

Earnings Effects of Career Interruptions and Children in a Model With Endogenous Choice of Sector^{*}

by

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Abstract:

If effects of birth-related interruptions and child penalties differ across sectors, a natural consequence would be that mothers choose the sector favouring preferences for family-friendly policies. In the Danish case, the birth-related compensation and working conditions differ substantially between the public and private sector. These differences in the outcome of the bargaining process can be explained from effort bargaining theory. Hence the two sectors attract individuals with different preferences for children and leave. Using detailed information on career patterns for Danish women (1981-1997), we estimate earnings effects of various career interruptions in these sectors. In order to model the endogeneity of sector choice, the study is performed within the framework of an endogenous switching model.

JEL codes: J13, J22, J33, J45

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1. Introduction

If compensation and working conditions for mothers employed in the public sector are much more attractive than in the private sector and if, furthermore, women are penalized for having children and interrupting their career in the private sector, why not enter the public sector in the first place? All studies on interruption effects and child penalty show significant interruption effects (that may die out over time) and wage penalties in the private sector. However, results for the public sector are mixed and dubious. If significant at all, ‘penalties’ in the public sector are often found to be positive. Therefore, one may hypothesize that rational females expecting to have children choose the public sector deliberately to collect the benefits of family-friendly policies and avoid the penalty of the private sector. This is exactly the main hypothesis of the present paper, where we analyse child penalties and interruption effects in a model that allows for endogenous sector choice.

Based on the effort bargaining literature, where unions bargain over both wages and effort (work conditions), the idea is that individuals cluster in the public and private sectors depending on their preferences for wage versus effort. Since the focus of this paper is on children and sector choice, we analyze whether individuals with certain characteristics that are supposed to indicate preference for family friendly policies, tend to cluster in one or the other sector. Individuals with preferences for long and ‘cheap’ interruptions may cluster in the public sector, the union of which on the other hand negotiates contracts that favours this kind of individuals. Individuals who only care about high wages cluster in the private sector. We test this hypothesis through an analysis of self-selection into the public and private sectors.

There is a long tradition for focus on work conditions rather than wages in the public sector in Denmark. Recently, wage growth has been extremely low in the public sector compared to the private sector, and at the same time, work conditions have improved considerably. To mention a few examples, pension schemes have improved, parental leave schemes have been extended in terms of both wage compensation and duration, normal working hours have declined and entitlement to vacation have increased. Though, a similar trend is seen in the private sector, it is by no means as pronounced as it is in the public sector. This is just a cementation of the trend in the eighties as described by Rosholm and Smith (1996).

The leave schemes are of special interest in this context of child penalties and wage effects of career interruptions. During the last two decades, the complete system of parental leaves has changed substantially in Denmark. Significantly prolonged entitlement periods and increases in the coverage of lost earnings during parental leaves have changed the participation behaviour of parents and of mothers, in particular. The parental leave schemes were very limited in the 1970s, but in the 1980s the duration of parental leave was extended and hence the period of job protection. In the 1990s it became possible to supplement the usual maternity/paternal leave with a parental/child care leave, resulting in some parents (in most cases mothers) being absent from the labour market for more than a year following a childbirth. In principle, the coverage of the leave schemes is universal, but there is a tendency that women in the public sector take more parental leaves than their peers in the private sector do. This may reflect that family-friendly policies, to a higher extent than in the private sector, are a part of the legislation for public employees. If women take these sector differences into account when they plan their working career and make their choice of sector, there is a possibility that the women with preferences for children, (long) parental leave and other child/family-friendly policies are more likely to work in the public sector.

The purpose of this paper is to study the interrelationship between career interruptions earnings effects and sector choice. This is done by estimation of earnings effects of different career interruptions, with a special focus on the effects of maternal/parental leaves. We use a longitudinal Danish data set including detailed information on event histories including time spent in the relevant leave schemes. In the estimation procedure we take into account the potential endogeneity of the sector choice in order to investigate whether neglecting this selection process results in endogeneity bias. To correctly account for endogenous sector choice, also endogeneity of education must be accounted for since some sorts of education are directly focussed towards the public sector (e.g. nurses and school teachers). In the career interruption and “family gap” literature, the endogeneity issue may be important, though it is usually neglected. Similarly, the effects estimated from the child variables may suffer from endogeneity bias, and therefore, we use an instrumental variable approach.

The outline of the paper is as follows: Section 2 reviews the existing studies within the literature. Section 3 presents the theoretical framework, which is closely linked to

the effort bargaining literature. Section 4 describes the data used in the empirical part of the paper, whereas section 5 describes the empirical methods. In section 6, the estimation results are presented and finally, section 7 concludes the paper.

2. Literature

In the earnings literature the interruption effects on the earnings of women have been studied extensively with a particular focus on the interruptions related to childbirth. However, there are several branches within this literature ranging from the traditional literature on gender wage gap and family gap (i.e. estimation of “child-penalties”) to studies focusing on interruption effects as such.

“The family gap” is defined as the earnings differential between mothers and childless women. It has been investigated for various countries using various specifications of the estimated models. The earlier studies (eg. Joshi 1990, Joshi *et al.* (1999)) has included dummies for having children and eventually for being married in the earnings equations. The analysis shows that having children and the subsequent increased likelihood of part-time work decrease the hourly pay of women. This decrease is mainly attributed to the return to part-time employment and loss of seniority (i.e. firm-specific human capital) with the current employer. This conclusion is confirmed when the family gap is investigated over time and is decomposed. The gap is of the same magnitude in 1991 as it was in 1978. The results show that the part of the gap accounted for by mothers being less educated and less able than childless women has decreased, whereas the negative earnings effects of motherhood due to part-time work and lost work experience have increased.

These simple measures for the family gap, may suffer from some problems. One is that *potential* rather than *actual* work experience is often included in the earnings equations. This problem is essential when women are studied, simply because women are more likely to interrupt their working careers than men.

