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## Women's Labour Supply after Childbirth: An Empirical Analysis for Switzerland

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# Women's Labour Supply after Childbirth: An Empirical Analysis for Switzerland

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## Abstract

In this paper, I investigate employment behaviour of women one year after childbirth. Since the study is based on a sample of mothers only, a corrective method for selection into motherhood has been applied. In the empirical work, I use the family sex composition as an instrument for fertility. The primary focus of this study is to investigate the regional differences in the labour supply of women after childbirth. In Switzerland, childcare policy is an area being the responsibility of cantons and communes. There are thus considerable geographical, linguistic and cultural differences in childcare provision within the country. For instance, childcare policy is more strongly integrated at the cantonal level in the French and Italian speaking regions ("Latin part") than in the German speaking regions ("German part") where communes operate at their own discretion. The federal structure of Switzerland poses thus issues of policy coherence. The main results of this paper indicate that Latin mothers are more likely to return to work and to report more hours of work than their German counterparts. As a consequence, a more coherent and more harmonised childcare policy at the federal level should prove worthwhile. Adopting measures that increase the availability and the quality of childcare is important to promote mother's full-time and continuous employment.

*Keywords:* fertility, labour supply, selectivity, instrumental variables.

*JEL Code:* D1, J13, J21

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# 1 Introduction

In Switzerland, the issue of families has been of policy concern since the 1990s. The social and economic changes that the country experienced during the last decades generated indeed an increasing poverty among families. In addition, mothers who are generally well-educated still experience large difficulties of integration to the job market. In this context, family policy has a crucial role, since one of its objectives is to ensure adequate resources for families. Second, a family policy that helps to balance family and work would facilitate full-time and continuous employment of mothers. Lastly, it would improve both fertility and female labour supply, which would also help facing the challenges of an ageing population (OECD, 2004a and b).

The focus of this paper is the work attachment of women after childbirth. The objective is to investigate to what extent having children and participating to the labour market are compatible decisions for women in Switzerland. This question has already been addressed in the empirical literature about female labour supply. Many empirical studies find evidence that childcare is intensively time demanding and that childcare costs tend to reduce the mother's labour supply (see for instance Heckman, 1974; Blau and Robins, 1988; and Connelly and Kimmel, 2003). In these studies, a recurrent problem is the modelling of childcare costs. Some studies combine information from household surveys and surveys of childcare providers in order to capture variations in the price-quality packages of childcare services. Other studies have only data from household surveys and the prices are reported by parents who choose among providers offering different level of prices and quality (which is usually unobservable). In this case, the endogeneity in childcare costs has been addressed by using instrumental variables such as regional variations in childcare expenditures (in order to measure price and quality changes).

Another strand of empirical literature on female labour supply considers the presence of children as an exogenous variable in the labour supply equation. Killingsworth and Heckman (1986) provide an excellent survey of work in this area. A consistent finding in these empirical studies is the negative effect of the number of children on hours of work. However, it is difficult to say anything about causality, because women who may have strong preferences on making career would be less prone to be mothers than those women who have

preferences for family activities. This selectivity problem makes the fertility variables in the labour supply endogenous. Some studies have solved this endogeneity problem by using instrumental variables. The major difficulty resides in finding instruments that are not weak i.e. finding variables that are not correlated with the labour supply but that are highly correlated with the fertility decision. As an illustration, membership of the Catholic faith is no longer a valid instrument, since the use of contraceptive methods has increased among Catholic women. A good candidate is the occurrence of twins-pairs. But, this corresponds to a rather rare event, except if the dataset is sufficiently large.

In this paper, I investigate the labour supply of women one year after childbirth. I take into account the selection into motherhood by specifying a joint model for the fertility and employment decisions. To my knowledge, currently, there is no empirical study that examines this question of endogeneity of fertility in labour supply for Switzerland. In this study, I use the sex of previous children as an instrument for fertility. Then, the model is estimated by maximising the likelihood function obtained through the joint specification of fertility and employment.

Besides these methodological considerations, it is interesting, from a policy point of view, to focus on the Swiss case, since Switzerland does not have a, so called, “nationwide family policy”. Due to its federal structure, cantons and communes are responsible for measures in this area. This results in large disparities between regions, especially in childcare provision. In this work, I investigate whether the labour force attachment of mothers living in the Latin region is similar to that for mothers living in the German region. The Latin region is characterised by a rather interventionist political tradition: the state intervenes in the balance between family and work. On the contrary, the political tradition in the German region is more liberal: individuals take the decisions in this area and thus the state does not intervene. If regional differences arise in mother’s labour supply, then they are attributed to the different implementation of intervention measures helping the reconciliation between family and work. This would shed some light on the question of the necessity of promoting childcare services at the federal level and of increasing the role of the state in the family policy, because the provision of formal childcare services is generally insufficient in Switzerland.

Turning to employment decision, I distinguish between non-participation, full-time employment and part-time employment. Empirical evidence (see for instance Nakamura and

Nakamura, 1983; and Blank, 1989) has confirmed the importance of distinguishing between part-time and full-time work. Currently, in Switzerland, the only way of combining work and family for women is to work part-time. Indeed, one in two women work part-time. In addition, situations such that mothers work less than half-time often arise. That is why I consider two distinct states for part-time employment.

The paper is organised as follows. Section 2 gives a brief overview of the existing literature on labour supply and fertility. Section 3 presents some stylised facts about family policy in Switzerland. In Section 4, some descriptive statistics about fertility and employment are reported. Section 4 also looks at the data which are used in estimation of the econometrical model that is presented in Section 5. Then, Section 6 presents the estimation results. Section 7 concludes.

## **2 Review of literature on labour supply and fertility**

In literature, the relationship between fertility and female labour market participation (resp. labour supply) has been largely discussed. There is empirical evidence that labour force attachment of women is negatively correlated with the number of children, whereas this correlation reverses and turns to be positive as children are older (see for instance Heckman and Walker, 1990; Gangadharan and Rosenbloom, 1996). In fact, the theory of time allocation within family (Becker, 1965 and Willis, 1973) predicts that childcare costs reduce female participation and labour supply. The hypothesis is that childbearing is time demanding and acts thus as opportunity costs: the higher are the wages, the higher are the costs of childbearing. Thus, this will reduce the demand for children. This behaviour has been widespread over the past decades in the European countries such as France, Germany and Italy. A substantial increase of female participation on the labour market has indeed been observed. In line with this increase, fertility rates have declined rapidly. This also holds for Switzerland.

However, since the late 1980s, it appears that the negative relationship between fertility and participation has reversed with a tendency to observe a positive association. For instance, France and Netherlands are countries that experience both high fertility and participation rates (OECD, 2001). On the contrary, Germany, Italy and Spain have low levels

of fertility and participation. Different factors may explain this positive association. First, the continuous increase of unemployment since the beginning of the 1990s may favour the decision of women to participate in the labour market in order to maintain the family income if the partner becomes unemployed (cf. the added-worker hypothesis, see for instance Filler *et al*, 1996). Second, the development of childcare infrastructure is an important factor describing this positive relationship (see for instance the studies by Hotz *et al*, 1997 and by Ahn and Mira, 2002). Moreover, Apps and Rees (2001) show that the OECD countries that provide childcare related services are likely to have both higher female labour supply and a higher fertility rate.

The issue of childcare and state assistance with childcare expenditures has motivated a large number of empirical studies. For the US, the studies by Heckman (1974), Blau and Robbins (1988), Connelly and Kimmel (2003) demonstrate that the availability and the quality of childcare are important to facilitate women's full-time and continuous employment. Similarly, Gustafsson and Stafford (1992) estimate the effect of childcare costs on labour force participation for women in Sweden; and Powell (1998) analyses how childcare expenditures affect employment behaviour of married women in Canada. For the European countries, Joshi and Davies (1992) show that mothers of 2 children lose on average 10 years of employment in Germany compared to their counterparts without children. This loss amounts to 8 years in UK, to 2 in Sweden and to zero in France. The full day infant schools ("écoles maternelles") which are free and universally available to all children from the age of 3 and which run 8 hours per day could explain the latter result for France.

In the empirical literature, a growing attention has been paid to labour supply of married women (see for instance the survey by Killingsworth and Heckman, 1986). The main focus concerned the sign of the labour supply response to changes in the level of unearned income (husband's income) and to changes in the marginal wage rate. In general, it turns out that women work less as their husbands' income rises. Similarly, the highly paid women tend to delay birth and to supply more hours. In addition, a consistent result in empirical studies of female labour supply concerns the influence of the number and age distribution of children on hours of work (see Mincer, 1962; Cain, 1966; Heckman, 1974 and Schultz, 1978). The labour supply is negatively influenced by the number of children and positively influenced by the age of children.

Most of empirical studies on female labour supply consider the variable capturing the presence of children as exogenous in the employment decision. This is restrictive since the fertility and labour supply decisions can be considered to be a joint decision process. As a consequence, it is not so clear whether more children “cause” women to work less. In addition, it is possible that for some unknown reasons, some women who have strong preferences for work activity are less prone to be mothers than those who have a lower attachment to the labour force. The technique of instrumental variables can get round this problem. Several studies have used instrumental variables to check for the endogeneity of fertility variables (see the survey by Browning (1992) which gives a comprehensive overview of work in this area). The majority of these studies find some evidence that children variables are endogenous in the female labour supply. The main problem in estimating the causal effect of fertility on female labour supply is to find suitable variables which fulfil the joint requirements of being exogenous and having as much explanatory power as possible. Some variables such as birth of twins are difficult to use except in large data sets, because they refer to very rare events. Other variables such as religion and mother’s opinion on ideal family size are probably related to labour market behaviour via other effects than fertility. Recently, Angrist and Evans (1998) and Carrasco (2001) have used the sex of the first two children as an instrument for fertility. This instrument exploits the result obtained in the demography literature on parent’s preferences over the sex composition of their children. There is indeed a consensus that parents in developed countries prefer a mixed sibling-sex composition, although these preferences vary between cultures and within the same culture over time (see for instance the empirical studies by Westoff *et al.* 1963; Ben-Porath and Welch, 1976 and Williamson, 1983).

The last point of this section presents a brief overview of the empirical studies about fertility and female labour supply in Switzerland. To my knowledge, there is no empirical study for Switzerland investigating the issues of fertility and labour supply simultaneously. The existing applications for the Swiss case focus on one particular aspect of female labour supply. For instance, Gerfin (1992) and Kolodziejczyk (2003) investigate the impact of progressive income tax on female labour supply. Using a life-cycle model, Kolodziejczyk (2003) finds that progressive taxation has negative incentives for female labour supply. Gerfin (1992) finds that restrictions on hours cause much higher welfare losses than the tax system. Other empirical studies by Gerfin (1993) and Bauer (1998) find results on the effect of family structure on female labour supply. The number of children and the presence of young children

have a negative effect similar to that found in the existing literature on female labour supply. Finally, the recent study by Gerfin and Leu (2003) explores another feature of labour supply. The primary focus of this study is on the low income working households. In their work, Gerfin and Leu provide a micro-simulation of the effects of introducing different schemes of in-work benefits on poverty and household labour supply. Another strand of literature which is directly related to the presence of children in families concerns the differences between men and women in labour market outcomes. Gender wage gaps have been widely studied in Switzerland (see for instance Kugler, 1988; Bonjour, 1997; Henneberger and Sousa-Poza, 1999 and Sousa-Poza, 2002). Using different data sets, these studies lead to the robust conclusion that persistent wage gaps (of at least 20%) are observed between men and women.

