by employees earning more than a certain threshold. Depending on eligibility criteria members of the National Insurance scheme qualify for pensions, sickness, industrial injury and unemployment benefits. | Individual taxation<br>Average tax rates second earner/single [b]:<br>38 / 24 / *1.6*<br>39 / 29 / *1.4* |
| **UK** | High share of part-time employment, flexible working hours, low long-term unemployment | Maternity leave: 18 weeks<br>Maternity benefits: 44 % of average wage<br>Maximum duration of maternity/child-care leave: 31 weeks<br>Paid leave: 8 weeks | Low level of cash support for families, relatively higher for families in greater need, (e.g. working families tax credit) | A high number of childcare facilities for children age < 3 years (34%), 3< aged ≤ 6 yrs.: medium coverage (61%) | Opening hours: 9:00-12.00 13:00-15:30 hours increase with age of child<br>Meal provision / supervision during lunch break: Yes | Individual based social insurance. Basic medical care is mainly financed through taxes, small proportion from National Insurance contributions and patients' co-payments. All residents are covered by the public health insurance. | Individual taxation<br>Average tax rates second earner/single [b]:<br>24 / 19 / *1.3*<br>36 / 24 / *1.1* |

Notes: a) Years refer to 1998 for Denmark and Italy and 2000 for Germany and the UK (OECD 2001, Table 4.7, Jaumotte 2003, Table 3).

c) Numbers refer to 1998 for Denmark and Italy and to 2000 for the UK and Germany (OECD 2001).

b) The first line refers to women earning 67% of the "Average Production Worker's Wage" in 2001, the second line to women earnings 100% of APW (Jaumotte 2003). Numbers in italics are ratios of tax rates of second earners and singles.

Source: Own compilation.

## 3 Descriptive Evidence on Employment and Working Hours of Mothers

The subsequent empirical analysis is based on the European Community Household Panel (ECHP). The major advantage of the ECHP is that it provides harmonized high-quality panel data for a large number of European countries. The first wave of the ECHP was carried out in 1994 in twelve European countries. When it was terminated in 2001, fifteen European countries were represented in the ECHP, among them the four countries we analyze here.[3] For the four countries analyzed here, the total number of female respondents in the period 1994-2001 range from about 19,000 in Denmark to about 66,000 in Italy.[4] For the following empirical analysis, we select two sub-samples. The first is restricted to all married or cohabitating women aged 20-50 years. Women in education or vocational training are excluded from the sample. The second sub-sample excludes all women who do not work. Respondents are coded as "employed" if they report to have worked at least one hour during the week before the interview. For employed women, working hours in the main and any additional job during the week before the interview are also available in the ECHP. Table A1 in the Appendix reports the number of respondents per wave and country for both samples.

Employment rates of married women aged 20-50 differ greatly between the four countries. Within our observation the period 1994-2001, the average employment rate ranges from almost 90% in Denmark to just 50% in Italy, with Germany (66%) and the UK (76%) being in-between these two extremes (see Table A2 in the Appendix). Hence, average weekly working hours also differ markedly across countries if calculated for the whole sample of married women. If non-employed married women are included with zero hours, the average number of weekly working hours ranges from 17.2 in Italy (with a standard deviation of about 19 hours) to about 31.5 (13.8) in Denmark. For this group, average weekly working time is 21.9 hours in Germany and 24.8 hours in the UK. Conditional on employment, cross country differences in average working hours are relatively small, ranging from 35.5 hours per week in Denmark (with a standard deviation of 8.5 hours) to 32.5 hours (13.2) in the UK (see Table A2). In Italy, the small share of employed married women apparently work, on average, longer hours than in Germany and the UK. In other words, if married women work at all in Italy, they tend to work full-time. Part-time work is more prevalent in Germany and the United Kingdom than in Denmark or Italy.

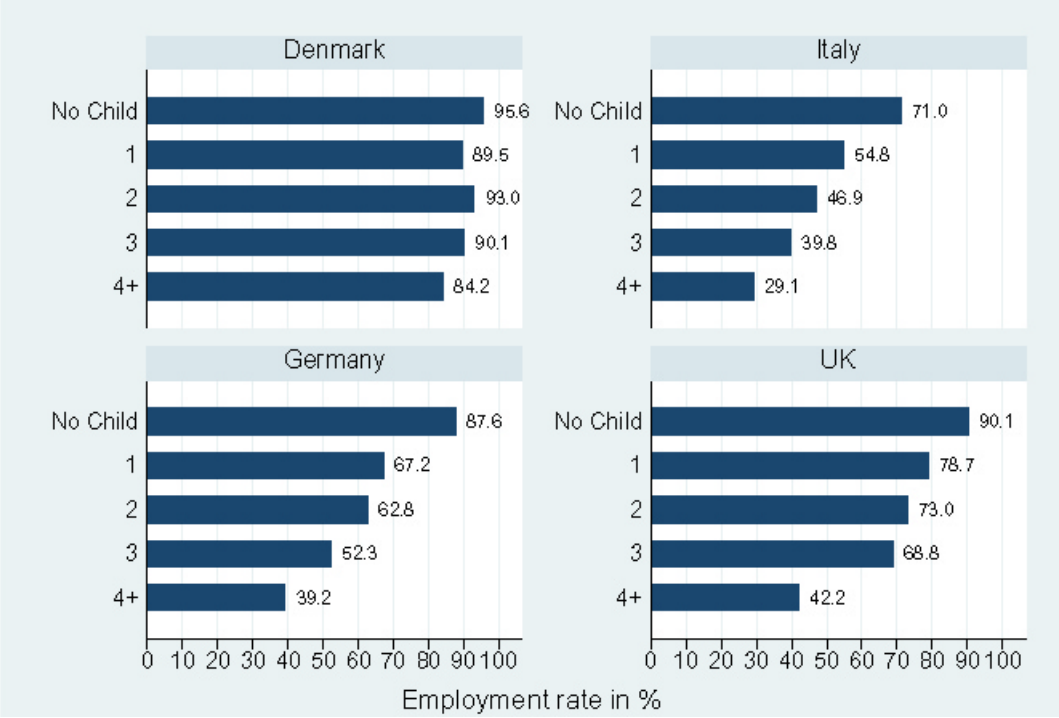
To which extent are these employment patterns across countries related to the presence of children in the household? Figure 1 presents employment rates and average weekly working hours

[3] In 1997, Germany and the UK terminated the original ECHP survey. For these countries, existing national panel studies – the German Socioeconomic Panel (SOEP) and the British Household Panel Study (BHPS) – were substituted for the ECHP to generate comparable data covering the period from 1994 to 2001 (EUROSTAT 1996).

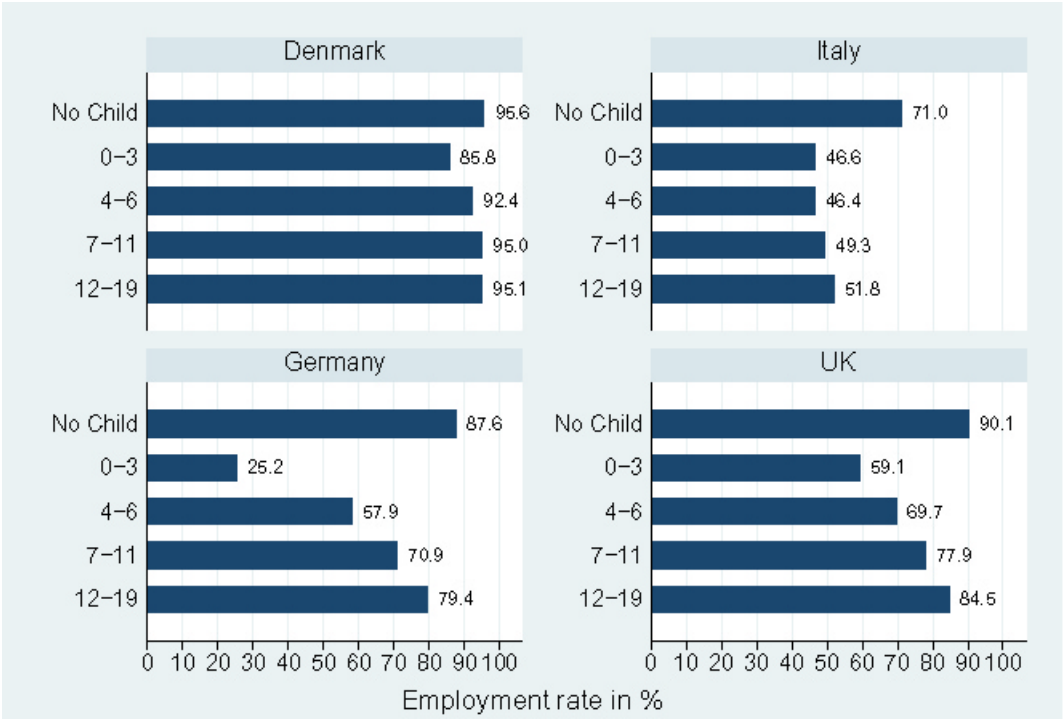
[4] The exact numbers are 18,882 for Denmark, 38,026 for Germany, 66,006 for Italy, and 48,408 for the UK. To the extent and potential effects of sample attrition in the ECHP, see Behr, Bellgardt and Rendtel (2005).