Waldfogel (1998) for UK and USA, finds that the negative effect of children is reduced when actual work experience is included rather than potential work experience reduces the, though not eliminated. In the paper it is furthermore investigated whether access to job-protected maternal leave influences earnings of

women. It is found that such an access has substantial positive wage effects in both countries investigated, offsetting some of the negative wage effect from children. This is explained by the higher propensity of return to the former employer after childbirth (hence diminishing depreciation of firm-specific human capital and retaining good job matches. In the Danish case, Datta Gupta & Smith (2002) find that, when they control for foregone human capital accumulation during periods out of the labour market, the birth of a child does lead to a temporarily slower wage growth than the wage growth for childless women. However, this earnings effect appears to be only temporary, since it vanishes around the age of 45 of the women.

Hence, controlling for actual work experience rather than potential, does affect the results, generally by reducing the child penalty. However, one further effect may be (mistakenly) reflected in the measure of the child penalty if not controlled for, namely human capital depreciation taking place during child related interruptions. In a study for Canada using a survey from 1995, Phipps *et al.* (2001) find that not only accounting for less human capital acquired but also allowing for human capital depreciation significantly reduce the penalty associated with ever having a child, though it does not completely disappear. Another result of the paper is that interruptions followed by a return to the former employer are not associated with an earnings loss, but in the case of a change of employer the earnings are reduced significantly. This corresponds with the distinction between depreciation of general versus firm specific human capital. Budig & England (2001) also investigate the wage penalty for motherhood using the NLS. In their fixed effects estimations they find a wage penalty per child of 7%, which is reduced to around 4% (for married and divorced women), when the interruptions, fewer years of job experience and part-time work is taken into account. The authors explain the remaining wage penalty from children by motherhood decreasing the production of the woman and/or employer discrimination of mothers.

For Denmark, Verner (2001) examines the earnings effect of career interruptions during the 1980s. The results of the analysis show evidence of linear depreciation during unemployment, both in the public and private sectors, and in addition, incidental effects are found from men. A significant part of the loss can be attributed

to loss of firm specific human capital. The earnings effects seem to be most persistent in the public sector both for unemployment and non-participation interruptions.

Albrecht *et al.* (1999) investigate earnings effects from career interruptions by the use of a very detailed Swedish data set, and they also estimate the effects separately for private- and public-sector employees. Their results show that in the private sector hardly any effects can be identified from interruptions (only for interruptions due to unemployment for women). However, in the public sector the various interruption variables have negative and highly significant effects, and the magnitudes are higher for men than for women, in absolute terms. As found for Danes (Datta Gupta and Smith, 2002), women in the public sector get a *positive* premium from having children when interruptions are controlled for.¹

In some of the studies referred to above sectoral differences of the wage determination has been identified. Rosholm & Smith (1996) have examined the differences in the gender wage gap in Denmark between the public and private sectors during the 1980s. They find that the wage twist policy resulting in lower earnings growth in the public sector due to female domination in public-sector employment has been a major determinant of increasing gender wage gap. However, as in the other studies on the sectoral differences (Albrecht *et al.* (1999), Datta Gupta & Smith (2000), Verner (2001)), the individual's choice of sector is taken as given, which may result in endogeneity bias, if the distribution of women into the two sectors is not random, but is related to e.g. choice of education etc.

The surveyed literature illustrates that significant differences in the wage determination process across sectors exist, also when the focus is on interruption effects and the child premium/penalty. In particular, this seems to be true in the case of Denmark (and other Scandinavian countries), where the evidence shows that earnings generally are lower in the public sector than in the private sector. This is a consequence of both a lower initial wage level and a flatter earnings profile of the public employees. Because the (rather scarce) evidence shows that also the effect of

¹ In line with this finding, a consultancy report from SBK Scandinavia showed that females employed as trade and office workers (Handel og Kontor) in the public sector do not experience increased risk of marginalization following a period of child rearing leave. On the other hand, their peers in the private sector do experience an increased risk of marginalization following a period of leave. The report also shows that it is the fact of taking leave that matters rather than the length of the leave period.

children and career interruptions are smaller in the public sector, females may incorporate this information when they plan their working career and fertility and make their sector choice. Especially, the counterintuitive finding of positive effects of children in the public sector indicates that the sectoral selection process should be examined in more detail. In the earlier studies mentioned above, the potential endogeneity of the choice of sector is not taken into account. If the selection into sectors depends on the expected number of interruptions, work conditions in connection with childbirth, leave schemes, care days etc. neglecting endogeneity yields biased estimates of the interruption effects.

Another source of bias in the attempt to identify the effects of children is the potential endogeneity of fertility measures. If the fertility choice depends on expected earnings then the estimated effects of children on earnings may be biased and the same goes for the interruptions associated with the childbirths.

3. Theoretical framework²

The main hypothesis, which is tested in this paper is derived from the effort bargaining literature (e.g. Rosen, 1989). In the effort bargaining literature unions are assumed to bargain over both wage and effort (or work conditions), because workers derive utility from both wage and work effort (work conditions). This is exactly what happens in practice; the unions decide before the tri-annual central negotiations what they are aiming for. One year they aim for better pension schemes, then they aim for full pay during leave, and another year they aim at entitlement to more vacation. For example, the outcome may be a 7% pay rise over 3 years, of which 5% is pure wage increase and the last 2% corresponds to increased vacation. The outcome is announced as a joint decision, where the union face a trade-off between pay rises and work conditions, and the employers focus on total increase in (computed) wage costs.

Following Rosen (1989), the firm is one monopolist that is assumed to face a constant elasticity of demand function and choose employment to maximize profits

$$\Pi = N(Pe-w)$$

where N is the number of workers, P is product price, e is effort and w is wage per unit of time.³ Maximizing profits, the price is found to increase with wage and

² This preliminary section is going to be extended.

decrease with effort. Effort increases production and employment, the latter of which may not hold in general for obvious reasons.