This paper sheds some lights on the labour supply of women one year after childbirth. In this empirical study, I explicitly model the employment decision simultaneously with the decision to give birth, following the approach of Hotz and Miller (1988). The determinants of labour supply are analysed for the sample of mothers, after correcting for selectivity into motherhood. Another contribution is that regional differences are accounted for. This is important since there is no federal family policy, but cantons and communes are competent in this domain. The regional differences that result in the labour force attachment of mothers one year after childbirth may lead to important policy conclusions. In fact, the analysis of the cantonal (regional) family policy and the employment behaviour of mothers after childbirth can reveal whether one region performs better than another and thus whether it is useful or not to introduce a family/childcare policy at the federal level.

### **3 Some Swiss institutional facts about family policy**

#### *3.1. Policy responsibility in Switzerland*

Switzerland is not a centralised country but a confederation of 26 relatively independent cantons. The traditional federal policy is not to intervene in the decision making process of families with young children, since decisions in this area are considered to be a private matter: parents themselves should decide how they wish to balance their work and care responsibilities. Thus, the first important fact about Swiss family policy is that there is no global concept at the federal level. According to Article 116, para.1 of the Federal

Constitution, “the Confederation must consider the needs of the family when it fulfils its tasks”. In other words, family policy is not a sector in itself as education or health. Then, the Constitution defines “family” in its widest sense. Family is a “community of adults and children” and “the right to marriage and the right to have a family” is guaranteed. There is an area of conflict between promoting each individual family member and promoting family as a unit. There is no clear guidelines in the Constitution on the direction family policy should take. The Confederation has both individual and institution centred policies. In general, the traditional family model applies where tasks of men and women are clearly defined and divided.

The Swiss political system is characterised by two fundamental related principles: “federalism” and “subsidiarity”. The federal structure means that the Confederation has competence only where it is empowered under the federal constitution. In all other cases, the cantons are responsible when the competence of the Confederation is not explicitly mentioned. In addition to the cantons, which are the main interlocutors of the federal authorities, municipalities play a central role in this decentralised system. The federal structure implies thus that family policy is the responsibility of cantons and communes. On the other hand, the principle of subsidiary implementation takes place for tasks that need harmonisation at the federal level, and for which cantons cannot achieve the completion on their own. As a consequence, the federal structure raises issues of policy coherence, especially if different administrative levels follow different policy objectives on the same issue. It also raises questions of efficient use of resources and of equal treatment.

### *3.2. Measures and interventions in family policy*

Different intervention areas characterise family policy in Switzerland. First, *economic* interventions cover family allowances, family taxation and means-tested family benefits. Second, *socio-institutional* interventions cover childcare outside the family and activities aimed at making professional life more family-friendly (Report on families, 2004). Cantonal family policy is centred on the economic intervention level. All cantons in Switzerland provide, in one form or another, family or child benefits, family-oriented tax exemptions, means-tested family support and other material benefits such as educational grants. Although the principles governing these economic benefits are similar across the cantons, there are often differences in the levels and rates applied. In terms of socio-institutional interventions,

there are substantial cantonal differences. Generally, the number of outside childcare organisations is very small. However, the cantonal differences observed are explained by the communes which are the principal actor of childcare policy, through the provision of outside childcare, crèches, kindergartens and after-school clubs.

The following section gives an overview of measures and interventions in family policy. A substantial determinant of family policy is the tax system. In Switzerland, the taxation is based on the principle that family represents an economic unit. Due to the progressive rates applied, this system of common taxation may lead to disincentive effects for married women to enter the labour market. Fiscal deductions and family/children benefits can mitigate these effects. However, in Switzerland, there is no "Swiss" tax system, but 26 different cantonal tax systems. In addition, the 2900 communes may levy taxes as multiples of the cantonal basic rate. Fiscal deductions for children vary considerably across cantons: 12600 CHF per child in 2003 in Ticino (TI), 6500 CHF in Geneva (GE) and 3200 CHF in Graubünden (GR).<sup>1</sup> In addition, childcare expenditures are deductible in 11 cantons, but the conditions are rather restrictive (see Gerfin and Leu, 2003).

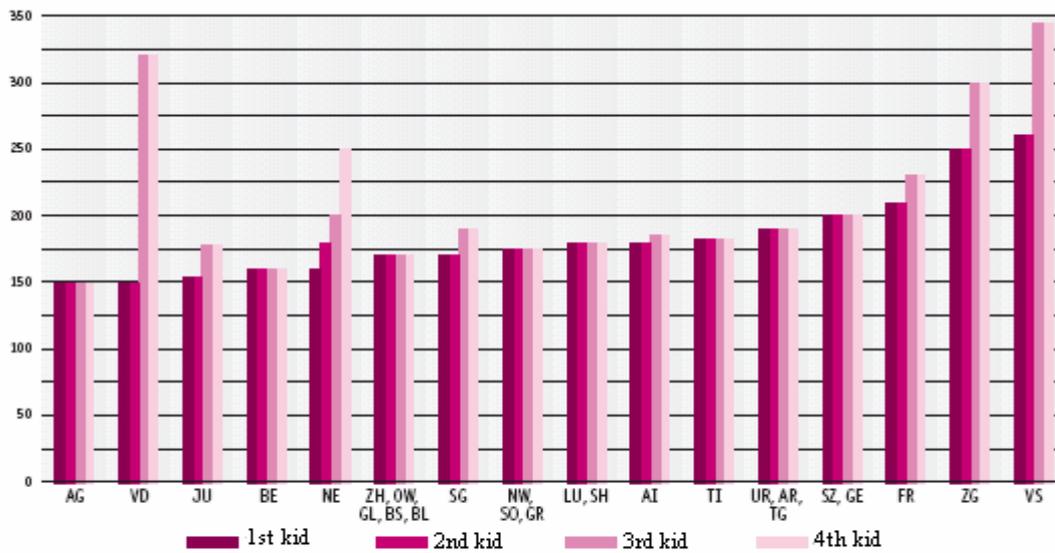
In addition to the tax system, children benefits paid to parents for bearing and rearing their children is an important part of family transfers. Although the Confederation has constitutional competencies in this domain, family benefits have not yet been harmonised at the federal level. There is indeed a federal law for parents working in agricultural sector only. For the other economic sectors, family benefits are ruled at the cantonal level. In 2004, they amount on average to 180 CHF (per child and per month). Figure 1 indicates that high cantonal differences are observed: with 150 CHF in Aargau (AG) against 260 CHF in Valais (VS) for the first two children and with 150 CHF in AG against 320 CHF in Vaud (VD) and 344 CHF in VS from the third child. Moreover, the payment is conditional on the labour market status of the parents: most cantons require full-time employment for parents as eligibility criteria. In addition, the amount of benefits is relative small compared to the effective costs of rearing children.<sup>2</sup>

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<sup>1</sup> The average deduction at the national level in 2003 amounts to 5600 CHF per child (according to the Federal Tax Administration Documentary Service, 2003).

<sup>2</sup> According to Swiss family organisations, children benefits do not cover all expenses implied by the presence of children, including food, clothing, furniture's, bigger housing and education.

Figure 1: Family benefits in 2004 (in CHF and per month)



Source: Office fédéral des assurances sociales, section statistique

In terms of family leave policies, Switzerland is lagging behind the other OECD countries (OECD, 2001). Although planned in the Federal Constitution of 1959, there is still no maternity insurance in Switzerland. At the federal level, protection of pregnancy and maternity is regulated in different federal laws which are not well coordinated. For instance, the Federal Law on Work of 1964 guarantees an employment protection during the pregnancy and the 16 weeks following childbirth. It further stipulates the right for women to not work during the 8 weeks following childbirth. However, it is still possible, with agreement of the pregnant woman, to shorten this leave to 6 weeks. Furthermore, the employer has to pay a salary during 3 weeks after childbirth (this duration increases with seniority in the firm). As a consequence, situations such that the salary is only paid during a part of the leave often arise. This is the most important legal gap. Since 1945, all attempts aimed at instituting a federal maternity insurance have been rejected in referenda. GE is the only canton which has introduced a cantonal law on maternity insurance for working women (enacted in 2000). The canton of VD prepares for doing the same. The lack of legislation in this domain is partially covered by social assistance allowances. In fact, twelve cantons (ZH, LU, GL, ZG, FR, SH, SG, GR, AG, TI, VD and NE) provide help to poor families including pregnant women.<sup>3</sup> This help is characterised by (mean-tested) benefits paid according to need. In this domain, TI remains a pioneer, because the entitlement period for these benefits is much longer than in other cantons. In addition to children benefits and educational grants (independently of

<sup>3</sup> See Table 1 for a list of abbreviations of the name of the cantons.

income), the “modèle tessinois” provides a mean-tested benefit paid to children until the age of 15 and an allowance paid to very young children until the age of 3.

Besides the economic measures, childcare related services are another important feature of family policy. In Switzerland, it is difficult to record the different childcare institutions that operate outside the family. In fact, there is no definition and no uniform structure for crèches, nurseries, kindergartens and after-school care. Moreover, it is difficult to obtain statistics at the cantonal level, such that the comparison between cantons is possible. In spite of these difficulties, the lack of formal childcare arrangements is striking in Switzerland. For instance, in 2000, 50'000 childcare places are available for about 560'000 children aged under 6 in 2000 (i.e. less than 1 place for 11 children).<sup>4</sup> Moreover, demand exceeds supply such that many parents have to wait for 2 years before placing their child in a nursery. In this area, the Federal Department of Home Affairs has published a report on families in Switzerland in 2004. This report indicates that about one third of households with children use childcare services outside the family. In addition, 60% of these families use these services for at most one day per week. In half of families, grand-parents look for children while day-care lasts a very few hours. In case of higher needs, parents turn to childcare institutions. Furthermore, the report sheds some light on the cantonal variability in childcare services. GE is the Swiss canton that has the highest supply of services (crèches and nurseries) per 1000 children under 7 (see Table 1). On the contrary, the density is zero for AI. Besides GE, urban cantons such as ZH, BS and NE perform better than the Swiss average. Finally, cantons in the central and eastern part of Switzerland have a supply of one facility for at least 1400 children under age of 7. In interpreting the number for TI, we have to keep in mind that kindergartens in TI are integrated in the schooling system, and are thus not considered in Table 1.

In addition to the number of crèches and nurseries, the attendance duration in kindergartens displays a high cantonal variability. The age of entrance in kindergartens is very variable. In most of cantons, children attend at age 4 for a duration of 2 years. An exception with TI which allows the entrance at the age of 3 for a duration of 3 years. On the contrary, 5 cantons (AI, FR, OW, SZ and ZG) fix the minimum entrance age at 5 and an attendance duration of 1 year (see Figure 2). Figure 2 shows that in GE and in TI, children attend the kindergartens for the longest time. The average duration at the Swiss level is slightly less than

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<sup>4</sup> The reference for the number of childcare facilities comes from the parliamentary initiative of the federal counsellor Jacqueline Fehr.