**Figure 1 Average employment rates of married or cohabitating women by country, number of children and age of youngest child (2000/2001)**

**a) number of children**



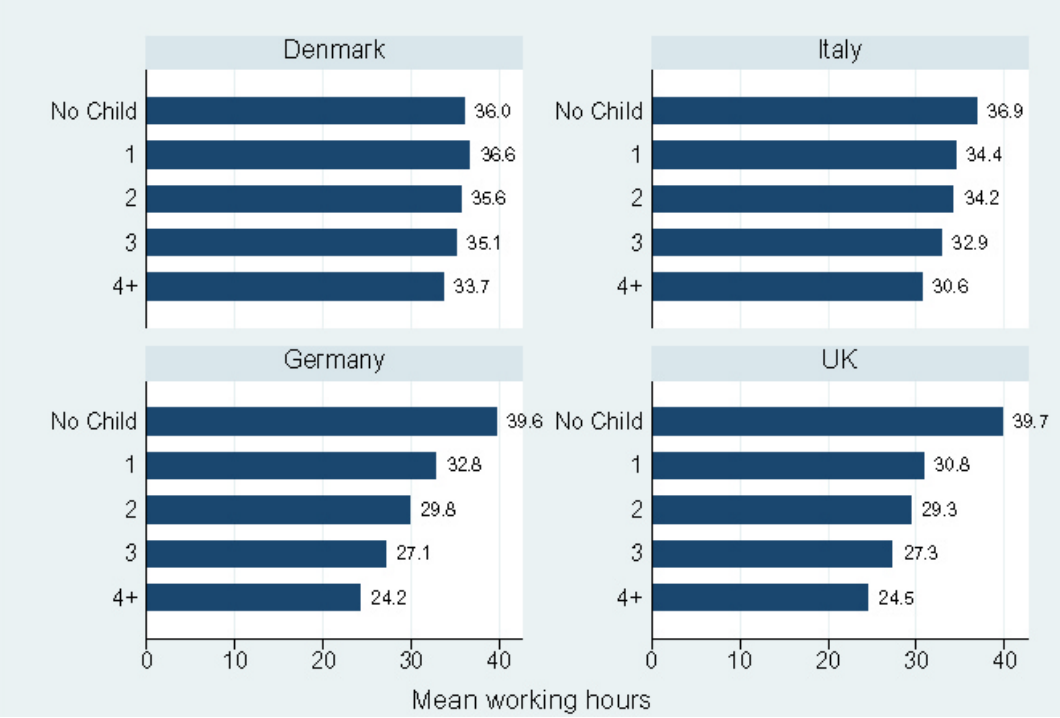

**b) age of youngest child**



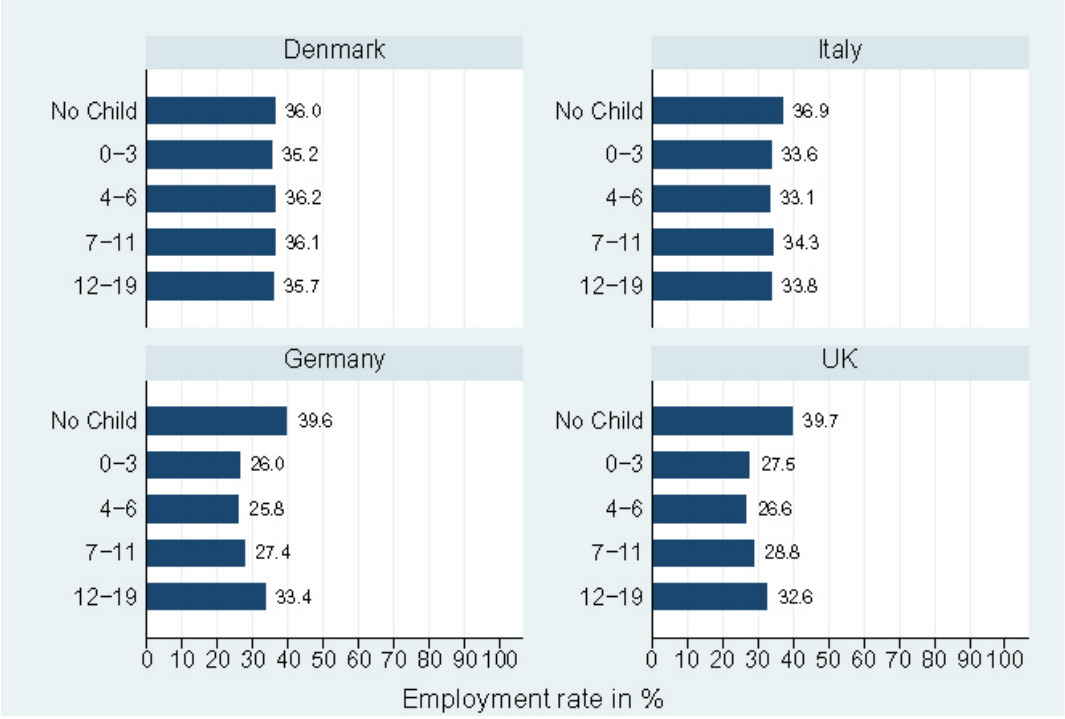

Source: ECHP, waves 2000/2001, own calculations.

**Figure 2 Average weekly working hours of married or cohabitating women by country, number of children and age of youngest child (2000/2001)**

**a) number of children**




**b) age of youngest child**




Source: ECHP, waves 2000/2001, own calculations.

for the years 2000/2001 stratified by country and by the number of children.[5] As shown in Figure 1a, employment rates of married women decline markedly with the number of children in all countries, except for Denmark, although to a varying degree. This decline is particularly strong in Italy and Germany, where employment rates of married women with one child are some 20 percentage points lower, on average, than the respective rates of women without children. In stark contrast, in Denmark employment rates of married women with children differ little from those of married women without children. In the UK, too, married women's employment rates decline much less with increasing number of children, except for the group of women with 4 or more children.

Figure 1b documents the relationship between employment rates and the age of the youngest child in the household. Again, this relationship seems to be very weak in Denmark, whereas the presence of children below the age of 3 years in the household is associated with an extremely low average employment rate of only about 25% Germany, compared to more than 86% in Denmark, about 60% in the UK and almost 50% in Italy. The other striking country difference is that employment rates of mothers with older children do not differ much from those with small children in Denmark and Italy, whereas in the UK and especially in Germany employment rates of mothers with older children are much higher. For example, in Germany the average employment rate of mothers with children aged 4-6 years is almost 60%, compared to 25% for mothers with small children, and almost 80% for women with children aged 12-19 years. A similar if less extreme pattern is also observed for the UK.

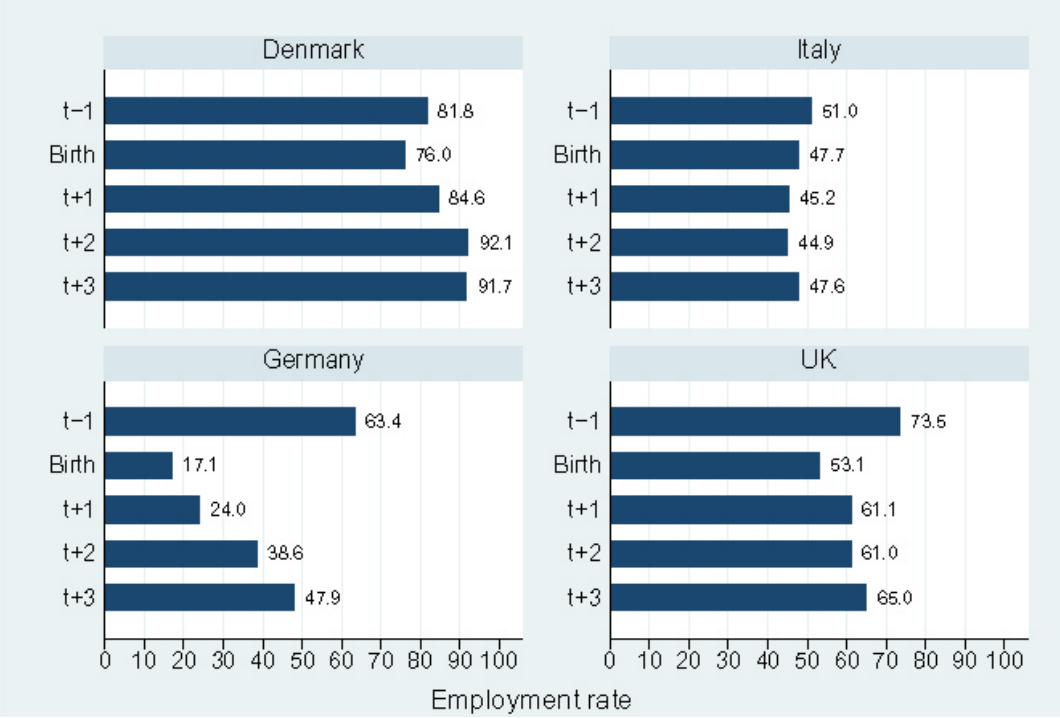
Figure 2a shows that the number of children seems to be only weakly related to average weekly working hours of *employed* married women in Denmark, whereas there is a modest negative relationship between these two variables in Italy. In both Germany and the UK, the more children there are in the household, the smaller the number of working hours of employed mothers, where the magnitude of this correlation seems to be very similar in these two countries. For example, whereas employed married women without children work about 40 hours per week in both Germany and the UK, this number declines to about 30 hours in the presence of one or two children. As shown in Figure 2b, working time of employed married mothers also differs little by the age of the youngest child in Denmark and Italy, whereas in Germany and the UK average working time of employed mothers with children is significantly smaller than that for married women without children.

Of particular interest for the subsequent empirical analysis is the relationship between married mothers' labor market behavior and childbirth. Here, we use the panel structure of our data base and calculate employment rates and working hours of married mothers the year before childbirth, in that year, and in a number of subsequent years for the four countries. Figure 3a shows that employment

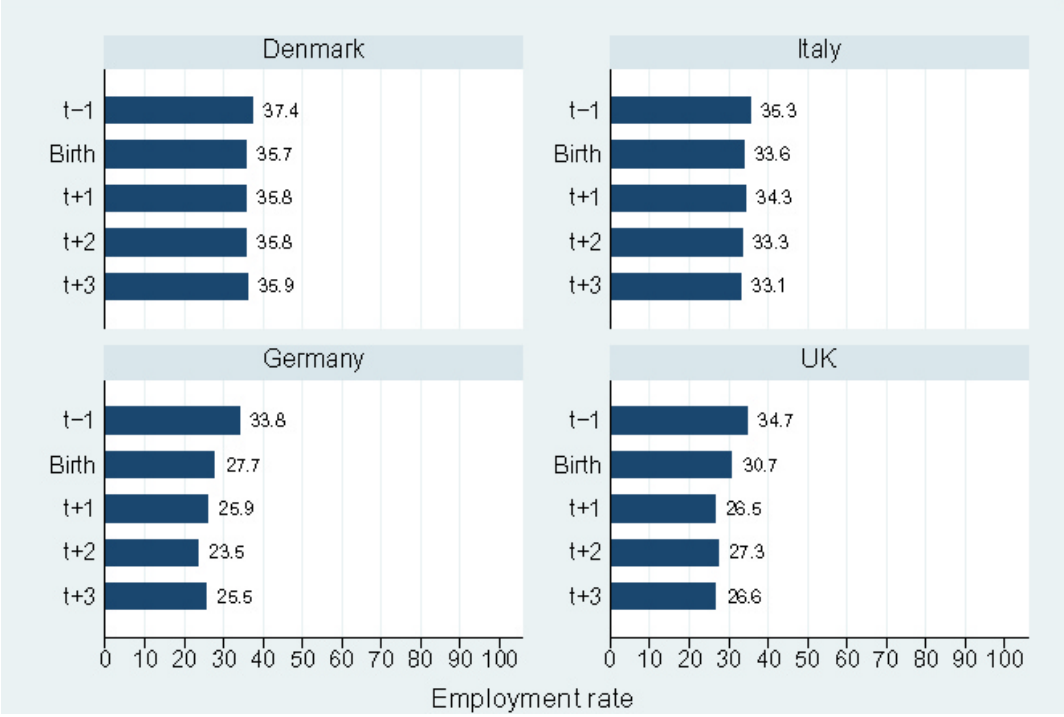
[5] We aggregate the two years to increase number of observations and average out cyclical factors.