The union maximizes:

$$Z(w,e) = N(w,e) (u(w) - g(e)) + (D - N (w,e)) v$$

The resulting union-indifference curves are ellipsoids in the w-e plane. Therefore, at a given wage, the union is indifferent between two levels of effort because the two levels of effort are associated with different levels of employment.

Assume that the firm and the union bargain simultaneously over wage and effort to reach the efficient outcome, and then the firm chooses employment. The resulting contract curve slopes downward (in the w-e plane) indicating that efficient outcomes are composed of either high wages and low effort or the opposite.

Imagine that the economy is segregated into two sectors (a private and a public sector) with separate unions and employers confederations. Then each sector might end up in different equilibria depending on the preferences of the workers and the profit function of the 'firms'.

A rational woman would aim at employment in the sector that fits her preferences best. Hence, if the steepest contract curve is to be found in the public sector, workers with preferences for low work effort (e.g. family friendly policies) would tend to be attracted to the public sector, and workers with preferences for money would apply for jobs in the private sector. Hence, clustering would be observed according to preferences, which are correlated with observed and unobserved characteristics.

A testable implication from the above theory is that individuals self-select into sectors according to observed and unobserved characteristics related to preferences for work and effort. In this paper, the focus is placed on the aspects of work effort related to family friendly policies such as favourable leave schemes. The theory would predict that females with preferences for children and long and cheap interruptions would choose the sector that remunerate these demands (i.e. the public sector).

Where the above-mentioned effort-bargaining theory with the implied downward-sloping contract curve confirms (anecdotal) evidence for Denmark, Andrews and Simmons (1995) find that an upward sloping contract curve would be more

³ It is important to note that the relevant wage is not related to productivity (and effort) but only to unit

appropriate to describe the British wage setting. An upward-sloping contract curve is allowed in the sequential effort bargaining model that they construct where wages are negotiated before effort (work conditions).

4. Data

In the following section the data available for the econometric analysis are presented and some initial indications of the expected results are shown.

4.1 *Data source*

The original data set holds information on a representative sample of 5% of all Danish individuals in the 15-74 age bracket. The data set is longitudinal and it covers the period 1981-97. It is an unbalanced panel. Information stems from several registers all maintained by Statistics Denmark. The registers include variables describing demographics and education on a yearly basis. Furthermore, labour market status including periods of employment, unemployment, maternal leave, and publicly subsidized child rearing leave is known on a weekly basis.

In the empirical analysis we use a subsample of women aged 20-40 years who are employed more than 200 hours per year, who are not self-employed and not undertaking education. The lower age bound is chosen to exclude individuals who are in the state between two types of education, for instance high school and university. The upper age bound is chosen to exclude women who consider early retirement as this may affect both wage contracting and choice of sector. Finally the analysis is performed on a cross-section of individuals in 1997, using the retrospective information on the labour market history.

4.2 *Descriptive statistics*

It should be emphasized that what follows is merely a description of the variables and their mutual relations. The resulting tables may therefore to a large degree be sensitive to variation in other variables.

of employed time.

The endogenous variables in the models to be estimated are the choice of sector and the hourly wages.⁴ The hourly wages are calculated from annual earnings and number of working hours. Working hours are calculated from contributions to supplementary pension payments (ATP). Registered children are those who woman has given birth to. Thus, it is assumed that the number of biological children is more important than the number of children in the household. It may be a problem, if children in the household other than the biological children of the woman affect her choices and actions. However, a clear advantage of using the number of biological children instead of the number of children in the household is that the data set holds precise information on date of birth of the biological children. This is not the case for children in the household.

Table 1. Distribution of women across sectors and mean hourly wages and number of children (1997).

Number of children	Distribution across sectors		Hourly wages (DKK)	
	Public sector	Private sector	Public sector	Private sector
No children	38.78	52.27	127.27	128.25
1 child	18.82	18.17	124.79	130.88
2 children	30.64	23.60	123.99	131.62
3 children	9.85	5.04	122.73	128.68
4 children	1.63	0.79	120.39	129.08
5 or more children	0.28	0.13	108.80	116.69
All	100.00	100.00	125.19	129.54
N	14257	15684	14257	15684

It is seen from Table 1 how the 29941 women of the sample are distributed across sectors and number of children they have given birth to. Women without children amounts to more than half of the women employed in the private sector, whereas only 38.8% of the women employed in the public sector are childless. The share of women with one child is the same in the two sectors, but for women with more children the picture is reversed. Mean hourly wages vary with sector and that the difference to a high degree depends on the number of children. The average wage for women with no children is slightly higher in the private sector than in the public sector. This difference increases with the number of children. It seems, therefore, that in terms of wages, women with children are better off in the private sector. Despite that, a larger share of women in the public sector has more than 2 children. This may indicate that women employed in the public sector attach importance to other factors than hourly

⁴ In a future version of the paper also the fertility decision will be modeled.

wages and that they are rewarded differently from women in the private sector. Though, the observation that the tendency for average wages to decrease with the number of children is noteworthy, one should be cautious when comparing average wages between women with different numbers of children. The assumption *ceteris paribus* is less likely to hold in this case because one might expect the observable characteristics to vary substantially with number of children.