**Table 1: Number of facilities per canton, for 1000 children under age of 7**

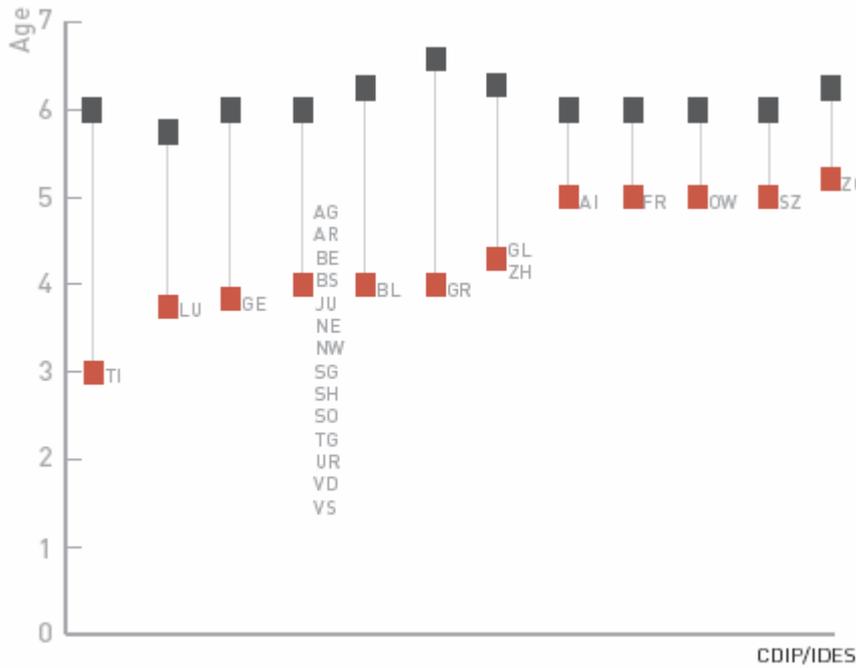
Region, canton	1985	1991	1995	1998	2001
<b>Switzerland</b>	<b>0,9</b>	<b>1,0</b>	<b>1,2</b>	<b>1,6</b>	<b>2,0</b>
<b>Région Lémanique</b>	<b>1,0</b>	<b>1,0</b>	<b>1,5</b>	<b>2,7</b>	<b>2,8</b>
Geneva (GE)	1,3	1,4	2,4	5,8	5,8
Vaud (VD)	1,3	1,0	1,4	1,7	1,8
Valais (VS)	0,1	0,2	0,6	0,7	0,8
<b>Espace Mittelland</b>	<b>0,7</b>	<b>0,8</b>	<b>1,0</b>	<b>1,1</b>	<b>1,5</b>
Bern (BE)	0,6	0,7	0,9	1,1	1,4
Fribourg (FR)	0,2	0,4	0,8	0,8	0,9
Jura (JU)	0,7	0,7	0,8	1,3	1,5
Neuchâtel (NE)	2,4	1,9	2,9	2,3	3,3
Solothurn (SO)	0,4	0,5	0,7	0,6	1,1
<b>Nordwestschweiz</b>	<b>0,9</b>	<b>1,0</b>	<b>0,8</b>	<b>1,1</b>	<b>1,4</b>
Argau (AG)	0,5	0,6	0,5	0,6	0,9
Basel-Land (BL)	0,5	0,5	0,8	0,8	1,0
Basel-Stadt (BS)	3,2	3,2	1,7	3,8	4,1
<b>Zurich (ZH)</b>	<b>2,3</b>	<b>2,5</b>	<b>2,6</b>	<b>3,4</b>	<b>4,1</b>
<b>Ostschweiz</b>	<b>0,4</b>	<b>0,4</b>	<b>0,5</b>	<b>0,7</b>	<b>0,8</b>
Appenzell A.Rh (AR)	0,2	0,2	0,2	0,4	0,7
Appenzell I.Rh (AI)	0,0	0,0	0,6	0,0	0,0
Glarus (GL)	0,9	0,9	0,9	0,9	1,0
Graubünden (GR)	0,2	0,3	0,4	0,4	0,5
St.Gallen (SG)	0,3	0,3	0,5	0,8	0,8
Schaffhausen (SH)	0,9	1,0	1,2	1,4	1,6
Thurgau (TG)	0,5	0,3	0,4	0,5	0,5
<b>Zentralschweiz</b>	<b>0,4</b>	<b>0,4</b>	<b>0,5</b>	<b>0,6</b>	<b>0,7</b>
Luzern (LU)	0,4	0,4	0,5	0,8	0,8
Nidwalden (NW)	0,0	0,0	0,0	0,3	0,7
Obwalden (OW)	0,0	0,0	0,7	0,4	0,4
Schwyz (SZ)	0,4	0,3	0,3	0,4	0,6
Uri (UR)	0,6	0,6	0,3	0,3	0,4
Zug (ZG)	0,7	0,5	1,0	0,7	0,6
<b>Ticino (TI)</b>	<b>0,3</b>	<b>0,3</b>	<b>0,9</b>	<b>0,8</b>	<b>1,0</b>

Source: Report on families (2004), Nordwestschweiz (Northwestern), Zentralschweiz (Central), Ostschweiz (Eastern).

2 years. This duration has increased for 4 months since 1980/1981. Although this increase affects all cantons, the Central region of Switzerland has taken the least advantage of this increase. It is in the Latin region where the duration of attendance is the highest in 2002/2003 with slightly more than 25 months. Then, the Northwestern region comes at the second position with slightly more than 23 months and the Eastern region with 21 months. The

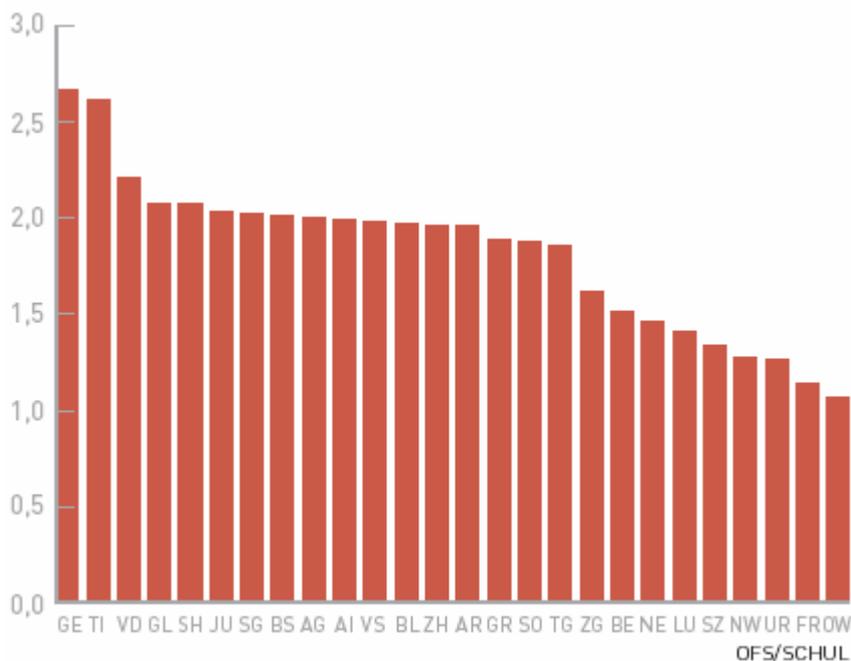
**Figure 2a: Age of attendance in kindergarten and in obligatory school according to legal dispositions in cantons, 31.12.2002**

■ Age of attendance in kindergarten  
 ■ Age of attendance in obligatory school



Source: Report on families (2004).

**Figure 2b: Average attendance duration in kindergarten per canton, in years, in 2002/2003**



Source: Report on families (2004).

Central part of Switzerland comes at the last position with 17 months. As a consequence, it seems that children attend kindergartens for longer time in the Latin region than in the German region.

### *3.3. Regional differences: example of 4 cantons*

In this last section, I overview the main regional differences in the structures of family policy in 4 cantons VD, ZH, LU and TI. This section is based on the report on families published by the Federal Department of Home Affairs (2004) and the OFAS report on family policy at the cantonal and communal level (2004). The choice of these cantons is explained by linguistic, geographical and cultural characteristics. In fact, 3 of the 4 linguistic regions (German region, French and Italian region) are represented.<sup>5</sup> Within these 4 cantons, only cantons of VD and TI have set in their constitution important objectives and dispositions in terms of family policy. For instance, in VD, the new constitution enacted in April 2003, stipulates that the canton has to institute a maternity insurance before 2006 if the Confederation has still not introduced a maternity insurance at the federal level. In TI, support for family tasks and for financial security of women before and after childbirth is ruled. In ZH, several laws mention some important objectives in terms of family policy (fiscal deductions, family benefits...). Finally, only the canton of LU still has no constitutional basis defining the principles of family policy.

The report on families (2004) shows that all cantons investigated provide, in some form or another, family or child benefits. The basis formula of these economic benefits is similar across the cantons. However, there are often differences in the levels and rates applied. For instance, in 2003, TI provides the highest fiscal deductions for minor children (about 12'600 CHF per child) while cantons of ZH and LU stay at the average Swiss level (of about 5'600 CHF per child). As for family benefits, all 4 cantons are at the average Swiss level of 180 CHF per month and per child. Moreover, TI has at its disposal an extended legal basis that rules financial support to families (allowances for children until 15; allowances for youths between 15 and 20 in training; allowances for poor families, allowances for young children under 3).

The survey of cantonal family policy shows that generally a very small density of outside care organisations is observed. Childcare for young children varies very much across cantons in line with different policy objectives. For example, the canton of VD has shown a proper engagement in childcare policy, where balancing work and family life and gender equality are explicitly cantonal policy goals. The provision and the financing of outside

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<sup>5</sup> The fourth language is "Romanche" which is the official language of the canton of GR only.

childcare is thus explicitly mentioned in the new Constitution. Second, hours of the crèches and nurseries have to be compatible with working hours of the parents. Moreover, day-care units for school children (*unités d'accueil pour écoliers*) care for pre-school age and older children in centres with longer daily opening hours. In TI, the new Law on families of 2003 specifies that measures aimed at conciliating work and family have to be promoted. Childcare policy targets at children older than 3 with infant schools (*Scuola dell'Infanzia*), which are part of a tradition that exists for more than 150 years. As a consequence, in VD and TI, infant schools make it possible to take care for most children of pre-school age for more than a half-day period. On the contrary, kindergartens in ZH are generally attended by children for periods of three to four hours per day. Most parents who wish to use childcare for more hours per day must combine several types of childcare to ensure all-day care, which is even more difficult if there is more than one child. This makes it difficult for mothers to have children and work full-time.

The federal structure thus poses challenges to childcare policy. While a strong integration of childcare policy exists at the cantonal level in TI and in VD, there is no clear cantonal engagement of ZH and LU in this domain. In these latter cantons, municipalities are principally responsible for outside childcare institutions. The differences observed in cantonal engagement of VD, TI, ZH and LU reflect the divergences of the political traditions that govern the political life in the cantons. On the one hand, a model based on the principle that the state is more active prevails in the Latin part of Switzerland (VD and TI). On the other hand, the idea of independence of communes and of subsidiary implementation that limits the intervention of the state to the minimum is more anchored in the German part of Switzerland (ZH and LU). Therefore, these differences observed in political positions of leaders reflect shortages of supply in formal childcare services. In terms of use of childcare, parents living in the Latin part of Switzerland generally use more non-parental childcare facilities (this concerns 35% of households with children under 15) than those in the German part (27%, see the study by Buhmann, 2001).

To conclude, it seems that the regional differences between the Latin and the German part are less pronounced in terms of economic interventions. However, both financial and socio-institutional interventions indicate that the Latin region provides more support to families that help the family/work balance than the German region.