**Figure 3 Employment rates and average working hours in the year before childbirth, at childbirth, and in subsequent years by country (1994 – 2001).**

**a) Employment rate**




**b) Working hours**




Source: ECHP, waves 2000/2001, own calculations.

rates of mothers only slightly decrease in the year of childbirth in Denmark and Italy, but drop from roughly 60% the year before childbirth to less than 20% the year of childbirth in Germany, and from more than 70% to about 50% in the UK. To some extent, the dramatic decline of the employment rate of German mothers following childbirth is reversed in subsequent years: 3 years after childbirth, mothers' employment rate has, on average, increased by about 30 percentage points to a level of almost 50%, still considerably below the employment rate before childbirth. Hence, both the short-run and longer-term effects of childbirth on employment of mothers seem to be much more pronounced in Germany than in the other countries analyzed here.

A similar picture emerges regarding the relationship between childbirth and working hours of *employed* married mothers, as shown in Figure 3b. In Denmark and Italy, average working hours of employed mothers change little in the years following childbirth, whereas there is a marked decline in working hours of this group in Germany and the UK which subsequently stabilize at a somewhat lower level than prevailing the year before childbirth. This, again, suggests that the short-run and long-term effects of childbirth on married women's employment behavior are quite different across countries.

Having established some empirical evidence on the relationship between married women's employment behavior and the presence of children in the household we now turn to a more thorough empirical analysis based on dynamic employment and hours equations which will allow us to quantify the short-run and long-term effects of childbirth on married women's labor market behavior.

## 4 Dynamic Employment and Hours Equations

To model the short-run and long-term effects of childbirth on married women's employment rates and working hours, we need to specify dynamic employment and hours equations accounting for sluggish adjustment in labor market behavior. Individual employment rates and working hours between two consecutive periods are highly correlated. This empirical correlation can arise from "true state dependence" or from spurious correlation (see, e.g., Heckman 1981, 2001:704-712, Hyslop 1999). True state dependence in individual employment rates, for example, means that employment during the current period increases, for structural reasons, the likelihood of being employed in the next period. This structural dependence may be related to the accumulation of human capital or arise because continuous employment acts as a positive signal to firms screening job applicants. However, correlation in employment rates between two periods may also be purely spurious, for the following reasons (Heckman 1981a):

(i) if the sampling scheme is such that a single employment spell, on average, overlaps two consecutive periods;

(ii) due to unobserved individual heterogeneity and/or serial correlation in time-varying error components;

(iii) if initial conditions or relevant pre-sample history of the employment process are not taken properly into account in the estimation.

Given panel data it is, in principle, possible to account for these factors and identify true state dependence effects by specifying and estimating dynamic employment and hours equations, as described in the following.

## 4.1 Specification

To assess the influence of children on the labor market behavior of women, it is important to take into account that the presence of children not only influences the decision of the mother whether to seek employment or not (extensive margin) but also the amount of working hours (intensive margin). There are only a few studies which attempt to model both decisions within an intertemporal discrete choice model, Haan (2005) being the only study for Germany we are aware of. Here, we specify similar dynamic models for the two labor supply margins but estimate them separately.

The dependent variable (married women's employment status or working hours per week), $y_{it}$, for woman $i$ in period $t$ is expressed as a function of its lagged realization, $y_{i,t-1}$, a row vector of explanatory variables, $Z_{it}$, an individual-specific fixed effect, $\alpha_i$, and an error term varying across individuals and time, $u_{it}$:

$$(1) \quad y_{it}=\lambda y_{i,t-1}+Z_{it}\beta+\alpha_i+u_{it}, \quad i=1,...,N \text{ and } t=1,...,T_i$$

where the adjustment ("state dependence") parameter $\lambda$ and the column parameter vector $\beta$ are to be estimated. Regarding the error components $\alpha_i$ and $u_{it}$ we will assume that there is no remaining autocorrelation in $u_{it}$, after conditioning on $y_{i,t-1}$ and $Z_{it}$ , that $\alpha_i$ and $u_{it}$ are conditionally uncorrelated, and that $u_{it}$ and all components in $Z_{it}$ are at least pre-determined, i.e.:

$$\begin{aligned} & E\left(u_{it}u_{i,t-\tau} \mid y_{i,t-1}, Z_{it}\right)=0, \quad \forall \tau>0,\ i=1,...,N \text{ and } t=1,...,T_i \\ (2) \quad & E\left(\alpha_i u_{it} \mid y_{i,t-1}, Z_{it}\right)=0, \quad i=1,...,N \text{ and } t=1,...,T_i \\ & E\left(u_{it}Z_{it+s}\right)=0, \quad \forall\, Z_{it}, s=0,1,..., \ i=1,...,N \text{ and } t=1,...,T_i. \end{aligned}$$

For the estimation of the $\lambda$ and $\beta$ parameters we need not make parametric assumptions on the distribution of the error components. In particular, we need not assume $\mu_i$ to be uncorrelated or even independent of the components in $Z$. Of course, $\alpha_i$ and $y_{i,t-1}$ will be correlated, almost by definition. In the estimation, we will treat $\alpha_i$ as individual-specific fixed effect and eliminate it by taking first-differences of equation (1). The assumption that $u_{it}$ is serially uncorrelated can be tested, as described below, and additional lags of $y_{i,t}$ can be included in equation (1) if required.

Estimating equation (1) with an individual's employment status as a binary (0/1) variable gives the dynamic linear probability model. Compared to non-linear probability models, such as the panel probit or logit model, this model is not only easy to estimate on panel data but also requires less restrictive assumptions regarding the distribution of the error components as far as consistent estimation of the $\lambda$ and $\beta$ parameters is concerned. Marginal effects, such as the short-term and long-term effects of child-birth on mothers' employment probability, can easily be derived from the model. Furthermore, this simple estimator circumvents the initial-condition problem, which constitutes a general problem of dynamic panel data models (see, e.g., Hyslop 1999, Wooldridge 2005).[6] However, predictions from the model are not restricted to the unit interval and standard errors of estimated parameters will be biased, but this latter problem can be avoided as described below.

We could have used the linear probability model to construct a selectivity-correction variable to be included in the second-step estimation of the conditional hours equation. Since this would have required the choice of some exclusion restrictions which, in the present context, are somewhat difficult to substantiate convincingly, we chose to estimate equation (1) without explicit selectivity correction under the assumption that selection bias can be avoided by eliminating unobserved heterogeneity. This would be the case if married women's employment and working hours, conditional on $Z_{it}$, $y_{i,t-1}$ and $\alpha_i$ , were only correlated through time-invariant individual effects. Since we estimate the employment and hours equations on an unbalanced panel ($T_i$ varies across individuals), we also have to assume that sample attrition, conditional on $Z_{it}$, $y_{i,t-1}$ and $\alpha_i$ , is purely random.[7] Before we describe how exactly we take these effects into account in the estimation, we briefly discuss the specification of $Z$ in the employment and hours equations.

[6] Croda and Kyriazidou (2005) apply a dynamic conditional logit model with fixed effects, which allows them to eliminate the unobserved heterogeneity and thereby also circumvent the initial condition problem. However, severe limitations of this approach are that individual-fixed effects can only be removed if the explanatory variables do not vary over time and that marginal effects cannot be calculated.

[7] Behr, Bellgardt and Rendtel (2005) show that response rates in the ECHP mainly depend on whether households have moved during the sample period and whether there was the interviewer changed, but that the resulting sample attrition has little effects on the distribution of incomes and the ranking of national results.

The explanatory variables of main interest in the subsequent analysis are those relating to childbirth. A dummy is created for the event of birth, since this event usually implies a certain period of hospitalization. Moreover, many leave legislations allow to take the maternal leave several weeks prior to childbirth. However, the data do not provide sufficient information about the exact month of birth. The Danish data do not provide this information for each child, and the German data do not include this information at all. The Italian and British data do provide this information, but only with numerous missing values. Thus, the dummy variable is coded 1 if a baby is less than one year old. It is also coded 1 if the child is already one year old, but the respondent did not report having a baby in the former wave.

Since child care becomes less time intensive but more goods intensive as the child grows up, we would expect the strongest age effect to occur in the year of childbirth and the subsequent two to three years, especially in countries where public childcare coverage for infants is scarce. Thus, to account for the age of the youngest child, four dummies are included in both the participation and hours equation. The first dummy covers the period from one to three years of age. This dummy comprises children within the most care-intensive age group. The second dummy variable refers to children aged four to six years. Most countries provide private or public care, e.g. pre-schools, for this age group. The next dummy contains children between six and twelve years of age; where children typically start school at six. Teenagers aged twelve to nineteen are represented by another dummy, and having no child aged 19 or younger is used as the base category. The effects of the number of children (2, 3, and 4+) on married mothers' labor market behavior are captured by a set of dummy variables. Note that the effect of having only one child cannot be separated from the age effect of the youngest child. The group of respondents having no children is used as the base category.

In addition to yearly time dummies, we include several control variables. These include four dummy variables for the mother's age, a dummy for her health status as well as the household income excluding own earnings. A third set of variables includes information about the spouse, i.e. his employment and health status and whether he also looks after the children on a daily basis. Dummy variables describing the spouse's employment status are also included. Tables A1 and A2 in the Appendix present summary statistics of the variables that are used in the data analysis for the whole sample and the sample of employed women, respectively.