The interruption information is a subset of the spells in the very accurate working histories are computed on a weekly basis. Incidences of unemployment and non-participation are registered from 1981 and onwards while maternity leave and parental leave in connection with childbirth can be traced back to 1984. Before 1984 maternity leave is included in the non-participation category. From 1980-1983 mothers were eligible for 18 weeks of maternity leave (4 weeks before expected birth and 14 weeks after), which means that for some women in our sample a significant part of maternity leave may be hidden in the residual category non-participation. In 1984 the maternity leave scheme is extended with 10 weeks of parental leave. These 10 weeks can be shared between the mother and the father.⁵ Also, the father can take 2 weeks of leave during the first 14 weeks after the birth. This scheme is in accordance with existing law. Parental leave and maternity leave are included in the same interruption category from 1984 and onwards. In 1997 it is found that 5% of the women in our sample working in the public sector are on maternity and/or parental leave. In the private sector the share is 6%.⁶

In 1994, in addition to the parental leave schemes, three new types of publicly subsidized leave schemes are introduced: Child rearing leave, sabbatical leave, and leave due to education. The length of these types of leaves is registered from 1995 and onwards.

⁵ In the representative 5% sample, most often mothers take the full 10 weeks of parental leave. See www.cls.dk under fertility variables, specifically the descriptive statistics on the variable *varfod*.

⁶ See Appendix 1 for a more detailed description of the Danish leave schemes during the period of observation.

Table 2. Mean duration of spells (1981-96) distributed according to sector of the woman in 1997.

Duration of spells (weeks)	Public sector		Private sector		All	
	Mean	N	Mean	N	Mean	N
Employment	51.18	105181	65.72	83384	57.61	188565
Unemployment	11.09	94884	11.94	74248	11.46	169132
Child rearing leave	27.08	1128	26.54	720	26.87	1848
Sabbatical leave	27.09	89	28.00	40	27.37	129
Birth-related leave	63.36	1223	63.35	849	63.36	2072

In table 2 the mean duration of the observed spells are seen. Both the length of employment and unemployment spells are higher in the private sector than is the case for the public sector. Concerning the leave schemes associated with parenthood, not much difference is seen in terms of length of the spells. However, it should be noticed that the share of women who has been on maternal leave in the observation period is 36% and 32% in the public and private sector, respectively, whereas the same numbers for child rearing leave is 8.4% and 6%. This is an indication of differences in the preferences for these leave schemes across the two sectors.

Table 3. Mean hourly wage (1997), distributed according to sector and accumulated duration of birth-related leave (years 1984-96).

Duration birth-related leave spells	Public sector		Private sector		All	
	Mean hourly wage	N	Mean hourly wage	N	Mean hourly wage	N
0	125.75	13046	130.13	14842	128.08	27888
1-50	126.14	325	129.06	247	127.4	572
51-100	117.04	818	115.74	544	116.52	1362
101-150	110.48	68	106.75	48	108.93	116
151-200	.	.	102.81	3	102.81	3
All	125.19	14257	129.54	15684	127.46	29941

As the topic of interest in this study is effect of interruptions on the hourly wage it is interesting to see what the “raw data” can tell us about this. In tables 3 the mean hourly wage rate is calculated for women employed in the two sectors, depending on time spent in the leave schemes associated with birth. It is seen that in both sectors hourly wages are declining in time spent in child rearing leave but there is basically no variation across sectors. However it seems that the mothers employed in the private sector and who have been on birth-related leave for 1-100 weeks have lost more than the women in the public sector.

5. Methodology

The effect of career interruptions on wages of privately employed women is often found to be stronger than the effect on wages of publicly employed women. However, as clear from section 2, it remains an open question, whether part of this effect stems from the fact that women who actually plan to interrupt their career are more likely to aim at employment in the public sector in the first place. To address this question, we model public and private sector wages for females in an fully parametric endogenous switching framework.

5.1 Endogenous switching model

Let w_{1i} and w_{2i} be the hourly wages in the public and private sector, respectively, and let x_i and z_i be sets of explanatory variables, and let β_1 , β_2 and γ , be parameters to be estimated. Then the endogenous switching model may be written as follows.

$$\begin{aligned}
 \ln w_{1i} &= x_i \beta_1 + \varepsilon_{1i} && \text{(public sector)} \\
 \ln w_{2i} &= x_i \beta_2 + \varepsilon_{2i} && \text{(private sector)} \\
 I_i^* &= z_i \gamma + u_i && (1) \\
 I_i &= \begin{cases} 1, & \text{if } I_i^* \geq 0 \\ 0, & \text{if } I_i^* < 0 \end{cases} && \begin{matrix} \text{(public sector)} \\ \text{(private sector)} \end{matrix}
 \end{aligned}$$

where I_i^* is a latent variable corresponding to the observable indicator variable I_i that equals one if the individual is employed in the public sector and zero if the individual is employed in the private sector.

Hartog and Oosterbeek (1993) and Glewwe (1996) use the fully parametric approach suggested by Lee (1978) to study the public-private wages in the Netherlands and Cote d'Ivoire, respectively. The error terms are assumed to follow a trivariate normal distribution $N(0, \Sigma)$, where the covariance matrix is:

$$\Sigma = \begin{bmatrix} \sigma_1^2 & \sigma_{21} & \sigma_{u1} \\ \sigma_{21} & \sigma_2^2 & \sigma_{u2} \\ \sigma_{u1} & \sigma_{u2} & 1 \end{bmatrix} \quad (2)$$

All parameters in equation (2) can be estimated except, σ_{21} , because we never observe an individual in both sectors. The likelihood contribution for individual i is:

$$L_i = \Pr(u_i \geq -z_i\gamma, \varepsilon_{1i} = \ln w_{1i} - x_i\beta_1)^{I_i} \Pr(u_i < -z_i\gamma, \varepsilon_{2i} = \ln w_{2i} - x_i\beta_2)^{1-I_i} \quad (3)$$

Or, rewritten

$$L_i = \left[\Phi \left(\frac{Z_i\gamma - \frac{r_{u1}\varepsilon_{1i}}{\sigma_1}}{\sqrt{1-r_{u1}^2}} \right) \frac{1}{\sigma_1} \phi \left(\frac{\varepsilon_{1i}}{\sigma_1} \right) \right]^{I_i} \cdot \left[\Phi \left(\frac{-Z_i\gamma + \frac{r_{u2}\varepsilon_{2i}}{\sigma_2}}{\sqrt{1-r_{u2}^2}} \right) \frac{1}{\sigma_2} \phi \left(\frac{\varepsilon_{2i}}{\sigma_2} \right) \right]^{1-I_i} \quad (4)$$

where $r_{uj} = \text{corr}(\varepsilon_j, u)$, for $j = 1, 2$.