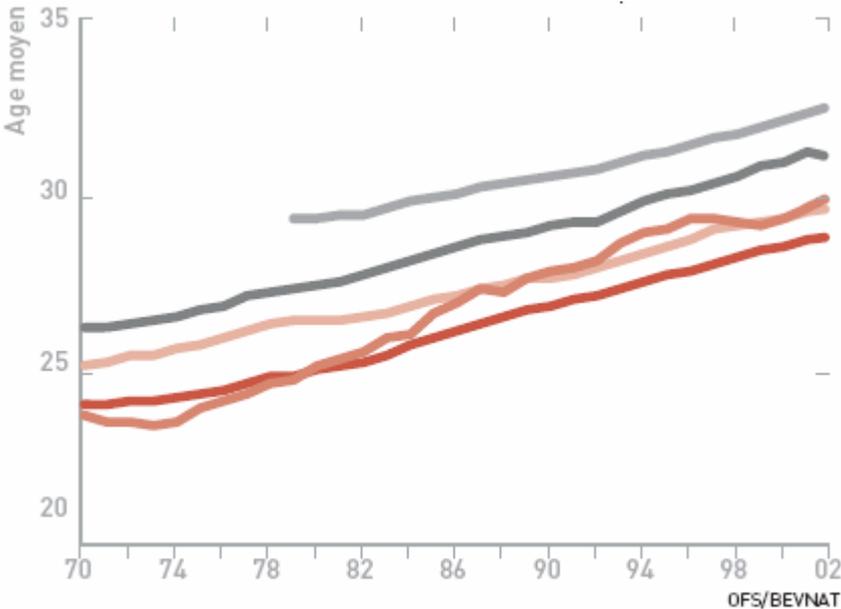
## 4 Descriptive statistics

### 4.1. Fertility behaviour

Low fertility is increasingly becoming a policy concern in Switzerland because of its negative consequences for future labour supply and the financial sustainability of social protection systems. Since the 1980s, the total fertility rate has been fluctuated around 1.4-1.5 children per woman. The postponement of marriage and childbearing is one of the reasons for the decline in fertility. From 1970 to 2000, the mean age at childbirth has increased by 4 years, largely in parallel to the increase in age at marriage (see Figure 3). The increase in the proportion of not marrying and the decline in marital fertility itself are other important factors. In 2000, 22% of all women at age 40 are childless and 15% have only one child. High-skilled women have no child, with 4 of 10 women with tertiary education remaining childless, presumably to avoid decreasing their career opportunities (see the report on families, 2004). To what extent the increase in female employment has contributed to the decline in the fertility is a matter of debate. However, a negative relationship between fertility and employment is observed in Switzerland (see Figure 4).

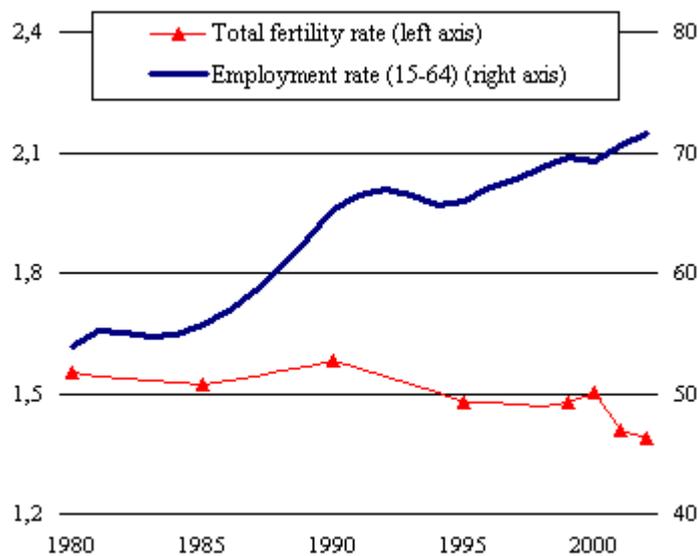
Figure 3: Mean age of women at first marriage and childbirth, 1970-2002

- Age at first marriage for a woman  
■ Age at first childbirth for a married woman  
■ Age at first childbirth for a non married woman
- Age at first marriage for a man  
■ Age at first childbirth for a married man



Source: Report on families (2004).

Figure 4: Trend in total fertility rate and female employment rate (age 15-64)



Source: OECD (2004b).

#### 4.2. Mothers in employment

In this section, I provide some first descriptive statistics about employment patterns of women according to the family composition. Table 2 investigates to what extent the marital and the family status influence both participation and labour supply choices. It turns out that in Switzerland the partner effect is very marked: in 2003, the probability of not working for a childless married woman is twice the one for a childless non-married woman. Bauer (1998) has also found the similar result. This finding may be due to the strong association between marriage and childbirth decisions. In fact, married women anticipate childbirth event by reducing their participation rate or/and by supplying less hours for those who work. The presence of children exerts a complementary role in reducing the participation decision. The probability of not working is 32% for married women having one child. In addition, Table 2 shows that the way the family enlargement affects labour supply has changed over time. At the beginning of the decade, a larger family leads to an increase in non-participation. Nowadays, women prefer to work part-time when family becomes larger. Concerning single mothers, they are more likely to participate and to supply a higher number of hours than their married counterparts.

**Table 2: Civil status and employment of women**

Situation	Not working <i>pNW</i>			Working part-time 1 <i>pPT<sub>1</sub></i>			Working part-time 2 <i>pPT<sub>2</sub></i>			Working full-time <i>pFT</i>		
	1991	1999	2003	1991	1999	2003	1991	1999	2003	1991	1999	2003
Non married childless	7,3	8,7	8,0	4,0	4,9	4,6	17,1	17,9	21,5	71,6	68,5	65,9
Married												
Childless	21,1	18,9	16,3	19,0	16,3	15,7	23,1	27,7	30,6	36,8	37,0	37,4
One child	32,3	31,2	24,4	30,2	24,6	30,6	17,3	27,1	27,9	20,2	17,1	17,1
Two children	42,2	34,8	28,3	37,2	35,2	40,2	13,3	18,7	22,7	7,3	11,3	8,9
Single mother	16,7	16,4	12,7	9,9	10,3	18,9	29,6	35,7	44,4	43,8	37,6	24,0

Notes: Women are between 25 and 55 years old. The situation is defined by: probability of not working for pNW; of working part-time with a degree of occupation of less than 49% (resp. between 50% and 89%) for pPT1 (resp. pPT2) and of working full-time for pFT (with a degree of occupation of more than 89%).

Source: SLFS 1991-2003.

The age of the youngest child is also a critical factor in the participation decision. Table 3 indicates that in 2003 the participation rate of all mothers having children under 6 is about 68% against 82% for women with children older than 6. Thus having young children decreases participation. Table 3 further shows differences by education level. Participation rates of less educated mothers are lagging behind. One reason is the lower benefit they can expect from the labour market. They are indeed less likely to be granted working arrangements by firms. The second fact concerns single mothers who have a higher participation rate than their counterparts living in couples. This is related to the fact that they have to maintain the household income. The only way of combining work and family in the situation of lacking childcare infrastructure is to work part-time. In fact, Table 2 indicates that 63% of single mothers work part-time. As a consequence, there is a potential source of underused labour supply that is mainly attributed to the lack of childcare services.

**Table 3: Participation rates of mothers with children under 6**

Year	Mothers living in couples				Single mothers		All women with children under 6	All women with children older than 6
	All mothers	By educational level			All mothers	Share		
		low	medium	high				
1991	49,9	47,5	56,6	57,2	78,9	4,6	51,1	75,2
1999	60,2	60,2	60,5	72,7	77,8	4,9	62,8	75,9
2003	66,7	61,9	63,6	81,5	86,1	5,7	67,9	81,6

Notes: Women are between 25 and 55 years old. "low" means primary, "medium" secondary and "high" tertiary level

Source: SLFS 1991-2003.

### 4.3. Definition of the states of the labour force

This section presents the data used in the empirical analysis. This study is based on the data of the Swiss Labour Force Survey collected by the Swiss Federal Office since 1991. The Survey is carried out once a year, during the 2<sup>nd</sup> quarter (April-June). It covers the population of persons aged 15 or more who are permanent residents in Switzerland (at least for one year).<sup>6</sup> The Swiss Labour Force Survey provides important internationally comparable information on the labour market situation in Switzerland. Each year approximately 16'000 persons randomly drawn from the phone register of the Swiss PTT are interviewed.<sup>7</sup> Given the chosen survey method (through phone interviews), only the household that dispose of a private telephone are taken into consideration. As a consequence, all persons having no telephone or having a cell phone are not covered by the survey. Participation is voluntary. Questions are asked on work activity, professional experience, working times and conditions, job seeking, former occupation, reasons for not being economically active and incomes. The data collected provide information about socio-demographic characteristics of the employed, unemployed and inactive individuals. This empirical study uses the waves from 1991 to 2003. The data set consists of a rotating panel: each year, one fifth of the individuals already included in the sample is replaced and the other four fifths are re-interviewed. As a consequence, an individual can stay in the sample for at most 5 consecutive years.

The empirical analysis concentrates on women between 17 and 51 years, because they are at risk of devoting time to childbearing and rearing. To define the employment situation, I consider 4 labour market states: i)- non working (*NW*), ii)- working part-time with a degree of occupation of less than 49% (*PT1*), iii)- working part-time with a work degree between 50% and 89% (*PT2*) and iv)- working full-time (*FT*). Two points concerning the definition of the states should be discussed briefly. First, the definition of the states is based on the natural ranking in the hours of labour supply.<sup>8</sup> Second, it would be restrictive to consider only one state for part-time work. Indeed, a feature of the Swiss labour market is that the fraction of women working part-time is very high compared to other OECD countries (see OECD, 2003 and OFS, 2000). In addition, part-time work in Switzerland covers a high range on working hours. It is thus hard to believe that all deviations from 20 and 42 hours can be interpreted as

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<sup>6</sup> Individuals living in Switzerland during a short period, the cross-border workers and the refugees are excluded.

<sup>7</sup> From 2002, the number of persons randomly chosen increased to about 40'000 persons.

<sup>8</sup> The distribution of observed hours of work has 2 modes with peaks around 20 and 42 hours per week (see Appendix A2). A degree of occupation of 90% and of 50% corresponds to 42 and 21 hours per week.

measurement errors or as random fluctuations of working time. That is why, I use two different states for part-time employment.

One purpose of this study is to look at the regional differences in the labour supply after childbirth. Table 4 reports the fractions of being in a given state of the labour market at year  $t$  conditional on childbirth event at  $t-1$ .<sup>9</sup> It seems that slightly a half of women do not work one year following childbirth. In addition, Table 4 reports marked differences in the labour supply between mothers living in the Latin and in the German part of Switzerland.

**Table 4: Regional differences in labour supply after childbirth**

State at $t$ Region	Not working $p_{NW}$	Working part-time 1 $p_{PT_1}$	Working part-time 2 $p_{PT_2}$	Working full-time $p_{FT}$
Switzerland	48.5 (0,015)	28.7 (0,013)	15.5 (0,010)	7.3 (0,007)
Latin part	46.2 (0,024)	18.7 (0,019)	23.2 (0,021)	12.0 (0,016)
German part	49.8 (0,018)	34.4 (0,017)	11.1 (0,012)	4.6 (0,008)

*Notes:* own calculations, probabilities in percent, standard errors in brackets, At  $t-1$ , the youngest child is between 0 and 1 year old.

It turns out that Latin mothers are more attached to the labour market: conditional on working, they are more likely to report a higher degree of occupation than their German counterparts. For instance, Latin mothers have a full-time employment probability of 12% against 5% for German mothers. This result is in line with the institutional facts presented in the previous section that the family policy in the Latin part is more friendly for the work/family balance than in the German part. Besides fostering employment of mothers, a family friendly policy can achieve the goal of maintaining or increasing the fertility rate. In fact, a recent study by Wanner and Fei (2004) about fertility in the Swiss communes between 1970 and 2000 indicates that over the period 1990-2000, the French part of Switzerland had a higher fertility rate than the German part.<sup>10</sup> As a consequence, the main policy recommendation that can result from the descriptive statistics is to promote (full-time) female employment by increasing public spending on childcare structures. The major challenge that Switzerland will face is to make the actions of the different administrative levels more coordinated, perhaps through a harmonisation at the federal level.