## 4.2 Estimation

As mentioned above, we will treat $\mu_i$ as individual-specific fixed effect and eliminate it by taking first-differences ($\Delta$) of equation (1):

(3) $\Delta y_{it} = \lambda \Delta y_{i,t-1} + \Delta Z_{it}\beta + \Delta u_{it}, \quad i=1,...,N \text{ and } t=2,...,T_i.$

Given our maintained assumption about the error terms in equation (2), $\Delta y_{i,t-1}$ and $\Delta u_{it}$ are obviously correlated and OLS estimation of equation (3) would yield biased and inconsistent parameter estimates. Consistent estimates can be obtained, however, by instrumenting $\Delta y_{i,t-1}$ in equation (3). Given the panel structure of our data base and the assumption that the initial condition $y_{i,1}$ is uncorrelated with $y_{i,t}$, for t =2, 3,..., $T_i$ , i.e. it has to be predetermined, appropriately lagged levels and differences of $y_{i,t}$ for observations with $T_i \geq 3$ are potentially valid instruments for $\Delta y_{i,t-1}$.[8] Following Arellano and Bond (1991), we use appropriately lagged levels of the dependent variable as instruments to construct a GMM estimator.

Since $T_i > 3$ for most individuals in the panel, there is a large number of such instruments available. To test the validity of over-identifying restrictions, we apply the Sargan test (Arellano and Bond 1991). However, lagged levels might not be adequate instruments for first differences in case of persistent variables, such as individual employment rates. Therefore, we alternatively apply the "System-GMM" estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998), which also uses lagged differences as instruments for the equations in levels, under the assumption that the individual-fixed effect is not correlated with the first-differenced error terms.

To select a valid model for both the employment and the hours equation, each model is estimated with three different sets of instruments, with the lag length of instruments being restricted to *t*-4 for the equation in differences and to *t*-3 for the equation in levels. The first set of instruments ("levels") uses lagged levels as instruments for the first differenced equation, whereas the second set of instruments ("differences") uses lagged differences for the equation in levels, and the third set of instruments ("system") uses both lagged differences as well as lagged levels as instruments. For every specification, a Sargan test for over-identifying restrictions and autocorrelation tests are calculated. If the system estimator results in the lowest Sargan statistic, it is preferred to the others. If more than one model yields valid test statistics, a Difference Sargan test (Arellano and Bond 1991) is computed. To this end, the model in differences or levels reporting the lowest Sargan statistic is used as base and tested against the system estimator. However, it is only possible to test the system against one of the other models but not the other two specifications against each other. If no model leads to valid test statistics, the system estimator is chosen on the basis of its superior overall behavior.

[8] There would be no such instruments if the within-transformation were applied to equation (1) to eliminate $\alpha_i$ because this transformation would obviously induce correlation between the transformed error term and the transformed lagged dependent variable which would be an average of all leads and lags of $y_{i,t-1}$.

# 5 Estimation Results

## 5.1 Employment equation

For each of the four countries, the preferred specification ("differences", "levels", "system") of the employment equation was selected on the basis of the principles described at the end of the previous section. Full estimation results for the alternative specifications are reported in Table A4 in the Appendix. As suggested by the test statistics reported at the bottom of the table, the preferred specifications in terms of chosen instruments is "levels" for Denmark, "differences" for Italy and "system" for both Germany and the UK. These specifications pass the Sargan and Sargan Difference as well as the autocorrelation tests, except for weak evidence of second-order autocorrelation in case of Germany. However, the Difference Sargan test against the levels specification shows that the additional instruments are accepted at the 5% level (test statistic is 7.54 with 6 degrees of freedom). Therefore, the GMM system estimator is chosen. For each country, the main difference in estimation results between the various specifications relates to the coefficient on the lagged dependent variable ("state dependence" parameter), whereas the other estimated coefficients differ little across specifications.

Table 2 summarizes estimation results for the lagged dependent variable and the child dummies in our preferred specification of the employment equation for each of the four countries. Estimated coefficients of these variables are of main interest since together they determine the short-run and long-term effects of childbirth on married mothers' employment rates and working hours. The estimated coefficient on the lagged employment status, i.e. the $\lambda$ coefficient in equation (3), ranges from about 0.25 in Denmark to about 0.3 in Germany, Italy and the UK. Thus, all four countries exhibit a similar degree of state dependence in married women's employment rates. The interpretation of this effect is the following: In Germany, for example, the current employment rate of a married women who has already been employed in the previous year is about 30 percentage points higher than it would have been had she been non-employed the year before. This interpretation assumes that all other factors affecting individual employment rates are effectively controlled for by the individual-specific effect and the time-varying explanatory variables included in model. When comparing state dependence effects between countries it should be kept in mind that, on average, employment rates of married women differ greatly (see section 3). Thus, in relative terms, the state dependence effect in Italy is even greater compared to Germany, for example, than indicated by the estimated coefficients in Table 2.

One useful model check is to compare the $\lambda$ coefficient estimate obtained form the first-differenced GMM estimator to the one obtained from a simple OLS regression of equation (1) and from the within-transformation of this equation (Fixed-Effects estimator), because a consistent esti-

**Table 2 Estimation results for participation equations - GMM estimation with alternative set of instrumental variables**

| | Denmark | Italy | Germany | UK |
|---|---|---|---|---|
| | Levels | Differences | System | System |
| Employed (t-1) | 0.255 | 0.358 | 0.289 | 0.325 |
| | (0.043) | (0.035) | (0.018) | (0.026) |
| Birth | -0.158 | -0.060 | -0.582 | -0.290 |
| | (0.025) | (0.016) | (0.020) | (0.020) |
| Child, 0-3 years | -0.047 | -0.074 | -0.351 | -0.202 |
| | (0.020) | (0.014) | (0.019) | (0.017) |
| Child, 4-6 years | -0.019 | -0.066 | -0.186 | -0.141 |
| | (0.020) | (0.014) | (0.018) | (0.018) |
| Child, 7-11 years | -0.022 | -0.053 | -0.089 | -0.093 |
| | (0.018) | (0.014) | (0.015) | (0.016) |
| Child, 12-19 years | -0.008 | -0.032 | -0.029 | -0.026 |
| | (0.013) | (0.012) | (0.012) | (0.014) |
| Two children | 0.010 | -0.072 | -0.014 | -0.030 |
| | (0.011) | (0.012) | (0.011) | (0.013) |
| Three children | 0.019 | -0.130 | -0.069 | -0.064 |
| | (0.016) | (0.018) | (0.018) | (0.018) |
| Four+ children | -0.027 | -0.192 | -0.153 | -0.159 |
| | (0.033) | (0.029) | (0.032) | (0.033) |
| Number of observations | 4971 | 17023 | 15608 | 10066 |
| Number of individuals | 1043 | 3387 | 2965 | 1995 |
| P-Value | 0.99 | 0.00 | 0.08 | 0.44 |
| AR1 | 0.00 | 0.00 | 0.00 | 0.00 |
| AR2 | 0.60 | 0.06 | 0.02 | 0.90 |

Notes: Yearly time dummies and a number of additional control variables not shown in the table are included in all regressions. Full estimation results are reported in Table A3 in the Appendix. Standard errors are given in parantheses. For the interpretation of the Sargan, AR1 and AR2 test statistics see note to Table A3 in the Appendix.

mate of the $\lambda$ coefficient should fall between the lower and upper bound determined by these two estimators (Nickell 1981, Bond 2002). Since employment rates are positively correlated over time, the simple OLS estimator is upward biased, whereas the Fixed-Effects estimator is biased towards zero. As shown in the upper part of Table A6 in the Appendix, the expected pattern in fact obtains: $\lambda$ coefficients estimated by OLS are always much larger than those reported in Table 2, with the estimate for Italy reaching a value of 0.84, almost three times the estimate obtained by the GMM "differences" estimator. In stark contrast, the Fixed Effects estimator is clearly biased towards zero, with estimated values for $\lambda$ of about 0.1 for Denmark, Germany and the UK, and about 0.2 for Italy.

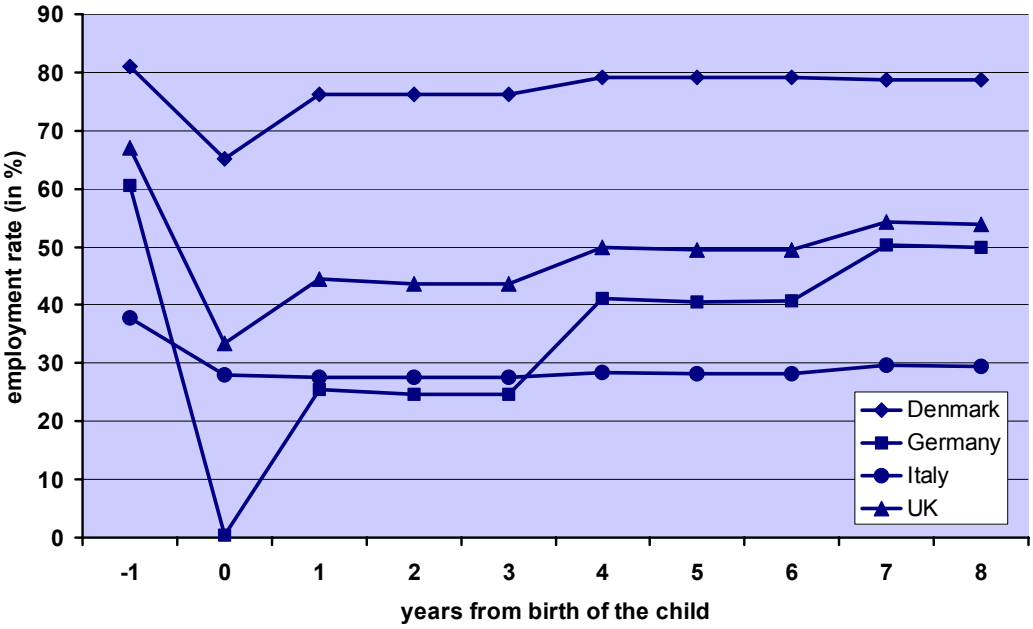
Before we turn to the long-term effects of childbirth on married women's employment rates, which are partly determined by the size of the estimated $\lambda$ coefficient, we discuss the *short-run effects* of childbirth and the impact of other child related variables summarized in Table 2. Estimated coefficients of the childbirth dummy indicate huge country differences in the short-run effects of childbirth on married mothers' employment rates which more or less confirm the pattern documented in Figure 3a. That is, even after conditioning on previous employment status and controlling for observed and time-invariant unobserved factors, the impact of childbirth on married mothers employment rates is much larger in Germany than in any of the other three countries: Whereas childbirth reduces mothers' employment rate by almost 60 percentage points in Germany in the year of birth, on average, this short-run effect amounts to about 30 percentage points in the UK, 16 percentage points in Denmark and only 6 percentage points in Italy. Although these effects have to be interpreted in relation to the different employment levels in the four countries, Germany clearly is an outlier concerning the impact of childbirth on married mothers' employment rates, whereas there seems to be relatively little difference in this respect between Denmark and Italy, two countries with greatly differing employment rates of married women.