5.2 Identification issues

As discussed by Dustmann and van Soest (1997), appropriate instruments and exclusion restrictions are crucial to obtain reliable estimates on sectoral wage differentials.

However, if more specific inference is based on exact coefficient estimates, an additional issue to be considered concerns endogeneity of right-hand side variables. In particular, Dustmann and van Soest (1997) find that the variable education in the switching regression is highly endogenous, supposedly because it reflects unobserved variables regarding the demand for different types of education in the two sectors (e.g. high demand for nurses and teachers in the public sector). Hence, they conclude that a standard endogenous switching model is sufficient, if only wage differentials are of interest, though loosening up the exogeneity restrictions is needed if more detailed inference is wanted.

Based on these results we study the following model specifications, and estimate the following by MLE: 1) A set of separate equations with no correlation between errors, 2) a standard endogenous switching model, and 3) an endogenous switching model with endogenous education and fertility.

As instruments, we use information about the parents of the woman measured when she was 15-17 years. To identify the parameters of the sector choice equation, the main instrument is the sector of employment for the parents. In the model specifications that allow for endogenous education and/or fertility/leave, education of the parents is the main instrument for education and the number of younger siblings is an instrument for fertility/leave.

To correct for endogeneity of education and fertility/leave, one may use a two step approach (e.g. Rivers and Vuoug, 1988) and subsequently correct the standard errors. Alternatively, one may add two equations and estimate the whole system of five equations by a fully parametric approach or a discrete factor approximation. We start out with the first approach. A non-negligible proportion of females is observed to be non-participants or unemployed and has no observed wage. Therefore, the sketched models may suffer from selection bias. To account for selection effects stemming from participation and subsequently obtaining employment, we add another binary choice equation to the model.⁷

6. Results

In this section we present our results. We estimate a model where we take no endogeneity into account (probit for the sector selection, OLS for the wage equations), the original ESM estimated by ML, and the ESM where the possible endogeneity of education and fertility is accounted for. All models are reduced form models.

6.1 *Specification of the earnings profile.*

Following human capital theory earnings are modelled as Mincerian earnings equations. The dependent variable is log hourly earnings. In order to allow for various

⁷ Glewwe (1996) presents the likelihood function and estimates the model by maximum likelihood.

effects of the (child-related) interruptions, we include the following measures reflecting the human capital stock of the woman: Actual work experience, actual work experience squared, duration of the latest leave and unemployment spell (helps to identify depreciation) and a child indicator to capture “residual child effects” i.e. the child penalty/premium. In order to allow the earnings of women to catch up what may have been lost during the interruption, yearly indicators for interruption of the various types are included (though results are only reported for the child-related leaves), hence allowing the level of earnings to differ, depending on the time past since the latest leave. This has also been labelled “the recovery phase” in the literature.

6.2 Model with no correlation between errors

Table 4 presents the results from a binomial probit model of the choice of sector. The estimated coefficients indicate the effect of a given variable on the probability of working in the public sector.

Regarding the family variables it is seen that both being married and having a child increase the probability of being in the public sector. Thus, the results from this simple model of selection indicate that married women and mothers self-select into the public sector. Also, a high level of education increases the probability of being employed in the public sector. Finally, the coefficients to the variables indicating whether the parents of the woman were employed in the public sector when the woman was young (15-17 years) are both positive and significant (note, that these variables are used as instruments for the choice of sector in the ESM-models).

Table 4. Results from estimation of a sector choice equation, probit specification.

	selection equation	
	Coefficient	Std. dev.
Intercept	-1.8085	0.0043
Experience (years)	0.0155	0.0006
Experience squared	0.0005	0.0003
Education (years)	0.1219	0.0003
Owner of real estate (0/1)	-0.1683	0.0166
Married (0/1)	0.0481	0.0182
Province (0/1)	0.0605	0.0157
Child (0/1)	0.3867	0.0192
Mother employed in public sector (0/1)	0.1027	0.0164
Father employed in public sector (0/1)	0.0767	0.0242
Log likelihood	-19216.97	
# observations	29430	

Note: Bold coefficients are significant at a 5% level.

Table 5 shows the results from the simple OLS wage equations. Separate wage equations are estimated for each sector not taking the selection into account. The dependent variable is log hourly wages in 1997 and the models are specified as Mincerian wage equations extended with an indicator for having children and a set of interruption variables. The types of career interruptions considered are unemployment, birth-related leave, child rearing and sabbatical leave, leave due to education, and non-participation.⁸ We include indicators for the timing of the latest interruption of a certain type (reference category: no interruption of that type) and the length of the last interruption. That is, we allow for variation of the effect of the interruption as time passes (i.e. *catching up*). Furthermore, we include the cumulated duration of unemployment spells since 1981 to capture the effect of frequent and/or long unemployment spells.⁹

Table 5. Results from estimation of wage equations.