<sup>9</sup> As no information concerning the month of birth is available in the data, the event of childbirth occurs when the age of the youngest child is 0 (i.e. when the child is between 0 and 11 months).

<sup>10</sup> The evolution of fertility in time indicates that 2,2 children were born in 1970 in the German part against 1,39 in 2000. The statistics for the French part is of 1,83 children in 1970 against 1,49 in 2000 and for the Italian part of 2 children in 1970 against 1.26 in 2000 (see Wanner and Fei, 2004).

## 5 Methodological framework

### 5.1. Structural model

Employment behaviour of a mother depends on the utility she can expect from working and non-working. In this paper, I assume a simple model of female labour supply along the lines of the (neo-classical) static model. In the neo-classical model of labour supply, women have preferences over consumption  $C$  and leisure  $L$  that are represented by a utility function of the form  $U = U(C, L, Z)$ , where  $Z$  stands for a set of socio-demographic characteristics. They face a budget constraint that limits the consumption possibilities for a given wage rate  $W$  and an unearned income level  $Y$ ,  $C = WH + Y$ . The hours of work  $H$  and leisure are related by the identity  $H = T - L$ , where  $T$  represents the total amount of time available. Women maximise their utility function under the budget constraint. This maximisation leads to the derivation of the optimal labour supply level  $h^{opt} = h(W, Y, Z)$ , which depends on i) socio-demographic characteristics (which influence the shape of preferences), on ii) wage rates, unearned income and the tax system (which define the shape in the budget constraint). At this stage, some points about the implications of the Swiss institutional features on this labour supply model deserve attention.

Due to the complexities of the Swiss tax system, I choose not to model the effect of taxes on labour supply. Indeed, the main feature of the Swiss tax system is that federal taxes are only a minor part of total tax payments. The majority consists of cantonal and communal taxes. In this study, I retain only the fact that couples can file only jointly and that second earners face relatively high marginal tax rates. I set a discrete choice model where women have the choice between discrete hours alternatives. More details about this specification are given in the next section.

Furthermore, I assume that women take the labour supply of their partner as given when they determine the number of working hours. It is beyond the scope of this paper to determine whether or not an income sharing rule has to be accounted for.<sup>11</sup> In Switzerland, the traditional choice model of paid and unpaid work prevails: in this model, men are the main

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<sup>11</sup> More general models of household labour supply explicitly consider the income sharing rule (see for instance Beblo, Beninger and Laisney, 2003; Vermeulen, 2002; and van Soest, 1995).

earners and women are the second earners. This is reflected in the employment patterns between men and women: the participation rate of prime age men is very high (about 90%) while part-time work is an exception among working men (about 7%). It seems thus to be not restrictive to consider that in this study, partner's labour supply is given in female labour supply.

Possible explanatory variables for the employment decision are earnings capacity of household (own wage and alternative income resources such as partner's earnings) and some variables capturing socio-demographical characteristics such as age and education. In the rest of this section, I discuss the statements that can be made about these variables conditional on the Swiss institutional features. In this study, the lack of data on partner's earnings do not allow me to construct accurately the women's unearned income variable  $Y$ . Instead, the data provide detailed information about partner's education. I assume that a partner with a tertiary level of education is more likely to have a higher income than a partner with a primary or secondary level. As a consequence, I expect that the presence of a highly educated partner will have a disincentive effect on spouse's labour supply.

The next point concerns the definition of female's earnings. The data I have at my disposal provide information about yearly net earnings and hours worked in the last week.<sup>12</sup> The wage variable  $w$  capturing the wage rate thus can be constructed. Woman's wage enters both the opportunity cost of children and the utility of participation. However, the use of the woman's wage as an explanatory variable in the fertility and labour supply equations poses two problems. First, the wage is not observed for non-working women. Second, the wage is likely to be correlated with unobserved variables affecting both fertility and labour supply. Here, I adopt the standard solution to these problems which consists in estimating a wage equation on the working sub-sample and correcting for selection bias using the 2-step procedure suggested by Heckman (1979). In this way, the simultaneity problem is solved with a 2SLS technique, and the problem of unobserved wages is solved by imputing the predicted wages to not working women. Using predicted wages for non-working women will introduce two distinct distributions for wages. As a consequence, I use predicted wages for all women, including the working. The two-stage Heckman's approach is based on the existence of instrumental variables. Here, household composition (marital status, number and age

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<sup>12</sup> The yearly net earnings variable is a reconstructed variable delivered by the Statistical Federal Office.

distribution of children) are the exclusion restrictions, because it seems not to restrictive to claim that marital and family status influence the working decision, but not the hourly wage rate (which does not depend on the number of hours of work). Estimation results for the wage regression are presented in Appendix A.3. One can expect that wage will have a positive effect on the propensity of mothers to work after childbirth.

The above mentioned variables capture the different sources of household income. Beside these financial resources, the degree of labour market orientation can exert an impact on mother's employment after childbirth. As a consequence, I control for mother's age and education. The motivation for this is that more educated and older women will return to the labour force soon after childbirth. I also include a set of interaction dummies between mother's age and education in order to give more flexibility to the functional form of the employment equation. Additionally, willingness to work might depend on cultural background. This is the reason why I include a dummy variable for being a foreign mother. There is a stylised fact in Switzerland that foreign women are more likely to participate in the labour market than the Swiss ones because of the financial constraints the foreign households face (OECD, 1996). These financial constraints force women to return to the labour market soon after childbirth.

Next, I discuss the effect of children aged more than 1. This effect is specified by interacting the number and age of the children already living in the household. This allows me to capture the institutional context. It might be indeed important whether further children in the household are below age 7, the age of enrolment in primary school. Furthermore, I control for the degree of urbanisation by including a dummy for living in highly urbanised cantons such as BS, ZH and GE. Actually, the assumption I make here is that persons living in the cities of Basel, Zurich and Geneva are similar to the persons living in other communes of the corresponding cantons. This assumption is restrictive, but the information about the degree of urbanisation is missing in the data. The reason for including this variable is that one might think that larger cities offer more opportunities of childcare than rural areas. The last specified variables give some indications about time pattern. In the considered time span, female participation rate has been increasing since the beginning of the 1990s. In line with this increase, fertility rate has decreased. In order to capture this time pattern, I specify a time trend. A description of the variables used in the study is presented in Appendix A.4.

## 5.2. Reduced form model

In analysis the labour supply of women after childbirth, the focus on the sample of mothers may lead to a selection problem, since other reasons (that are unobserved to the econometrician) can make some career-oriented women less prone to give birth than those who have a lower labour force attachment. If these unobserved factors influence both childbirth and employment decisions, then analysing work behaviour of women while restricting the sample to mothers could lead to biased results. One solution to this selectivity problem is to model the selection into motherhood. In this case, I follow the approach of Hotz and Miller (1988) and I estimate the determinants of labour supply simultaneously with those for childbirth (see for instance the recent empirical studies by Büchel and van Haam, 2004 and by Lauer and Weber, 2003, which also use a sample selection model). The estimation technique is derived from the Heckman's (1979) two-step approach. Again, this approach of taking the sample selection problem into account is viable in presence of instrumental variables. This point about exclusion restriction will be discussed in the next section on identification. The rest of this section presents the model which specifies the joint probability distribution of fertility and labour supply.

The difference with the standard Heckman's two-step approach is that the dependent variables involved in the "selection" and "regression" equations are both discrete. Van de Ven and Van Praag (1981) develop a bivariate probit model with sample selection in order to estimate a two-step selection model in presence of two binary outcomes. The model presented in this section is an extension of this latter model. It stems from the formulations proposed by Huang *et al* (1999), and Weber and Lauer (2003) where a categorical variable enters the "regression" equation.

In the first step, the probability of giving birth is specified by writing a "fertility" equation. Let us assume that  $F_i^*$  represents a latent index measuring the disutility of giving birth for woman  $i$ . Conditional on some observed variables  $Z_i$  that relate to woman  $i$ 's characteristics, and on some unobserved factors  $u_i$ , this disutility is defined as follows:

$$F_i^* = -\gamma Z_i + u_i, \quad (1)$$

where  $i = 1, \dots, N$  and  $\gamma$  is the parameter vector measuring the impact of variables  $Z_i$  on the disutility of woman  $i$ . The index  $F_i^*$  is not observable. Instead, one has information about a binary variable indicating whether woman  $i$  has given birth or not. The latent variable and the observable variable are related by the following expression:

$$F_i = \begin{cases} 1 & \text{if } F_i^* \leq 0, \\ 0 & \text{if } F_i^* > 0. \end{cases} \quad (2)$$

Using the above definition, the event  $F_i = 0$  corresponds to women not giving birth while  $F_i = 1$  refers to women who give birth.

In the second step, I give a functional specification to the utility function  $U$  presented in the structural model of the last section. Let us assume that  $A_i^*$  represents this latent utility index for the inclination to work. Woman  $i$  who becomes a mother knows her own utility from work activities, which depends on certain measurable factors  $X_i$  and certain unobservable factors  $e_i$ . We can write the following equation:

$$A_i^* = \beta X_i + e_i, \quad (3)$$

where  $\beta$  is the parameter vector measuring the effect of variables  $X_i$  on the mother's propensity to work. Here, I assume a discrete choice labour supply model. Women have the choices between 4 hours alternatives. These 4 states refer to *NW* workers ( $A_i = 1$ ), *PT1* workers ( $A_i = 2$ ), *PT2* workers ( $A_i = 3$ ) and *FT* workers ( $A_i = 4$ ) (see Section 4.3 about the exact definition of these states). These 4 employment categories can relate to an ordered choice modelling framework in the sense they represent the labour supply in hours. The relationship between the latent and the observed variables is expressed as:

$$A_i = \begin{cases} 1 & \text{if } A_i^* \leq \mu_1, \\ 2 & \text{if } \mu_1 < A_i^* \leq \mu_2, \\ 3 & \text{if } \mu_2 < A_i^* \leq \mu_3, \\ 4 & \text{if } A_i^* > \mu_3. \end{cases} \quad (4)$$

The  $\mu$ 's are unknown parameters to be estimated together with  $\beta$ .

Turning to the distributional assumptions for the error terms in equations (1) and (3), I assume that  $u$  and  $e$  follow a bivariate standard normal distribution which can be expressed in the following way:

$$\begin{pmatrix} u \\ e \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_u^2 & \rho \\ \rho & \sigma_e^2 \end{pmatrix}\right). \quad (5)$$

Using this assumption, one can derive the probabilities of the events  $F_i = 0$  and  $\{F_i = 1, A_i = j\}$  with  $j = 1, \dots, 4$  (see Appendix A.5):

$$P(F_i = 0) = \Phi\left(\frac{\gamma}{\sigma_u} Z_i\right).$$

and

$$P(F_i = 1, A_i = j) = \Phi_2\left(-\frac{\gamma}{\sigma_u} Z_i, \frac{\mu_j}{\sigma_e} - \frac{\beta}{\sigma_e} X_i, \rho\right) - \Phi_2\left(-\frac{\gamma}{\sigma_u} Z_i, \frac{\mu_{j-1}}{\sigma_e} - \frac{\beta}{\sigma_e} X_i, \rho\right).$$

The functions  $\Phi$  and  $\Phi_2$  stand for the standard and for the bivariate normal distribution functions. The set of parameters to be estimated is composed of the coefficients  $\beta$ ,  $\gamma$  and the thresholds  $\mu$  as well as of the correlation parameter  $\rho$  and the variances  $\sigma_u^2$  and  $\sigma_e^2$ . The coefficients  $\beta$  and  $\gamma$  are identified only to a scale factor. As a consequence, I use the standard normalisation  $\sigma_u^2 = 1$  and  $\sigma_e^2 = 1$  which are specified in discrete choice models as identification assumptions. The parameters of interest can thus be recovered by maximising the following likelihood function:

$$L = \prod_{i=1}^N P(F_i = 0)^{1-F_i} \prod_{j=1}^5 P(F_i = 1, A_i = j)^{F_i A_{ij}}, \quad (6)$$

where  $A_{ij} = 1[A_i = j]$ .