Regarding the age and number of children on married mothers' employment rates estimation results in Table 2 also reveal pronounced country differences in the short run. Although the younger the child, the stronger its negative impact on mothers' employment rate tend to be in each country, age differences in these short-run effects are much more pronounced in Germany than in any of the other three countries. The employment rate of German married mothers with a new-born baby is, on average, about 35 percentage points lower than that of comparable mothers with a child aged 1-3 years. In Denmark and the UK this relative effect amounts to about 10 percentage points, whereas it is virtually zero in Italy. In stark contrast to the relatively weak age effect in Italy, the presence of more than one child in the households has a markedly stronger negative impact on married mothers employment rates there than in either Germany or the UK. In Denmark, having more than one child seems to have no statistically significant short-run effects on employment rates of married mothers.

Simulated *long-term effects* of childbirth on married mothers' employment rates across countries are illustrated in Figure 4. These simulations are based on estimation results from the preferred model specification for each country and refer to married mothers having one child before giving birth to a new one, and all other explanatory variables in the model set at either the base category in case of dummy variables or sample means (see Table A4 in the Appendix). The simulations assume that, conditional on the other explanatory variables in the model, the estimated effects of the child's age – from the year of birth to adulthood – can be treated as if they were observed over the child's early lifecycle, although we effectively observe only a snapshot of eight years at most and effects are estimated on the basis of the information contained in the first

differences of the respective variables only. To avoid out-of-sample predictions, we restrict the simulations to the time horizon covered by our observation period, i.e. to eight years.

**Figure 4 Short-run and long-term effects of childbirth on married mothers' employment rates across countries**




Note: The graphs refer to average employment rates of married women with 2 children and other characteristics defined by the base category of the respective variables, see Table A1 in the Appendix.

Source: Own simulations based on estimation results in Table 1.

The figure shows pronounced country differences in the dynamics of married mothers' employment rates following childbirth: In Denmark, after a modest decline in the year of childbirth, the employment rate returns quickly to its high previous level, which is reached when the child becomes 4 years of age. That is, there is no long-term negative effect of childbirth on married women's employment rates is Denmark. In the other three countries, though, long-term effects of childbirth on employment rates are negative, but both the magnitude of these effects and the dynamic adjustment process in employment rates differ significantly across countries. In Italy, the employment rate remains at its slightly lower level it reaches after childbirth irrespective of the child's age. Thus, childbirth seems to have a negative long-term effect on employment rates of married women in Italy, although the magnitude of this effect is rather small.

In Germany and the UK, the long-term employment effects of childbirth are similar and of modest size.[9] However, the adjustment process in employment rates is quite different in the two countries: Not only is the negative short-term effect of childbirth in Germany much stronger than in

[9] Estimation results show that the long-term effect would be slightly negative in Germany but would not be statistically

the UK, its negative impact on employment rates of married mothers is much more pronounced when the child is between 1 and 3 years of age and still significant when the child is aged between 4 and 6 years. The differential impact of childbirth on married mothers' employment rates in the two countries only disappears when the child has become 7 years of age.

We will discuss potential reasons for these country differences in the adjustment of employment rates to childbirth in section 6, after the effects of childbirth on married mothers' working hours have been presented.

## 5.2 Hours equation

Following the model selection strategy described in the previous section, we have estimated and tested various specifications of the hours equation for each country which differ in the chosen set of instrumental variables. Full estimation results for the alternative specifications and test results are reported in Table A5 in the Appendix. At first sight, estimation results are puzzling since, using only lagged levels as instruments for the lagged differenced hours variable, the estimated coefficient on this variable – the state dependence parameter – is insignificant (at the 5% level) for all countries, although all tests suggest the specification to be valid. As discussed in the previous section, a consistent estimate of the state dependence parameter in a linear dynamic panel model should be bounded by the simple OLS and the Fixed-Effects estimates, which range between about 0.7 and 0.1, see Table A6 in the Appendix. Furthermore, the "levels" and the "system" specifications show completely different results in each case. As described in the literature (see, e.g., Blundell et al. 2000), applying the standard "differenced" GMM estimator to panel data with highly persistent dependent variables, such as weekly working hours, may raise estimation problems. We therefore follow suggestions in the literature and estimate the hours equation for all four countries using the GMM system estimator instead. Except for the Sargan test for over-identifying restrictions in the case of the UK, this specification passes all tests and also yields plausible estimates of the state dependence parameter for each country.

Table 3 summarizes estimation results for the state dependence coefficient and the child dummies in our preferred specification of the hours equation for each of the four countries. The estimated $\lambda$ coefficient in the hours equation varies rather little across countries, form from about 0.25 in Germany to 0.33 in the UK. The interpretation of the state dependence effect in the hours equation is the following. In Germany, for example, a married women who worked 40 hours in the previous period, say, works about 5 [=0.25×(40-20)] hours more in the current period than she would, had she worked only 20 hours in the previous period. This interpretation is valid if all other

different from zero for the UK.

**Table 3 Estimation results for the hours equation - GMM system estimation**

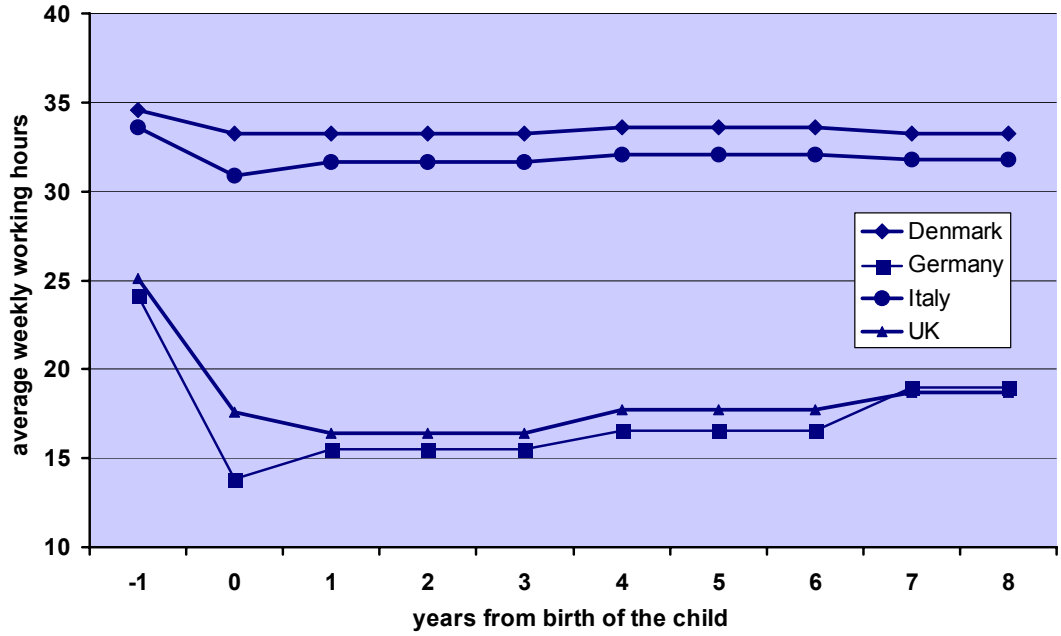
| | Denmark | Italy | Germany | UK |
|---|---|---|---|---|
| Working hours (t-1) | 0.310 | 0.287 | 0.251 | 0.327 |
| | (0.044) | (0.047) | (0.112) | (0.044) |
| Birth | -1.274 | -2.701 | -10.325 | -7.474 |
| | (0.829) | (0.492) | (1.708) | (0.688) |
| Youngest Child, 0-3 years | -1.327 | -1.978 | -8.630 | -8.701 |
| | (0.809) | (0.425) | (1.840) | (0.755) |
| Child, 4-6 years | -0.936 | -1.568 | -7.584 | -7.390 |
| | (0.772) | (0.426) | (1.461) | (0.835) |
| Child, 7-11 years | -1.323 | -1.808 | -5.155 | -6.368 |
| | (0.701) | (0.402) | (1.045) | (0.764) |
| Child, 12-19 years | -0.423 | -0.748 | -1.940 | -2.709 |
| | (0.514) | (0.363) | (0.816) | (0.607) |
| Two children | -0.452 | -0.389 | -0.872 | -1.913 |
| | (0.475) | (0.318) | (0.490) | (0.422) |
| Three children | -1.286 | -0.596 | -1.187 | -2.450 |
| | (0.534) | (0.508) | (0.846) | (0.677) |
| Four+ children | -1.751 | 1.383 | -2.603 | -1.813 |
| | (1.435) | (1.991) | (1.921) | (1.515) |
| Number of observations | 4149 | 7588 | 8737 | 7155 |
| Individuals | 974 | 1817 | 2200 | 1648 |
| P-Value | 0.40 | 0.29 | 0.27 | 0.03 |
| AR1 | 0.00 | 0.00 | 0.00 | 0.00 |
| AR2 | 0.06 | 0.95 | 0.12 | 0.00 |

Notes: See notes to Table 2. Full estimation results are reported in Table A4 in the Appendix.

factors correlated with individual working hours are effectively controlled for by the individual-specific effect and the time-varying explanatory variables included in model.

The state dependence effect refers to employed women only because hours equations are estimated on the sub-sample of employed people for whom we observe a positive wage. Furthermore, as already mentioned in the previous section, differences in the level of working hours should be taken into account when interpreting state dependence effects between countries. These caveats should also been kept in mind when interpreting the short-run effects of childbirth as well as the number and age of children on working hours summarized in Table 3.