	Public sector		Private sector	
	Coefficient	std. dev.	Coefficient	std. dev.
Intercept	4.5269	0.0147	4.4680	0.0147
Experience (years)	0.0058	0.0018	0.0170	0.0020
Experience squared	0.0001	0.0001	-0.0002	0.0001
Education (years)	0.0250	0.0010	0.0278	0.0011
Child (0/1)	-0.0249	0.0060	-0.0005	0.0070
Occupation high level (0/1)	0.1424	0.0088	0.1927	0.0105
Occupation medium level (0/1)	-0.0454	0.0072	0.0421	0.0072
Occupation low level (0/1)	-0.0716	0.0060	-0.0743	0.0053
Last birth-related leave 1992 (0/1)	-0.0076	0.0095	0.0112	0.0121
Last birth-related leave 1993 (0/1)	-0.0049	0.0090	0.0176	0.0113
Last birth-related leave 1994 (0/1)	0.0028	0.0092	0.0093	0.0108
Last birth-related leave 1995 (0/1)	-0.0093	0.0087	0.0136	0.0100
Last birth-related leave 1996 (0/1)	-0.0063	0.0072	-0.0042	0.0084
Child rearing/sabbatical leave 1995 (0/1)	-0.0021	0.0118	0.0083	0.0164
Child rearing/sabbatical leave 1996 (0/1)	-0.0215	0.0187	-0.0251	0.0275
Duration, last birth-related leave (weeks)	-0.0007	0.0001	-0.0013	0.0002
Duration, last child rearing/sabbatical leave (weeks)	-0.0003	0.0004	-0.0006	0.0005
Adjusted R-square	0.2902		0.2604	
# observations	15442		13988	

Note: Bold coefficients are significant at a 5% level.

Contrary to the findings of Datta Gupta & Smith (2000) we estimate a significant child penalty in the public sector and no significant effect of children in the private

⁸ Cf. section 3.

⁹ The results on unemployment and non-participation are not presented in this paper. They are available from the authors on request. In general it is found that recent spells decrease wages more than earlier spells. Also, the effect of the cumulated duration of unemployment spells is significant and negative in all models.

sector when controlling for actual experience and career interruptions.¹⁰ Using a 15% sub sample of the dataset applied in this paper Nielsen *et al.* (2002) find that not taking account of the effect of career interruptions leads to a significant child penalty in both sectors. That is, including information on interruptions cannot account for the penalty associated with having children in the public sector, whereas controlling for the interruptions outweigh the child penalty in the private sector.

Considering the interruption variables, we find that long birth-related leaves are punished in both the public and the private sector. Note that the negative effect is largest in the private sector. However, all the timing indicators for birth-related are insignificant indicating that no catching up is taking place. Furthermore, there seems to be some differences in returns to observable characteristics between the two sectors. Especially, returns to experience and occupational level indicate differences in wage structures between the two sectors.

6.3 *The endogenous switching model*

The results from the standard endogenous switching model are shown in table 8. Here, the selection- and wage equations are modelled simultaneously allowing for correlation of the unobserved characteristics. Taking the potential endogeneity of sector choice into account has an effect on both the selection equation and the wage equations. Considering the selection equation, the effect of living outside the metropolitan area on the probability of being employed in the public sector is increased while the effect of ones father being employed in the public sector becomes insignificant. These effects may be caused by the fact that variables correlated with potential wages in each sector are included in the selection equation while allowing for correlation of the effects of unobserved characteristics affecting both sector selection and potential wages. The estimated correlation parameters indicate positive selection in unobserved characteristics in the private sector, whereas individuals employed in the public sector have unobserved characteristics, which decrease wages in the public sector. The interpretation may be that the same unobserved characteristics are demanded in both sectors and at the same time the returns to these characteristics are higher in the private sector (ranking). This means that individuals who are working in the private sector have higher levels of unobserved characteristics.

¹⁰ Remember, though, that we do not model the decision to participate in the labour market.

Loosening the restrictions of independence across equations causes a dramatic change in some of the parameters of the wage equations. Firstly, the child penalties in the independent wage equation are turned into significant child premium in the public sector and no effect is found in the private sector. When the child indicator is interpreted as preferences for flexible work conditions and family-friendly policies, the existence of a child premium in the public sector supports the hypothesis that women with preferences for having children self-select into the sector where they are punished less.

Table 6. Results from estimation of an ESM by ML (model 2).

	Selection equation		Wage equation Public sector		Wage equation Private sector	
	Coefficient	Std. dev.	Coefficient	Std. dev.	Coefficient	Std. dev.
Intercept	-1.7128	0.0412	4.0127	0.0154	4.4594	0.0151
Experience (years)	-0.0110	0.0056	0.0042	0.0019	0.0157	0.0020
Experience squared	0.0004	0.0003	0.0002	0.0001	-0.0002	0.0001
Education (years)	0.1152	0.0031	0.0451	0.0010	0.0317	0.0020
Owner of real estate (0/1)	-0.1500	0.0136				
Married (0/1)	0.0286	0.0149				
Province (0/1)	0.1733	0.0126				
Child (0/1)	0.3590	0.0185	0.0424	0.0066	0.0153	0.0091
Mother empl. in public sector (0/1)	0.0596	0.0131				
Father empl. in public sector (0/1)	0.0362	0.0193				
Occupation high level (0/1)			0.1640	0.0079	0.2092	0.0090
Occupation medium level (0/1)			-0.0186	0.0060	0.0551	0.0069
Occupation low level (0/1)			-0.0443	0.0051	-0.0636	0.0051
Child rearing/sab. leave 1995 (0/1)			0.0014	0.0123	0.0105	0.0162
Child rearing/sab. leave 1996 (0/1)			-0.0144	0.0185	-0.0274	0.0272
Birth-related leave 1992 (0/1)			-0.0061	0.0103	0.0099	0.0130
Birth-related leave 1993 (0/1)			-0.0053	0.0099	0.0155	0.0121
Birth-related leave 1994 (0/1)			-0.0035	0.0093	0.0070	0.0119
Birth-related leave 1995 (0/1)			-0.0136	0.0093	0.0120	0.0105
Birth-related leave 1996 (0/1)			-0.0102	0.0074	-0.0058	0.0088
Dur., last child rearing/sab. leave (weeks)			-0.0004	0.0004	-0.0005	0.0005
Dur., last birth-related leave (weeks)			-0.0006	0.0001	-0.0013	0.0002
r_{ou}	-0.8617	0.00507				
r_{pu}	-0.2738	0.08586				
s_o			0.2966	0.0017		
s_p					0.2568	0.0044
Log likelihood			-18080.8			
# observations	29430		15442		13988	

Note: Bold coefficients are significant at a 5% level.