### 5.3. Identification of the model

When specifying a two-step model, we have to ensure the model is properly identified (see Heckman, 1979). The strategy relies on the availability of some instrumental variables that affect only the fertility decision and not the employment decision. Here, the difficulty is that we can expect very similar factors to influence both the probabilities to be a mother and to work. For instance, we may think that some socio-demographic variables such as age and education are determinants of both fertility and employment decisions. The strategy I adopt here comes from the studies by Angrist and Evans (1998) and Carrasco (2001). The idea is to use the sex of previous children as instrument. This follows from the wide consensus in the demography literature about parents' preferences for families with at least one child of each

sex. They are thus more likely to have an additional child if the previous ones are of the same gender. This instrument is valid when the desire for children is 2 or higher. Nevertheless, I do not exclude from the sample women with less than two children, because they could be relevant to analyse other aspects of the model.<sup>13</sup> Hence, the dummy variable whether the sex of the next child matches the sex of the previous children is used as the instrument of this study.

The next point argues why sibling-sex composition is a good instrument for fertility. Our data indicate that the fraction of women who had a second child is almost invariant to the sex of the first child (47.1% if the first child is a boy against 45.6% if it is a girl). However, this changes when the sex of the first two children is accounted for. Women with 2 children of the same sex are more likely to have a third child: only 21.2% of women with 1 boy and 1 girl have a third child compared to 27.8% and 24.7% for women with 2 girls and 2 boys respectively. In addition, the fraction of mothers with 1 boy and 1 girl who work is 65.5% and 65.0% for those having 2 girls or 2 boys. Some other indirect evidence in favour of the same-sex exclusion restriction comes from families with only one child. The data indicate that the fraction of mothers with 1 boy or 1 girl who work are 73.1% and 72.1% respectively. There is thus no significant association between the probability for a mother to work and the sex of her first-born child. This finding supports the fact that the sex of children itself is not related to labour supply. As a consequence, the variable same-sex seems to be a good instrument.

Lastly, I discuss some points about the timing of both fertility and employment events. As suggested in the study by Lauer and Weber (2003), the information used to explain childbirth decision comes from the year preceding the birth event<sup>14</sup>. Then, in order to investigate to what extent a mother will work after childbirth, I look at the labour force state occupied in the second year following childbirth, i.e. at a point in time when the child is between 12 and 23 months. This means that three waves of the SLFS are used to analyse the employment behaviour of mothers. Actually, I could have looked at the employment situation at a later point of time after childbirth, because the SLFS presents the special feature of being a rotating panel such that an individual can be observed for at most 5 consecutive years. However, the number of persons will be insufficient in order to perform an empirical analysis.

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<sup>13</sup> In addition, the fraction of women with at least 2 children amounts to 56% for women of age 35 (35 corresponds to the mean age in the sample).

<sup>14</sup> The data do not provide information about the month of childbirth. They only report age in years of each child living in the household. Therefore, I define birth when a child is aged 0, i.e. between 1 and 11 months.

Finally, a birth event that occurs at point  $t$  is merged with the data from  $I_{t-1}$  as information for the birth equation and with the data from  $I_{t+1}$  from which I draw the information for the employment status and for the determinants of labour supply.

## 6 Estimation results

In the empirical analysis, I further restrict attention to women between 25 and 51 years, who are at risk of devoting time for childbearing and rearing without being involved in education and retirement decisions. This restriction leads to a sample of 19834 women.

### 6.1. Specification tests

Appendix A.6 presents the results of different specification tests. First, I run a series of Wald tests to test the joint significance of the coefficients for the variables used in the fertility and employment equations. These tests are run on the coefficients for groups of variables such as age dummies or regional dummies. The rule is that a group is retained in the final specification using a significance level of 10 percent as a criterion in order to control for a 5% size at the end of the sequence. It turns out that nationality does not influence the birth decision. In addition, education dummies, time trend variables and own previous earnings seem not to influence the employment decision for women conditional on having become a mother. Second, I run some global Wald tests based on the final specification. The results indicate that the null hypothesis that all slope coefficients in the two equations can be set to zero is rejected.

In order to account for the regional differences between the Latin and the German part of Switzerland, I test whether the coefficients of the equations differ across the region. As a consequence, I interact the explanatory variables with a dummy for the Latin region and I test for the significance of these interaction terms. Furthermore, I allow regional differences in the intercept for the birth equation and in the thresholds for the employment equation. For the birth equation, the tests reported in Appendix A.6 show that the intercept does not vary significantly between the Latin and the German regions. On the contrary, the slope coefficients for the time trend variables vary significantly across the regions. As a consequence, I take account for such a variation by interacting the trend variables with a

dummy capturing the linguistic region. For the employment equation, the tests indicate that there is no significant difference between the regions in the first thresholds. In this case, I use a common threshold for the Latin and the German regions in the final retained specification. Finally, for the other two thresholds, it turns out that they vary significantly across regions. Therefore, I estimate separate effects for the second and the third thresholds.

## *6.2. Determinants of fertility decision*

Tables 5 and 6 present the estimation results for the model with sample selection. First, it turns out that ignoring the selectivity into motherhood when analysing the labour force supply of mothers leads to biased results. The correlation coefficient between both the fertility and employment equations is significant (see Table 6). Therefore, the labour force supply of mothers has to be estimated simultaneously with their propensity to give birth.

In a first point, I discuss the results obtained for the fertility equation (see Table 5). The results on age characteristics indicate that women between 25 and 29 are the most likely to become mothers. Then, their probability to give birth declines as they become older. The education differences show that highly educated women are more prone to give birth than women with a secondary level of education. This is rather surprising since I would expect that highly educated women are more likely to be labour market oriented i.e. they will have a lower probability to give birth. The higher propensity to give birth for highly educated women could be explained by the fact that they are more likely to be younger than their less educated counterparts.<sup>15</sup> Results on the interaction terms between age and education dummies permit to shed some lights on the fertility behaviour of labour market oriented women. The negative effect in Table 5 indicates that the probability to become a mother decreases when a highly educated woman is between 25 and 29 years old. Moreover, this negative effect reduces as the highly educated woman becomes older. Older educated women tend to postpone childbirth event to a later point in time. All these results are in line with the predictions of the theory of time allocation that labour market oriented women are less likely to give birth (see Becker, 1965 and 1994).

Looking at the variables capturing the family background, women living alone are less likely to have children compared to cohabiting women. In this study, I assume that marital

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<sup>15</sup> for instance, 42.7% of less educated women are older than 40 against 34.2% of highly educated women.

**Table 5: Determinants of fertility decision**

<b>Variables</b>	<b>Coeff.</b>	<b>Std.err.</b>
<b>Socio-demographics</b>		
<i>Age (ref: older than 40)</i>		
between 25 and 29	<b>0,59</b>	0,05
between 30 and 34	<b>0,53</b>	0,05
between 35 and 39	<b>0,19</b>	0,06
<i>Marital status</i>		
no partner (ref: cohabiting)	<b>-0,81</b>	0,06
<i>Level of education (ref: secondary level)</i>		
low educated (primary level)	-0,08	0,05
high educated (tertiary level)	<b>0,19</b>	0,09
<i>Age and education</i>		
25-29 years old and high educated	<b>-0,42</b>	0,14
30-34 years old and high educated	<b>-0,22</b>	0,12
35-34 years old and high educated	0,00	0,12
<b>Household composition</b>		
<i>Number and age of children (ref: no child)</i>		
First child aged 1-2	<b>0,69</b>	0,05
First child aged 3-6	<b>0,45</b>	0,06
First child older than 7	<b>-0,44</b>	0,08
Second child aged 1-2	<b>-0,24</b>	0,07
Second child aged 3-6	<b>-0,44</b>	0,08
Second child older than 7	<b>-0,95</b>	0,11
Subsequent child aged 1-2	<b>-0,43</b>	0,10
Subsequent child aged 3-6	<b>-0,44</b>	0,14
Subsequent child older than 7	<b>-1,14</b>	0,21
Same sex	<b>0,16</b>	0,06
<b>Regional characteristics</b>		
highly urbanised areas (ref: less urbanised)	0,06	0,06
Nordwestschweiz (ref: Ostschweiz)	<b>-0,21</b>	0,07
Zentralschweiz	0,03	0,07
Zurich	-0,14	0,08
Espace Mittelland	<b>-0,20</b>	0,10
Région Lémanique	<b>-0,20</b>	0,10
Ticino	<b>-0,21</b>	0,11
<b>Earnings capacity</b>		
wage	<b>-0,06</b>	0,03
partner is highly educated	<b>0,19</b>	0,04
<b>Time trend</b>		
Trend*German part	<b>-0,82</b>	0,31
Trend squared*German part	<b>0,72</b>	0,25
<b>Constant</b>	<b>-1,43</b>	0,12

Notes : log-likelihood:-4884.24, number of observations: 23852. **Bold**: significant at 5% level, *Italics* : significant at 10%. The dependent variable is birth at time  $t$  and is explained using information from time  $t-1$ .

status enters the fertility equation exogenously. To the extent that marriage decisions are correlated with childbearing decisions, our estimates may not yield valid inferences about fertility and female labour supply. This implies that the estimation coefficients are more likely to capture a correlation than a causal relationship. A way of addressing the issue of the potential endogeneity of marriage decision is to specify a model for the marital formation. In this case, the problem is that a valid instrument is needed i.e. it has to be correlated with marriage decision without influencing the fertility decision. To my knowledge, the data do not dispose of any such variable. Hence, this issue of endogeneity is left for future research. The marriage decision is an issue that deserves as much attention as the childbearing decision.

Looking at the effect of family composition, the probability to have an additional child decreases with the number of children already living in the household. Beside this quantitative effect, the distribution of age plays a further explanatory role: as the youngest child becomes older, the probability to give birth to an additional child is lower. Since older women have older children, the age coefficient reflects more the effect of age itself than the effect of age of the youngest child. In addition, the probability to have a further child is the highest for women whose first child is of younger age (1-2 years old). This can be explained by the fact that parents prefer to avoid a large age difference between two consecutive children. Furthermore, having two children of the same sex increases the probability to have a third child. This reveals the preference of parents to have children of different genders.

The results indicate that there is no significant difference in fertility between women living in a highly urbanised area and those living in a less urbanised area. Turning to regional dummies, I find significant negative effects for the regions Zurich and Nordwestschweiz. This result can reflect the general insufficient provision of formal childcare services in Switzerland, even in highly urbanised cantons. Zurich and Nordwestschweiz are indeed regions with a relative high population density and a high urbanisation level compared to Ostschweiz. The regional differences provide also some insights about linguistic differences. The negative effects found for the Région Lémanique, Espace Mittelland and Ticino show that women living in the Latin part of Switzerland are less likely to give birth than women living in Ostschweiz (German part of Switzerland).

As mentioned in Section 5.1, I would expect that woman's earnings preceding childbirth would negatively influence the decision to give birth. The regression yields the

expected effect: the higher the woman's wage is, the lower is the probability to give birth. As a consequence, mothers' earnings prior to potential birth exert a statistically significant negative impact on the decision to give birth. This means that the opportunity costs of work interruption around the time of childbirth seems to be relevant for birth decision. In addition to own earnings, partner's earnings also influence the fertility decision. In this study, the partner's education level is a proxy for the partner's income. We observed a positive correlation between the probability of giving birth and the fact that women live with a highly educated partner. Partner's earnings play the role of an alternative source of income when the woman interrupts her career for childbearing reasons. This latter result is in line with the study by Hotz and Miller (1988) that increasing the father's income significantly increases the probability of another birth. As a consequence, childcare expenditures which would reduce the utility of having an additional child are compensated by father's income.