**Figure 5 Short-run and longer term effects of childbirth on married mothers' average weekly working hours rates across countries**




Note: The graphs refer to the average number of working hours of married women with 2 children and other characteristics defined by the base category of the respective variables, see Table A1 in the Appendix.

Source: Own simulations based on estimation results in Table 2.

In Italy and especially in Denmark, these effects are generally rather small. For example, the short-run effect of childbirth on married mothers weekly working time is 2.7 and 1.3 hours, respectively; short-run effects of the presence of older children in the household are even small in these two countries. This is also true for Germany and the UK, but the magnitude of these effects is much different. Childbirth reduces, in the same year, the weekly working time of employed married mothers by about 10 hours in Germany, and by almost 9 hours in the UK. The short-term effects of having children of pre-school age on mothers' working hours are of similar size in both Germany and the UK, with older children having markedly smaller negative effects in both countries. Having more than one child has a relatively weak impact on mothers' working time across all countries.

Performing similar simulations as in the previous section under the maintained assumption that the estimated effects of the child's age represent different stages of the child's early lifecycle, the *long-term effects* of childbirth on married mothers' working hours can be derived. Figure 5 shows these effects for the four countries, again for married mothers with one child before childbirth and all other explanatory variables in the model set at either the base category in case of dummy variables or sample means (see Table A5 in the Appendix). In all four countries, the short-run effect clearly dominates the adjustment of working hours to childbirth. Even in Germany and the UK, where childbirth reduces working hours of married mothers substantially in the short-run,

as already discussed above, there is very little adjustment of working hours towards the level attained before childbirth even in the longer term, i.e. when the child enters primary school. In fact, neither for Germany nor for the UK is the small increase in employment rates after the year of birth of the child visualized in Figure 5 statistically significant.[10]

## 6 Summary and Conclusions

Our comparative empirical analysis has revealed significant differences in the effects the birth and rearing of children on mothers' employment behavior between Denmark, Germany, Italy and the UK, which represent different institutional regimes regarding labor market regulations and family policies. In Denmark, childbirth has little effect on mothers' employment and working hours, both in the short run and in the longer term. Although these effects are also relatively small in Italy, they have to be judged relative to the very low employment level of Italian mothers. In the UK and, in particular, Germany childbirth has very strong negative short-term effects on mothers' employment and working hours. In long-term, mothers' employment rates adjust towards the levels attained before childbirth both in Germany and the UK, although especially in Germany mothers' employment rates remain substantially below its previous level until the child has reached school age. Denmark is the only country where mothers attain their previous employment level in the long-term. Regarding working hours of employed mothers, there is little adjustment after childbirth in both Denmark and Italy, whereas in the UK and especially in Germany mothers reduce their working hours substantially in the year of childbirth and also work significantly shorter hours in the long term. For these two countries, state-dependence effects in working hours seem even more pronounced than in employment rates.

Overall, country differences in the short-run and long-term effects on mothers' employment and working hours this study has established, seem compatible with the prevailing combinations of labor market flexibility and family policies in the four institutional regimes prevailing in Europe. Although part-time work of women is widespread in Germany and the UK, the employment rate of German mothers is lower especially in the presence of small children. Germany, representing the conservative welfare regime, provides less support for the double income family with small children than the UK, but rather still supports the "male breadwinner" model with the wife caring for young children. The very strong negative short-run effect of childbirth on employment in Germany can be explained by the rationing of publicly subsidized child-care facilities for children below the age of three in Germany, whereas the subsequent adjustment of German mothers' employment and working hours as the child grows older is compatible with the much easier access

[10] Statistic significance is tested by pairwise comparisons of estimated coefficients of child-age dummies.

to subsidized child care for older children (see Wrohlich 2005, 2006). However, to some extent, Germany seems to compensate the negative effect induced by rationing of publicly subsidized child care by relatively flexible work schedules which enable to adjust mothers' care activities and gainful employment. Another important factor contributing to discourage employment of married women in Germany, is the high tax rate on the income of the second-earner (see, e.g., Steiner and Wrohlich 2004). The UK, representing the liberal welfare state regimes, does not discourage double earner couples, but also does not provide comprehensive subsidized child care: Mothers might therefore often be forced to work part-time to reconcile child care responsibilities and employment, which is supported by in-work benefits for households with children (see, e.g., Haan and Myck 2006) and flexible working time arrangements.

Given the relatively small employment rates of Italian mothers, the empirically observed small adjustment in employment and working hours after childbirth in Italy compared to both Germany and the UK has different implications than for the Danish case, where employment rates and working hours of mothers are generally rather high and adjust little following childbirth. In Italy the labor market does not provide flexible working time arrangements and women mostly have to decide whether to work full-time or to completely withdraw from the labor market (Del Boca 2002). Furthermore, similar to Germany, tax rates on the income of the second-earner are quite high. In Denmark, employment is rather stable at a very high level due to the comprehensive system of publicly provided child care, a high degree of labor market flexibility, and an income tax that does not discourage employment of secondary earners (see, e.g., Immervoll and Barber 2005).

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# Appendix

**Table A1 Number of married or cohabitating women by country and year, 1994 - 2001**

| | Denmark | | Italy | | Germany | | UK | |
|---|---|---|---|---|---|---|---|---|
| Wave | All | Working | All | Working | All | Working | All | Working |
| 1 | 876 | 756 | 2.844 | 1.365 | 2.483 | 1.708 | 1.718 | 1.266 |
| 2 | 878 | 751 | 2.908 | 1.415 | 2.648 | 1.722 | 1.765 | 1.345 |
| 3 | 860 | 739 | 2.970 | 1.459 | 2.707 | 1.793 | 1.812 | 1.383 |
| 4 | 900 | 798 | 2.938 | 1.454 | 2.768 | 1.829 | 1.829 | 1.397 |
| 5 | 831 | 739 | 2.834 | 1.434 | 2.640 | 1.749 | 1.850 | 1.419 |
| 6 | 767 | 700 | 2.581 | 1.306 | 2.451 | 1.645 | 1.732 | 1.336 |
| 7 | 717 | 665 | 2.316 | 1.169 | 2.261 | 1.529 | 1.608 | 1.227 |
| 8 | 661 | 603 | 2.034 | 1.034 | 2.046 | 1.379 | 1.499 | 1.162 |
| Total | 6.490 | 5.751 | 21.425 | 20.004 | 13.354 | 10.636 | 13.813 | 10.535 |

Source: European Community Household Panel (ECHP), waves 1994-2001; own calculations.

## Table A2 Descriptive statistics

| | Whole sample | | | | Working women only | | | |
|---|---|---|---|---|---|---|---|---|
| | **Denmark** | **Italy** | **Germany** | **UK** | **Denmark** | **Italy** | **Germany** | **UK** |
| Employment rate | 0.89 | 0.59 | 0.67 | 0.78 | | | | |
| Working hours | 31.45 | 17.69 | 20.59 | 24.43 | 35.64 | 35.09 | 31.88 | 32.16 |
| | (13.92) | (18.94) | (18.71) | (17.90) | (8.36) | (10.05) | (13.48) | (13.16) |
| Birth | 0.08 | 0.05 | 0.03 | 0.06 | 0.06 | 0.05 | 0.01 | 0.04 |
| Child, age 1-3 | 0.17 | 0.15 | 0.10 | 0.16 | 0.16 | 0.14 | 0.05 | 0.13 |
| Child, age 4-6 | 0.12 | 0.14 | 0.12 | 0.12 | 0.13 | 0.13 | 0.10 | 0.11 |
| Child, age 7-11 | 0.14 | 0.19 | 0.20 | 0.16 | 0.15 | 0.18 | 0.20 | 0.16 |
| Child, age 12-19 | 0.19 | 0.25 | 0.25 | 0.18 | 0.20 | 0.26 | 0.29 | 0.20 |
| No child * | 0.24 | 0.12 | 0.21 | 0.25 | 0.25 | 0.17 | 0.27 | 0.30 |
| One child | 0.25 | 0.31 | 0.29 | 0.23 | 0.28 | 0.32 | 0.29 | 0.23 |
| Two children | 0.34 | 0.41 | 0.37 | 0.35 | 0.34 | 0.39 | 0.35 | 0.34 |
| Three children | 0.11 | 0.15 | 0.10 | 0.13 | 0.11 | 0.11 | 0.08 | 0.11 |
| Four+ children | 0.03 | 0.04 | 0.03 | 0.03 | 0.03 | 0.02 | 0.01 | 0.02 |
| Age 20--24 | 0.05 | 0.02 | 0.02 | 0.05 | 0.04 | 0.01 | 0.02 | 0.04 |
| Age 25-34 * | 0.33 | 0.30 | 0.29 | 0.34 | 0.32 | 0.30 | 0.27 | 0.34 |
| Age 35-44 | 0.38 | 0.44 | 0.44 | 0.39 | 0.40 | 0.45 | 0.46 | 0.39 |
| Age 45-50 | 0.24 | 0.24 | 0.24 | 0.22 | 0.25 | 0.23 | 0.25 | 0.23 |
| Bad health | 0.01 | 0.03 | 0.11 | 0.07 | 0.01 | 0.03 | 0.10 | 0.06 |
| Gross other income | 2.91 | 1.10 | 2.34 | 2.31 | 2.98 | 1.13 | 2.29 | 2.40 |
| | (1.67) | (0.97) | (1.68) | (2.00) | (1.68) | (0.97) | (1.66) | (1.91) |
| Spouse works (0-14h) * | 0.06 | 0.09 | 0.11 | 0.12 | 0.05 | 0.08 | 0.10 | 0.08 |
| Spouse works (15-37h) | 0.50 | 0.20 | 0.07 | 0.12 | 0.50 | 0.20 | 0.07 | 0.13 |
| Spouse works (38-50h) | 0.32 | 0.60 | 0.66 | 0.50 | 0.32 | 0.61 | 0.66 | 0.53 |
| Spouse works (50+h) | 0.12 | 0.11 | 0.16 | 0.26 | 0.12 | 0.11 | 0.17 | 0.25 |
| Spouse in bad health | 0.02 | 0.04 | 0.11 | 0.07 | 0.01 | 0.03 | 0.11 | 0.06 |
| Spouse looks after children | 0.47 | 0.37 | 0.48 | 0.21 | 0.47 | 0.42 | 0.42 | 0.22 |
| 1994 * | 0.12 | 0.13 | 0.12 | 0.13 | 0.12 | 0.13 | 0.12 | 0.13 |
| 1995 | 0.13 | 0.14 | 0.13 | 0.13 | 0.13 | 0.14 | 0.13 | 0.13 |
| 1996 | 0.13 | 0.14 | 0.13 | 0.13 | 0.13 | 0.14 | 0.13 | 0.13 |
| 1997 | 0.14 | 0.14 | 0.14 | 0.13 | 0.14 | 0.14 | 0.14 | 0.13 |
| 1998 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 |
| 1999 | 0.12 | 0.12 | 0.13 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 |
| 2000 | 0.11 | 0.11 | 0.11 | 0.11 | 0.12 | 0.11 | 0.12 | 0.11 |
| 2001 | 0.11 | 0.10 | 0.10 | 0.11 | 0.11 | 0.10 | 0.11 | 0.11 |
| | 6212 | 20483 | 18219 | 12122 | 5506 | 10061 | 11957 | 9267 |

Notes: * indicates base category; for working hours and gross other income, means and standard deviation (in parentheses) are given, for the other variable shares are reported. Gross other income is given in domestic currency, for Italy in 000's Lira.