The results concerning depreciation appears to be rather stable no matter the specification of the model and also in this case no catching up is identified. Finally, the returns to education increase when allowing for endogenous sector choice.

6.4 The endogenous switching model with endogenous education and fertility

In the model presented above we did not allow for the possibility of endogenous education and fertility. Table 9 gives the results from the endogenous switching model using the two-step instrumental variable approach.

Table 7. Results from estimation of an ESM by ML with endogenous fertility and education (model 3).

	Selection equation		Wage equation Public sector		Wage equation Private sector	
	Coefficient	Std. dev.	Coefficient	Std. dev.	Coefficient	Std. dev.
Intercept	-1.8435	0.0594	3.6734	0.0505	3.9849	0.0546
Experience (years)	-0.0063	0.0056	0.0030	0.0021	0.0137	0.0023
Experience squared	0.0001	0.0003	0.0004	0.0001	0.0001	0.0001
Education (years)	0.1325	0.0049	0.0755	0.0045	0.0552	0.0050
Owner of real estate (0/1)	-0.0769	0.0121				
Married (0/1)	0.0327	0.0132				
Province (0/1)	0.0138	0.0115				
Child (0/1)	0.3418	0.0180	0.0349	0.0067	-0.0670	0.0075
Mother empl. in public sector (0/1)	0.0436	0.0115				
Father empl. in public sector (0/1)	0.0253	0.0164				
Occupation high level (0/1)			0.0452	0.0211	-0.0603	0.0230
Occupation medium level (0/1)			-0.0814	0.0129	-0.1034	0.0141
Occupation low level (0/1)			-0.0544	0.0053	-0.0641	0.0054
Child rearing/sab. leave 1995 (0/1)			-0.0002	0.0130	0.0123	0.0163
Child rearing/sab. leave 1996 (0/1)			-0.0145	0.0193	-0.0217	0.0266
Birth-related leave 1992 (0/1)			-0.0004	0.0106	0.0133	0.0122
Birth-related leave 1993 (0/1)			0.0011	0.0103	0.0255	0.0115
Birth-related leave 1994 (0/1)			0.0084	0.0096	0.0191	0.0112
Birth-related leave 1995 (0/1)			-0.0037	0.0097	0.0209	0.0102
Birth-related leave 1996 (0/1)			-0.0016	0.0077	0.0016	0.0083
Dur., latest child rearing/sab. leave (weeks)			-0.0006	0.0004	-0.0008	0.0005
Dur., latest birth-related leave (weeks)			-0.0007	0.0001	-0.0013	0.0002
ρ_{ou}	-0.8557	0.0054				
ρ_{pu}	0.8556	0.0059				
σ_o			0.3017	0.0019		
σ_p					0.3368	0.0022
Log likelihood			-18511.41			
# observations	29430		15442		13988	

The coefficients from the endogenous switching model have changed relatively much by allowing for endogeneity of education and fertility. However, in the sector selection equation the effect of fertility and marriage seems rather stable as an important factor of explanation.¹¹ Thus, taking account of the potential endogeneity of

¹¹ Remember that the standard deviations are not yet corrected meaning that we cannot perform proper inference.

fertility and education still allows us to conclude that women with children do self-select into the public sector. In the wage equations a major change is that the effect of children in the public sector has decreased slightly and in the private sector it has become very negative – 6.7%! In both sectors, women are still penalized for long birth-related leaves and still not much evidence of catching up is found.

Finally, note that the coefficients related to education are numerically larger in all equations compared to the coefficients from the ordinary endogenous switching model.

6.5 Wage profiles

To illustrate the effect of child related career interruptions we present different wage profiles based on the results from the ESM model with endogenous length of education and fertility. We consider a woman who enters the labour market at the age of 25. At 28 she gives birth to a child and we allow her to take either 6 months or 18 months of maternity leave.

Figure 1. Wage profiles in the public sector.

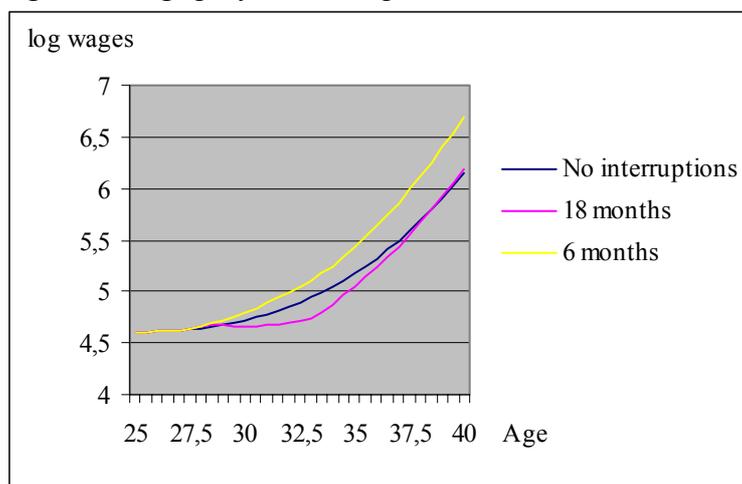


Figure 1 presents the wage profiles for the public sector. It is clear from the graph that women in the public sector are not penalised for taking 6 months of birth related leave. On the contrary, wages for women taking 6 months of birth related leave are at all points in time at least as high as wages for women without children. Also, women

taking 18 months of leave catch up after approximately 10 years. These results are due to the child premium that outweighs the penalty for taking leave.

Figure 2. Wage profiles in the private sector.