While no significant time trend is found for the fertility decision in the Latin region, a significant negative trend is observed in the German region for the considered observation period. Women were more prone to become mothers in the beginning of the 1990s compared to the beginning of the 2000s. In addition, the positive effect found in the quadratic specification of time trend gives some indication of the time pattern in the German region. The decrease of fertility speeds up during the last decade. This can reflect the deterioration of the labour market with an increasing unemployment rate, such that the risk for the partner to become unemployed forces women to delay birth. However, this can also indicate that childcare policy of the 1990s did not raise fertility in the German speaking part of Switzerland. This finding is confirmed by the higher fertility rates observed in the Latin regions (see Wanner and Fei, 2004). It is admitted that the provision of childcare institutions is generally insufficient in Switzerland: the supply of nurseries, kindergartens or day-care centres does not meet the demand. However, the analysis of childcare policy at the regional level in Section 3 indicates that the balance between work and family is even more difficult in the German speaking cantons. As a consequence, family policy of the 1990s seemed to not make progress fertility, especially in the German part of Switzerland.

### *6.3. Determinants of employment decision*

Table 6 presents the effects of the determinants of employment after childbirth. In addition, I report in Table 7a the marginal effects of the corresponding explanatory variables presented in

Table 6. The conditional probabilities of the states of the labour force  $p(A_i = j | F_i = 1)$  are first calculated for the reference person. This reference person corresponds to a woman having no child born before the childbirth event  $F_i = 1$ , living without a partner or having a less educated partner. In addition, this reference woman is Swiss by citizenship, older than 35 and lives in the German speaking part of Switzerland. Then, I recalculate these conditional employment probabilities by changing the variables of interest from the reference category to another category. Finally, the marginal effects are obtained by taking the difference between the “reference” and the “recalculated” employment probabilities. Computing these marginal effects is useful in order to investigate to what extent a change in a variable affects the probability of not working and of working part-time or full-time.

Table 6 indicates that negative age effects are obtained. It turns out that young mothers are more likely to display a lower level of labour supply, especially those in their late twenties. The negative effect decreases when the mother becomes older: the labour market attachment after childbirth thus seems to increase with age. This result is in line with the hypothesis that more labour market oriented mothers will delay their childbirth compared to family-oriented mothers. As a consequence, older mothers return to work soon after childbirth occurs. This is confirmed by the marginal effects in Table 7a: the marginal effect of age dummies on the probability of not working after childbirth is larger for mothers aged 25-30 than for mothers aged 31-35. In addition, mothers older than 35 will supply more hours of work than their younger counterparts who are more likely to work with an occupation degree of less than 50% (see the positive marginal effects on  $PT_1$  and negative effects on  $PT_2$  and  $FT$  for mothers younger than 35).

The coefficient for education is significant in the specification allowing the interaction between age and education dummies. The positive impact of education indicates that highly educated mothers are likely to be highly attached to the labour market by working one year after childbirth. The role of education of mothers is central in the special institutional context characterised by high costs of childcare provision. Highly educated mothers will expect a positive benefit from their working activity that will compensate childcare costs. On the contrary, for the less educated mothers, the benefit they can expect from working is lower and cannot cover childcare costs. Hence, the lack of childcare facilities will reduce the possibilities for the less educated mothers of entering the labour market and of supplying a

**Table 6: Determinants of employment decision**

<b>Variables</b>	<b>Coeff.</b>	<b>Std.err.</b>
<b>Socio-demographics</b>		
<i>Age (ref: older than 35)</i>		
between 25 and 30	<b>-0,19</b>	0,10
between 31 and 35	-0,09	0,05
<i>Marital status</i>		
married ( <i>ref: non married</i> )	<b>-0,44</b>	0,16
<i>Foreign citizenship</i>		
non Swiss ( <i>ref: Swiss</i> )	<b>0,29</b>	0,10
<i>Age and education</i>		
25-30 years old and highly educated	<b>0,47</b>	0,19
31-35 years old and highly educated	<b>0,34</b>	0,13
<b>Household composition</b>		
<i>Number and age existing children (ref: no child*)</i>		
First child aged 1-2	-0,19	0,15
First child aged 3-6	-0,16	0,12
First child older than 7	-0,25	0,28
Second and subsequent child aged 1-2	-0,22	0,17
Second and subsequent child aged 3-6	<b>-0,61</b>	0,11
Second and subsequent child older than 7	<b>-0,56</b>	0,20
<b>Regional characteristics</b>		
high urbanised areas ( <i>ref: few urbanised</i> )	0,12	0,07
<b>Earnings capacity</b>		
partner is highly educated	<b>-0,15</b>	0,08
<b>Thresholds</b>		
first threshold	-0,23	0,36
second threshold	<b>0,80</b>	0,33
third threshold	<b>1,52</b>	0,32
<b>Correlation coefficient</b>		
	<b>-0,29</b>	0,12
<b>Interaction terms for the Latin part</b>		
partner is highly educated	<b>0,27</b>	0,13
1 child aged 1-2	0,35	0,24
1 child aged 3-6	<b>-0,24</b>	0,12
1 child older than 7	-0,09	0,34
second threshold	<b>-0,58</b>	0,07
third threshold	<b>-0,47</b>	0,11

Notes: log-likelihood: -4884.24.13, number of observations: 23852. **Bold**: significant at 5% level, *Italics*: significant at 10%. \* existing children in the household excluding the recently born child.

high number of hours. This result is in line with the one obtained by Wanner *et al.* (2003). As a consequence, the general lack of childcare provision in Switzerland will deteriorate the situation of these mothers since a non-return to the labour market does not help to maintain their skills.

In addition, the positive impact of age and education interaction terms is in line with the previous result that highly educated and older women are likely to delay childbirth. Now, these women will return to work soon after childbirth. Hence, women who had invested more in their human capital are more labour market oriented. A further glance at these positive coefficients seems to indicate that the impact on employment is higher for mothers aged 25-30 than for mothers aged 31-35. However, this difference is not statistically significant. Indeed, the null hypothesis that the difference is zero is not rejected by the Wald test statistic.<sup>16</sup> The marginal effects in Table 7a show to what extent the positive impact of a higher education affects the participation and labour supply decisions.<sup>17</sup> Table 7a indicates that a higher level of education increases strongly the probability that mothers work full-time and slightly the probability to work part-time with a degree of occupation between 50% and 89%. In addition, it decreases the probability of not working and of working part-time with a degree of occupation of less than 50% to the same extent. As a consequence, a higher education leads essentially to an increase of labour supply.

The results in Table 6 indicate that foreign mothers display a higher labour force attachment than Swiss mothers. Gerfin (1993) finds a similar result in his study on the labour supply of married women. The financial difficulties the foreign families encounter in Switzerland are stronger when a new child is born. Indeed, in foreign households, the man is generally less educated and/or has a low level of income, so that a second income is necessary in order to maintain a decent standard of living. Childbirth events generate difficulties to foreign households, because they have to find a way to combine work and childbearing tasks without using the existing nurseries and kindergartens that are costly. The existence of some informal care assured by some social networks (extra-family solidarity) can help these foreign mothers who want to work. Another reason for the higher labour force attachment observed

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<sup>16</sup>  $\chi_1^2 = 0.36$  and p-value = 0.55.

<sup>17</sup> It is more interesting to know which marginal effects are significant. One way of computing the variances is to apply the delta method from the estimated coefficients of Table 6 and derive the asymptotic distribution of the 4 conditional employment probabilities. However, this technique is rather cumbersome. That is why, I do not compute the standard errors of the marginal effects.

**Table 7a: Marginal effects**

<b>Variables</b>	<i>pNW</i>	<i>pPT<sub>1</sub></i>	<i>pPT<sub>2</sub></i>	<i>pFT</i>
<b>Reference probabilities</b>	16,65	37,48	25,99	19,87
<b>Socio-demographics</b>				
<i>Age (ref: older than 35)</i>				
between 25 and 30	0,054	0,023	-0,027	-0,050
between 31 and 35	0,024	0,012	-0,011	-0,024
<i>Marital status</i>				
married ( <i>ref: non married</i> )	0,138	0,033	-0,068	-0,102
<i>Foreign citizenship</i>				
non Swiss ( <i>ref: Swiss</i> )	-0,065	-0,056	0,026	0,095
<i>Age and education</i>				
25-30 years old and high educated	-0,094	-0,097	0,030	0,160
31-35 years old and high educated	-0,074	-0,068	0,028	0,114
<b>Household composition</b>				
<i>Number and age of existing children (ref: no child*)</i>				
First child aged 1-2	0,053	0,023	-0,026	-0,050
First child aged 3-6	0,016	0,009	-0,008	-0,017
First child older than 7	0,072	0,027	-0,036	-0,064
Second and subsequent child aged 1-2	0,085	0,030	-0,042	-0,073
Second and subsequent child aged 3-6	0,204	0,025	-0,099	-0,130
Second and subsequent child older than 7	0,184	0,029	-0,090	-0,122
<b>Regional characteristics</b>				
highly urbanised areas ( <i>ref: few urbanised</i> )	-0,033	-0,020	0,015	0,038
<b>Earnings capacity</b>				
partner is highly educated	0,043	0,020	-0,021	-0,042
<b>Interaction terms for the Latin part</b>				
partner's education	-0,028	-0,244	0,064	0,208
First child aged 1-2	-0,039	-0,247	0,061	0,228
First child aged 3-6	0,089	-0,204	0,061	0,055
First child older than 7	0,103	-0,201	0,057	0,040
Latin part of Switzerland	0,000	-0,231	0,069	0,163

Notes: own calculations. \* existing children in the household excluding the recently born child. Effects in *italics* correspond to estimation coefficients that are not significant in Table 6.

for foreign mothers compared to the Swiss mothers is that yearly work permit owners are required to exert an activity in order to be able to stay in Switzerland..

Married mothers seem to be more family-oriented. They are indeed less likely to work with a higher degree of occupation after childbirth (see the negative marginal effects in Table 7a). Similarly, having a highly educated partner decreases the mother's willingness to work. Given the fact that I use the partner's education as a proxy for the partner's income, this result indicates that child rearing is essentially the mother's responsibility as long as the partner has a sufficient income to maintain the household income. A further look at the marginal effects in Table 7a indicates that participation and labour supply is lower for married mothers than for mothers having a highly educated husband. Moreover, the marginal effects on the probability of working full-time are less negative for mothers having a highly educated husband than for married mothers. This can be explained by the fact that high-educated men are more aware of the difficulty to combine work and family life. They will thus participate in childcare and facilitate the mother's re-entry into the active life. The fact that the repartition of care tasks between men and women is more egalitarian has also been obtained for young and high-educated households in the studies by Gabadinho (1998) and Höpflinger (2001).

Furthermore, partner's education appears to have a different effect for the Latin and the German regions. In the Latin region, mothers living with a highly educated partner report a higher degree of labour force attachment than their counterparts living in the German region (see Table 6). In addition, they are more likely to work full-time (see Table 7a). In the German part, however, mothers are more likely to work part or full-time the lower the partner's education is (i.e. the lower the partner's income is). Thus, it seems that partners contribute to childcare and facilitate employment of mothers to a greater extent in the Latin region than in the German region. These differences in contribution and facilitation reflect the influences of the French and the German culture. These cultural differences have also been found in the study by Lauer and Weber (2003) about employment of French and German mothers. It is more traditional in Germany to spend more time on childcare tasks than in France. Mühlberger (2000) shows also that Germany belongs to the countries where the female participation rate decreases at the birth of the first child, because childcare has to be provided by mothers due to the lack of public caring infrastructure. On the contrary, in France, mothers work more often full-time, since the public provision of childcare is well developed with for instance the full-day "écoles maternelles", which are free and run 8 hours a day. Switzerland seems to belong to the countries where female participation rate decreases after childbirth. However, there are some cultural differences within the country.