Source: European Community Household Panel, waves 1994-2001, own calculations.

# Table A3 Alternative dynamic specifications of empirical employment equations by country

| | Denmark | | | Italy | | | Germany | | | UK | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | System | Levels | Differences | System | Levels | Differences | System | Levels | Differences | System | Levels | Differences |
| Employed(t-1) | 0.348 | 0.410 | 0.255 | 0.414 | 0.358 | 0.459 | 0.289 | 0.277 | 0.304 | 0.325 | 0.332 | 0.338 |
| | (0.040) | (0.046) | (0.043) | (0.027) | (0.035) | (0.026) | (0.018) | (0.023) | (0.019) | (0.026) | (0.033) | (0.028) |
| Birth | -0.153 | -0.155 | -0.158 | -0.061 | -0.060 | -0.061 | -0.582 | -0.581 | -0.582 | -0.290 | -0.290 | -0.287 |
| | (0.026) | (0.026) | (0.025) | (0.015) | (0.016) | (0.015) | (0.020) | (0.020) | (0.020) | (0.020) | (0.021) | (0.020) |
| Child, 0-3 | -0.043 | -0.036 | -0.047 | -0.071 | -0.074 | -0.067 | -0.351 | -0.355 | -0.341 | -0.202 | -0.198 | -0.197 |
| | (0.020) | (0.020) | (0.020) | (0.013) | (0.014) | (0.013) | (0.019) | (0.020) | (0.019) | (0.017) | (0.018) | (0.017) |
| Child, 4-6 | -0.023 | -0.022 | -0.019 | -0.063 | -0.066 | -0.061 | -0.186 | -0.188 | -0.181 | -0.141 | -0.141 | -0.140 |
| | (0.020) | (0.020) | (0.020) | (0.013) | (0.014) | (0.013) | (0.018) | (0.018) | (0.017) | (0.018) | (0.018) | (0.018) |
| Child, 7-11 | -0.022 | -0.025 | -0.022 | -0.052 | -0.053 | -0.049 | -0.089 | -0.090 | -0.088 | -0.093 | -0.094 | -0.092 |
| | (0.018) | (0.018) | (0.018) | (0.013) | (0.014) | (0.012) | (0.015) | (0.015) | (0.015) | (0.016) | (0.016) | (0.016) |
| Child, 12-19 | -0.003 | -0.005 | -0.008 | -0.030 | -0.032 | -0.029 | -0.029 | -0.028 | -0.028 | -0.026 | -0.025 | -0.026 |
| | (0.013) | (0.013) | (0.013) | (0.011) | (0.012) | (0.011) | (0.012) | (0.012) | (0.012) | (0.014) | (0.014) | (0.014) |
| Two children | 0.016 | 0.017 | 0.010 | -0.064 | -0.072 | -0.059 | -0.014 | -0.016 | -0.012 | -0.030 | -0.030 | -0.027 |
| | (0.012) | (0.012) | (0.011) | (0.010) | (0.012) | (0.010) | (0.011) | (0.011) | (0.011) | (0.013) | (0.013) | (0.013) |
| Three children | 0.019 | 0.019 | 0.019 | -0.118 | -0.130 | -0.108 | -0.069 | -0.071 | -0.069 | -0.064 | -0.064 | -0.063 |
| | (0.016) | (0.016) | (0.016) | (0.016) | (0.018) | (0.016) | (0.018) | (0.018) | (0.018) | (0.018) | (0.018) | (0.018) |
| Four+ children | -0.025 | -0.013 | -0.027 | -0.177 | -0.192 | -0.160 | -0.153 | -0.154 | -0.149 | -0.159 | -0.157 | -0.157 |
| | (0.032) | (0.031) | (0.033) | (0.026) | (0.029) | (0.026) | (0.032) | (0.032) | (0.031) | (0.033) | (0.033) | (0.033) |
| Age group 21-24 | -0.055 | -0.052 | -0.059 | -0.111 | -0.125 | -0.104 | -0.051 | -0.051 | -0.048 | -0.057 | -0.057 | -0.057 |
| | (0.035) | (0.034) | (0.034) | (0.023) | (0.024) | (0.022) | (0.019) | (0.019) | (0.019) | (0.018) | (0.017) | (0.017) |
| Age group 35-44 | -0.008 | -0.010 | 0.003 | 0.034 | 0.036 | 0.030 | -0.002 | -0.001 | -0.003 | -0.004 | -0.004 | -0.004 |
| | (0.012) | (0.012) | (0.012) | (0.010) | (0.010) | (0.009) | (0.010) | (0.010) | (0.010) | (0.011) | (0.010) | (0.010) |
| Age group 45-50 | -0.005 | -0.004 | 0.005 | 0.015 | 0.017 | 0.012 | -0.047 | -0.048 | -0.047 | -0.055 | -0.054 | -0.055 |
| | (0.013) | (0.012) | (0.013) | (0.012) | (0.013) | (0.012) | (0.013) | (0.013) | (0.013) | (0.013) | (0.013) | (0.013) |
| Gross other household income | 0.008 | 0.007 | 0.009 | -0.003 | -0.002 | -0.003 | -0.012 | -0.012 | -0.012 | 0.000 | -0.000 | 0.001 |
| | (0.003) | (0.003) | (0.003) | (0.004) | (0.005) | (0.004) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) |
| Bad Health | -0.113 | -0.105 | -0.098 | -0.023 | -0.022 | -0.021 | -0.054 | -0.056 | -0.053 | -0.043 | -0.044 | -0.041 |
| | (0.040) | (0.042) | (0.041) | (0.016) | (0.017) | (0.016) | (0.012) | (0.012) | (0.012) | (0.015) | (0.015) | (0.016) |
| Spouse works 15-37 hours | 0.003 | 0.004 | 0.018 | 0.034 | 0.037 | 0.033 | 0.029 | 0.028 | 0.031 | 0.139 | 0.135 | 0.136 |
| | (0.027) | (0.027) | (0.027) | (0.014) | (0.015) | (0.014) | (0.018) | (0.018) | (0.018) | (0.019) | (0.019) | (0.019) |
| Spouse works 38-50 hours | 0.001 | -0.001 | 0.017 | 0.018 | 0.020 | 0.016 | 0.037 | 0.036 | 0.037 | 0.125 | 0.123 | 0.122 |
| | (0.028) | (0.028) | (0.028) | (0.013) | (0.014) | (0.013) | (0.014) | (0.014) | (0.014) | (0.018) | (0.018) | (0.018) |
| Spouse works 51+ hours | -0.008 | -0.011 | 0.004 | 0.036 | 0.037 | 0.033 | 0.046 | 0.045 | 0.047 | 0.113 | 0.111 | 0.110 |
| | (0.028) | (0.029) | (0.028) | (0.015) | (0.016) | (0.015) | (0.016) | (0.016) | (0.016) | (0.019) | (0.020) | (0.020) |
| Spouse in bad health | 0.005 | 0.005 | 0.010 | -0.038 | -0.043 | -0.033 | -0.019 | -0.018 | -0.019 | -0.022 | -0.019 | -0.019 |
| | (0.020) | (0.018) | (0.020) | (0.015) | (0.015) | (0.014) | (0.011) | (0.011) | (0.011) | (0.015) | (0.015) | (0.015) |
| Spouse looks after children | 0.014 | 0.016 | 0.014 | 0.060 | 0.062 | 0.054 | 0.026 | 0.026 | 0.026 | 0.101 | 0.102 | 0.099 |
| | (0.012) | (0.012) | (0.012) | (0.007) | (0.007) | (0.007) | (0.009) | (0.009) | (0.009) | (0.011) | (0.012) | (0.011) |
| Number of observations | 4971 | 4971 | 4971 | 17023 | 17023 | 17023 | 15608 | 15608 | 15608 | 10066 | 10066 | 10066 |
| Groups | 1043 | 1043 | 1043 | 3387 | 3387 | 3387 | 2965 | 2965 | 2965 | 1995 | 1995 | 1995 |
| Sargan statistic | 20.32 | 12.07 | 2.51 | 42.62 | 28.90 | 34.58 | 24.42 | 16.88 | 20.80 | 16.12 | 5.21 | 9.83 |
| Instruments | 42 | 36 | 36 | 42 | 36 | 36 | 42 | 36 | 36 | 42 | 36 | 36 |
| DF | 16 | 10 | 10 | 16 | 10 | 10 | 16 | 10 | 10 | 16 | 10 | 10 |
| P-Value | 0.21 | 0.28 | 0.99 | 0.00 | 0.00 | 0.00 | 0.08 | 0.08 | 0.02 | 0.44 | 0.88 | 0.46 |
| AR1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| AR2 | 0.38 | 0.29 | 0.60 | 0.03 | 0.06 | 0.02 | 0.02 | 0.02 | 0.01 | 0.90 | 0.95 | 0.99 |

Notes: Standard errors are given in parentheses. Yearly time dummies are included in all regressions. Since the choice of instruments is restricted to a lag length of t - 4 (levels as instruments) and t - 3 (differences as instruments), the models in levels and in differences always use 36 instruments. The system estimator uses 42 instruments, thus the Difference Sargan test has always six degrees of freedom. Sargan tests the validitiy of overidentifying restrictions, AR1 and AR2 against, respectively, first-order and second-order autocorrelation in the the differenced residuals. The model assumptions imply that the null hypothesis of no first-order autocorrelation should be rejected, whereas the null hypothesis of no second-order autocorrelation should not be rejected.