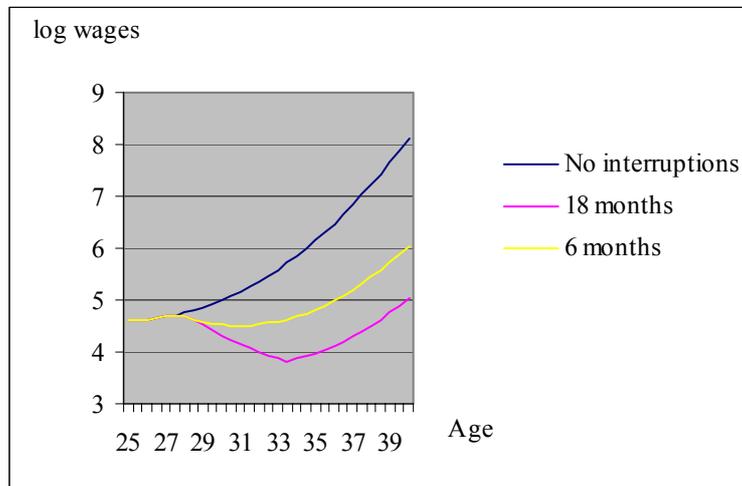


Figure 2 presents the wage profiles for the private sector. In this case, the catching up effect is not present. Women who choose birth related career interruptions are punished severely in terms of wages and this effect does not seem to vanish over time.

The wage profiles for the public sector may indicate the need to model the choice to participate in the labour market: It may be that women with children employed in the public sector have unobserved characteristics that increase wages compared to women with children who do not participate. This may bias parameter estimates and explain why women with children have relatively high wages. Therefore, in a later version of the paper we intend to model wages, sector selection, participation, education, and fertility simultaneously.

7. Conclusion

In this paper, we analyse the earnings effects of children taking potential endogeneity of the sector choice into account. Furthermore, we correct for the possible endogeneity of fertility and education by using an instrumental variable approach. We find that the parameters are very sensitive to both sources of endogeneity.

Having children increases the probability of being employed in the public sector, and has very strong explanatory power, when compared to other determinants of the choice of sector - regardless of the specification of the model. Furthermore, we find a child premium in the public sector and a child penalty in the private sector after correction for both sorts of endogeneity. Regarding birth-related leave, it is found that taking long leaves are punished in both sectors. Not much evidence is found that these losses are reduced subsequently. That is, the negative effect of taking leave may not be reduced over time. Finally, we estimate positive selection on unobserved characteristics in the private sector and negative selection in the public sector.

We expect the fertility variable to catch preferences for flexible work conditions, family friendly policies, leave schemes etc. Thus, we find support for the hypotheses of women self-selecting into the public sector according to the choice of having children and that women with children and child related career interruptions, *ceteris paribus*, are better off in terms of wages in the public sector.

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APPENDIX 1. The Danish leave schemes, 1981-1996

During the period of observation, there have been considerable changes in the Danish leave schemes towards an increasingly generous system in terms of the length of the leaves. In the following, the most substantial changes will be described.

In 1981, mothers were eligible for 18 weeks of maternity leave: 4 weeks before giving birth and 14 weeks after.¹² The law was changed in 1984¹³ extending the leave with 10 weeks of parental leave that could be shared between the parents, resulting in a maximum of 28 weeks of leave for the mother. In 1990 fathers were allowed 2 weeks of leave during the first 14 weeks after the birth (these could not be transferred to the mother).¹⁴ An important point is that law protects individuals who have set forth demands for or are already in maternity or paternity leave against being fired.¹⁵ During the maternity and parental leave all parents on leave are eligible for benefits corresponding to 90% of their former salary (up to a maximum). However, due to legislation in 1989 everybody employed in the public sector has received full salary during maternity/parental leave.

In 1994, in addition to the existing parental leave schemes, three new types of publicly subsidized leave schemes were introduced: Child rearing leave, sabbatical

¹² Cf. www.kvinfo.dk

¹³ Statute (Bekendtgørelse af Lov om barselsorlov m.v.), no 63 per 21/02/1984

¹⁴ Statute (Lov om dagpenge ved sygdom eller fødsel), no 852 per 20/12/1989

leave, and leave due to education.¹⁶ Child rearing leave was aimed at individuals who wanted to withdraw temporarily from the labour force in order to take care of their children. Therefore, the law limited the use of publicly provided childcare facilities for children of individuals in children rearing leave. The leave scheme was open to both employed and non-employed individuals and amounted to a maximum of 52 weeks per child aged 0-8 years for women in employment and 26 weeks for non-employed. In 1994, fully insured participants could receive 80% of the maximum unemployment benefit but in 1995 this was reduced to 70%.¹⁷ Individuals in child rearing leave also received job protection by law.

Contrary to child rearing leave, taking up sabbatical leave would not restrict the individual's use of publicly provided services or more generally lay down conditions for the individual's everyday. Therefore, sabbatical leave could, in principle, be a substitute for child rearing leave. However, only employed individuals could participate in the leave scheme and it was required that the employer hired an unemployed individual to fill in for the individual on leave. Sabbatical leave could be taken for 52 weeks and the benefits scheme corresponded to the scheme for child rearing leave.

Leave due to education could, of course, only be granted if the individual was actually taking up education. Also, only types of education approved by the government were allowed for; this would typically exclude education at university level. Leave due to education amounted to a maximum of 52 weeks and participants could receive the maximum earnings replacement.

Clearly, the extended maternity leave and the introduction of child rearing and sabbatical leave made it possible for women to stay at home and take care of their children for a longer period.

¹⁵ Cf. e.g. Bekendtgørelse af Lov om barselsorlov m.v., no 63 per 21/02/1984

¹⁶ Statute (Lov om orlov), no 435 per 30/06/1993

¹⁷ Statute (Bekendtgørelse om orlov til uddannelse, sabbat og børnepasning), no 1178 per 27/12/1994