## Table A4 Alternative dynamic specifications of empirical hours equations by country - full estimation results

| | Denmark | | | Italy | | | Germany | | | UK | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | System | Levels | Differences | System | Levels | Differences | System | Levels | Differences | System | Levels | Differences |
| hours (t-1) | 0.310 | 0.094 | 0.342 | 0.287 | 0.213 | 0.338 | 0.251 | 0.004 | 0.293 | 0.327 | 0.114 | 0.405 |
| | (0.044) | (0.087) | (0.051) | (0.047) | (0.194) | (0.043) | (0.112) | (0.211) | (0.049) | (0.044) | (0.038) | (0.034) |
| Birth | -1.274 | -1.028 | -1.125 | -2.701 | -2.721 | -2.454 | -10.325 | -11.294 | -10.222 | -7.474 | -8.410 | -7.135 |
| | (0.829) | (0.805) | (0.511) | (0.492) | (0.554) | (0.494) | (1.708) | (1.678) | (1.786) | (0.688) | (0.731) | (0.644) |
| Child, 0-3 | -1.327 | -1.322 | -1.071 | -1.978 | -2.198 | -1.762 | -8.630 | -11.815 | -8.113 | -8.701 | -10.874 | -7.938 |
| | (0.809) | (0.735) | (0.580) | (0.425) | (0.822) | (0.416) | (1.840) | (2.647) | (1.003) | (0.755) | (0.749) | (0.566) |
| Child, 4-6 | -0.936 | -0.886 | -0.765 | -1.568 | -1.765 | -1.347 | -7.584 | -10.081 | -7.019 | -7.390 | -9.531 | -6.522 |
| | (0.772) | (0.884) | (0.555) | (0.426) | (0.811) | (0.423) | (1.461) | (2.148) | (0.782) | (0.835) | (0.875) | (0.599) |
| Child, 7-11 | -1.323 | -1.090 | -1.007 | -1.808 | -1.984 | -1.589 | -5.155 | -6.823 | -4.801 | -6.368 | -8.162 | -5.776 |
| | (0.701) | (0.644) | (0.529) | (0.402) | (0.968) | (0.404) | (1.045) | (1.640) | (0.624) | (0.764) | (0.731) | (0.569) |
| Child, 12-19 | -0.423 | -0.315 | -0.200 | -0.748 | -0.818 | -0.624 | -1.940 | -2.491 | -1.740 | -2.709 | -3.542 | -2.554 |
| | (0.514) | (0.587) | (0.477) | (0.363) | (0.652) | (0.369) | (0.816) | (0.985) | (0.436) | (0.607) | (0.721) | (0.471) |
| Two children | -0.452 | -0.841 | -0.535 | -0.389 | -0.338 | -0.305 | -0.872 | -1.394 | -0.816 | -1.913 | -2.914 | -1.477 |
| | (0.475) | (0.385) | (0.371) | (0.318) | (0.381) | (0.310) | (0.490) | (0.805) | (0.432) | (0.422) | (0.471) | (0.404) |
| Three children | -1.286 | -1.763 | -1.125 | -0.596 | -0.634 | -0.557 | -1.187 | -1.982 | -1.246 | -2.450 | -3.681 | -2.037 |
| | (0.534) | (1.016) | (0.646) | (0.508) | (0.623) | (0.494) | (0.846) | (1.041) | (0.763) | (0.677) | (0.821) | (0.665) |
| Four+ children | -1.751 | -2.294 | -1.166 | 1.383 | 1.328 | -0.180 | -2.603 | -4.463 | -2.341 | -1.813 | -3.101 | -1.443 |
| | (1.435) | (2.275) | (1.150) | (1.991) | (1.801) | (1.453) | (1.921) | (2.371) | (1.678) | (1.515) | (1.904) | (1.422) |
| Age group 21-24 | -0.023 | -0.251 | -0.102 | -0.053 | 0.255 | 0.580 | -0.362 | -0.325 | -0.326 | -0.499 | -0.609 | -0.099 |
| | (0.966) | (1.431) | (0.694) | (1.902) | (1.335) | (1.263) | (0.574) | (0.648) | (0.561) | (0.758) | (0.968) | (0.603) |
| Age group 35-44 | 0.122 | 0.154 | 0.007 | -0.227 | -0.157 | -0.213 | -1.484 | -1.810 | -1.391 | -0.069 | -0.077 | -0.018 |
| | (0.290) | (0.815) | (0.285) | (0.343) | (0.363) | (0.307) | (0.363) | (0.745) | (0.328) | (0.343) | (0.440) | (0.332) |
| Age group 45-50 | -0.801 | -1.106 | -0.920 | -0.726 | -0.840 | -0.742 | -2.202 | -2.880 | -2.008 | -2.189 | -2.677 | -1.825 |
| | (0.599) | (0.591) | (0.434) | (0.402) | (0.467) | (0.386) | (0.446) | (0.931) | (0.428) | (0.446) | (0.508) | (0.418) |
| Gross other household income | 0.001 | 0.002 | 0.009 | -0.486 | -0.602 | -0.479 | -0.835 | -1.119 | -0.766 | -0.037 | -0.040 | -0.052 |
| | (0.124) | (0.192) | (0.155) | (0.139) | (0.225) | (0.139) | (0.226) | (0.274) | (0.150) | (0.077) | (0.095) | (0.073) |
| Bad Health | -1.149 | -1.364 | -1.220 | -1.339 | -1.397 | -1.182 | -0.127 | 0.032 | -0.163 | -0.702 | -0.462 | -0.886 |
| | (1.382) | (2.080) | (0.964) | (0.558) | (0.575) | (0.562) | (0.492) | (0.414) | (0.362) | (0.497) | (0.693) | (0.476) |
| Spouse works 15-37 hours | -0.286 | -0.167 | -0.864 | -1.206 | -1.363 | -1.020 | -1.128 | -1.415 | -1.124 | -0.703 | -0.900 | -0.680 |
| | (1.758) | (5.095) | (0.895) | (0.500) | (0.511) | (0.482) | (0.627) | (0.931) | (0.579) | (0.578) | (0.779) | (0.594) |
| Spouse works 38-50 hours | -0.353 | -0.230 | -0.916 | -0.260 | -0.351 | -0.132 | 0.223 | 0.225 | 0.181 | 0.004 | -0.124 | -0.038 |
| | (1.639) | (4.429) | (0.943) | (0.460) | (0.559) | (0.458) | (0.488) | (0.681) | (0.473) | (0.557) | (0.610) | (0.559) |
| Spouse works 51+ hours | 0.720 | 0.923 | -0.147 | 1.759 | 1.684 | 1.736 | 1.651 | 1.868 | 1.587 | 0.570 | 0.562 | 0.532 |
| | (1.560) | (4.160) | (1.001) | (0.651) | (0.921) | (0.649) | (0.625) | (0.889) | (0.616) | (0.642) | (0.698) | (0.631) |
| Spouse in bad health | 0.819 | 1.017 | 1.135 | 0.293 | 0.270 | 0.309 | -0.163 | -0.216 | -0.192 | 0.614 | 0.291 | 0.337 |
| | (0.908) | (1.163) | (0.828) | (0.398) | (0.567) | (0.389) | (0.341) | (0.475) | (0.325) | (0.529) | (0.547) | (0.514) |
| Spouse looks after children | 0.623 | 0.512 | 0.385 | 0.218 | 0.227 | 0.183 | -0.442 | -0.450 | -0.380 | 3.026 | 3.588 | 2.857 |
| | (0.753) | (1.252) | (0.455) | (0.219) | (0.245) | (0.217) | (0.323) | (0.320) | (0.265) | (0.345) | (0.358) | (0.344) |
| N | 4149 | 4149 | 4149 | 7588 | 7588 | 7588 | 8737 | 8737 | 8737 | 7155 | 7155 | 7155 |
| Groups | 974 | 974 | 974 | 1817 | 1817 | 1817 | 2200 | 2200 | 2200 | 1648 | 1648 | 1648 |
| Sargan statistic | 16.77 | 14.25 | 18.31 | 18.60 | 7.49 | 21.53 | 18.94 | 8.22 | 9.74 | 27.66 | 14.80 | 23.39 |
| Instruments | 42 | 36 | 36 | 42 | 36 | 36 | 42 | 36 | 36 | 42 | 36 | 36 |
| DF | 16 | 10 | 10 | 16 | 10 | 10 | 16 | 10 | 10 | 16 | 10 | 10 |
| P-Value | 0.40 | 0.16 | 0.05 | 0.29 | 0.68 | 0.02 | 0.27 | 0.61 | 0.46 | 0.03 | 0.14 | 0.01 |
| AR1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 |
| AR2 | 0.06 | 0.06 | 0.05 | 0.95 | 0.78 | 0.87 | 0.12 | 0.98 | 0.04 | 0.00 | 0.13 | 0.00 |

Notes: see Table A3.

Source: European Community Household Panel, waves 1994-2001.

**Table A5 OLS and Fixed Effects estimates of the λ coefficient in the dynamic employment and hours equations**

| | Denmark | Italy | Germany | UK |
|---|---|---|---|---|
| Employment equation | | | | |
| OLS | 0.480*** | 0.839*** | 0.596*** | 0.627*** |
| | (0.012) | (0.004) | (0.006) | (0.008) |
| Fixed Effects | 0.095*** | 0.191*** | 0.085*** | 0.125*** |
| | (0.015) | (0.008) | (0.009) | (0.011) |
| Hours equation | | | | |
| OLS | 0.702*** | 0.763*** | 0.776*** | 0.730*** |
| | (0.011) | (0.007) | (0.007) | (0.008) |
| Fixed Effects | 0.179*** | 0.100*** | 0.103*** | 0.174*** |
| | (0.017) | (0.013) | (0.012) | (0.013) |

Notes: Estimated coefficients refer to equation (1) in the text. Standard errors are given in parentheses. The regressions include the same variables as those in table A3 and A4.