Table 6 gives further results on the effect of children older than one year. It seems that the number and age of children in the household affect the employment decision of mothers of large families (having already two children before the birth of the third child). These mothers are indeed less likely to report work activities one year after the birth of an additional child. This is in line with the empirical evidence that the labour force attachment of women is negatively correlated with the number of children (see for instance Heckman and Walker, 1990; Gangadharan and Rosenbloom, 1996). Moreover, the findings on the effect of age distribution of children are again consistent with the empirical literature. Table 6 indicates indeed that the negative effect on labour supply is lower in families with children older than 7 than in families with children aged 3-6. This is also indicated by the marginal effects in Table 7a. The marginal effect on full-time probability is more negative for children aged 3-6 than for older children. As a consequence, the results on the effect of the number and the age of children are in line with the empirical studies about female labour supply: the presence of children has a negative impact on the labour supply, but this negative effect reduces as children become older.

The interaction effects for the regional dummy provide further information. The age of the first child has an additional effect on employment of Latin mothers. Table 6 indicates that for the age 3-6 a significant effect is found at the 5% level and for the age 1-2, the effect is only significant at the 10% level. *Ceteris paribus*, one year following the birth of her second child, a mother living in the Latin region is less willing to work than a mother living in the German region, if her first child is aged 3-6. A glance at the marginal effects in Table 7a gives further details about the nature of this negative effect. If we add the marginal effects for working full-time and part-time with a degree of occupation exceeding 50%, the effect is higher than the marginal effect for not working. As a conclusion, one year after childbirth, the probability of supplying a high number of hours for mothers living in the Latin part of Switzerland is higher than for their counterparts living in the German part, even in the presence of a young child before the childbirth event occurs.

The hypothesis that larger cities have better childcare facilities than rural areas seems to hold for Switzerland. In this study, the highly urbanised areas are defined by cantons of ZH, BS and GE. Table 6 shows that the effect of urbanisation degree is significant at the level of 10%. The positive effect indicates that mothers living in a large city are more likely to work after childbirth. Moreover, the marginal effects in Table 7a shed some lights on the

effect of urbanisation degree on the labour supply. It turns out that mothers living in a highly urbanised region are more likely to supply a high number of hours. As a consequence, the hypothesis that childcare services are better developed in larger cities is not rejected in this study.

Lastly, I discuss the results obtained when regional differences are accounted for. The results of the specification tests indicate that the first threshold is common to the regions, whereas there is a significant difference between the German and the Latin regions for the second and the third thresholds. The marginal effects in Table 7a indicate that *ceteris paribus* German mothers are less likely to supply a high number of hours of work and to work full-time in the second year after childbirth than Latin mothers. Finally, in order to have more details about the labour force attachment between mothers living in the Latin and in the German region of Switzerland, I calculate the probabilities for the two reference persons having the same characteristics as the above reference person of Table 7a, except that now, I explicitly oppose the “Latin” reference person with the “German” reference person (see Table 7b). The probability of working part-time with a degree of occupation higher than 50% is 32.9% for Latin mothers against 26% for German mothers; and the probability of working full-time is 36% for Latin mothers against 20% for German mothers. Concerning marginal effects, they are higher in absolute values for Latin mothers than for German mothers (see Appendix A.7). For instance, older and high educated Latin mothers are more likely to work full-time than their German counterparts. This also holds for foreign mothers or mothers living in highly urbanised areas. In addition, the marginal effects are negative for part-time work with a degree of occupation more than 50% when the reference person is from the Latin region, while it is positive when the reference person comes from the German part. As a conclusion, Latin mothers are more likely to supply more hours of work in the second year following childbirth than German mothers. While the provision of childcare is generally insufficient in Switzerland, childcare policy in the Latin region seems to be more successful in promoting the participation to the labour market and the access to full-time job positions than in the German region. In terms of financial measures like family benefits and fiscal deductions for children, both regions provide similar help (although there are still cantonal differences). However, in terms of measures helping the reconciliation between family and work, the analysis in Section 3 shows that the Latin region provides more support. As a consequence, the question of harmonisation of family policy at the federal level deserves some important attention. Second, the question of providing more support at the federal level

should prove to be useful. These issues are of high importance in the current debate about the intervention of the Confederation in the family policy.

**Table 7b: Reference persons, difference between the Latin and the German regions**

<b>Reference probabilities</b>	<i>pNW</i>	<i>pPT<sub>1</sub></i>	<i>pPT<sub>2</sub></i>	<i>pFT</i>
German region	16,65	37,48	25,99	19,87
Latin region	16,65	14,34	32,87	36,13

Source : own calculations.

## 7 Conclusion

The negative relationship between fertility and woman’s labour supply has become a policy concern in Switzerland since the 1990s. If measures are not taken, then Switzerland will face problems with an increasing poverty of families. In addition, the ageing of the population and the continuous decrease of fertility raise some questions about the financial viability of the social protection system. It is common knowledge that a well developed childcare policy would raise female labour supply and thus be one solution to the above mentioned problems. In Switzerland, the general provision of childcare services is insufficient. In addition, Switzerland has no federal family policy. Instead, cantons and communes set their objectives in this area. This implies that substantial differences in family policy are observed within the country. This is thus interesting to examine in which regions of Switzerland, the effect of fertility is the less negative on woman’s labour supply. If there is evidence that in some regions mothers are more likely to return to work after childbirth or to work full-time than in other regions, then it should be of policy concern to promote a family policy at the federal level that provides more support to mothers for the balance of work and care activities.

This paper gives a first attempt of investigating the regional differences in the labour force attachment of mothers one year after childbirth. In this work, I analyse the disparities between the French and Italian (called the “Latin Switzerland”) and the German (called the “German Switzerland”) speaking regions. Besides capturing the linguistic differences, the choice of this categorisation also reflects political and cultural differences. Indeed, the

political traditions are such that the state is more active in the Latin region, while the intervention of the state is limited to the minimum in the German region where the idea of independence of communes is deep-seated. In addition, childcare policy in the Latin region seems to support more parents in the balance between work and family. For instance, the cantons such as Vaud and Ticino have an integrated childcare policy at the cantonal level while other cantons such as Zurich and Luzern show no clear engagement at the cantonal level. In these latter cantons, communes act at their own discretion.

Motherhood is not considered to be exogenous in the labour supply. Instead, the employment decision is simultaneously modelled with the decision to give birth. The determinants of labour supply are analysed for the sample of mothers, after correcting for selectivity into motherhood. The selectivity problem is solved by using the technique of instrumental variables. I use the children's sex composition as an instrument for fertility. Actually, the main limitation of this instrument is that it estimates the effect for moving from 2 to 3 or more children in the population of women with at least 2 children. However, we have not dropped the women with less than 2 children, since they are relevant for the analysis of other aspects of the model such as the influence of education and foreign citizenship on the labour supply.

The results show that woman's past wages negatively affect the probability of having a child. As a consequence, wages act as an opportunity cost. Another central finding is that older highly educated women tend to postpone births. In addition, the probability to have an additional child decreases with the number of children. A glance at the time trend reveals that over the period of study, women living in the German part of Switzerland are less likely to give a birth than women from the Latin region. As a consequence, the current Swiss institutions and family policy do not help to obtain a sufficiently level of children.

Concerning mothers' employment, labour market oriented women will return to the labour market sooner after childbirth. In addition, the possibility of an alternative income source in the household exerts a negative influence on mother's employment. Due to the lack of childcare services in Switzerland, mothers are devoted to care tasks and husbands to work activities. However, there is perhaps a new trend that young and higher educated partners will contribute more to childcare tasks. Another result indicates that foreign mothers are more likely to return to work after childbirth than Swiss mothers are. This is also explained by the

alternative income argument. Given the fact that foreign households face financial constraints, the challenge that foreign mothers have to accept is to work without relying on costly childcare services. Concerning the age and distribution of the children, the results are consistent with the empirical finding that the labour supply is negatively influenced by the number of children, but as children become older, women return to work. Finally, mothers living in a highly urbanised area are more likely to work full-time than mothers living in a rural area, since larger cities are better equipped with childcare services than peripheral areas.

Last results concern the regional differences. It turns out that increasing partner's income has a negative influence on mother's labour supply in the German part while it is positive in the Latin part. The negative effect for German mothers may be attributed to the insufficient provision of childcare structure in the German region. Childcare infrastructure is better developed in the Latin part. As a consequence, Latin mothers can still work (full-time) after childbirth. This finding is confirmed by the analysis of marginal effects. *Ceteris paribus*, one year after childbirth, Latin mothers are more likely to work full-time than their German counterparts.

There is thus evidence that some mothers in Switzerland face barriers in balancing work and family. The consequence for the less educated mothers is of particular importance. Low educated mothers are a group at risk of staying at the margins of the labour market, because of the low benefit they can expect from working compared to the childcare expenditures. Providing measures that help to develop childcare infrastructure should promote mothers to a better social position where their labour market skills are maintained, their personal aspirations about work are enhanced and their access to full-time jobs is facilitated. The fact that German mothers face more difficulties in balancing work and family than Latin mothers reveals a lack of coherence in the Swiss family policy. This raises the question whether childcare policy should be instituted at the federal level. Finally, a well developed family policy does not only increase full-time employment, but it ensures a higher fertility rate.

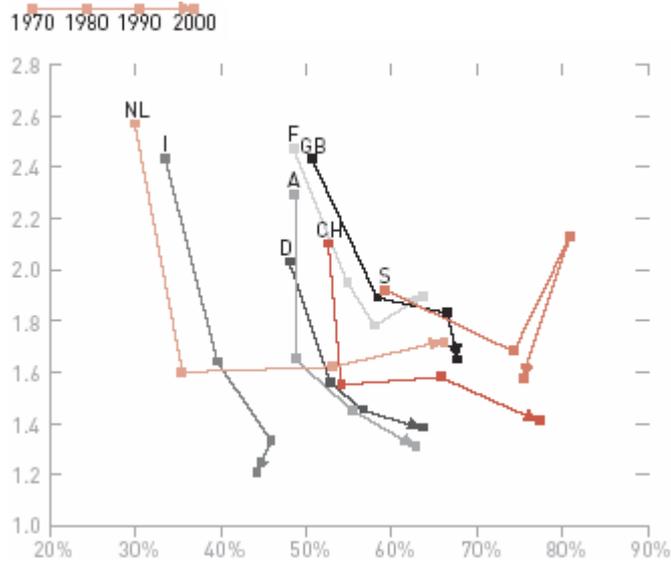
An interesting extension of this analysis would be to compare the results found when communes are accounted for in the empirical analysis. The communal level has been indeed ignored in this study. However, communes are important actors in childcare policy, especially in the German speaking region of Switzerland. Another worthwhile extension would be to

investigate the role of political actors. Finally, the main limitation of the instrument used in this study is that the estimation results do not necessarily describe the fertility movements from 0 to 1 or from 1 to 2 children. However, I find that the birth of the third child decreases labour supply. Since, there is empirical evidence that the marginal effect of the second child and of the subsequent children is more negative than that of the first child, the results of this analysis may have implications for women with less than 2 children.

## Appendices

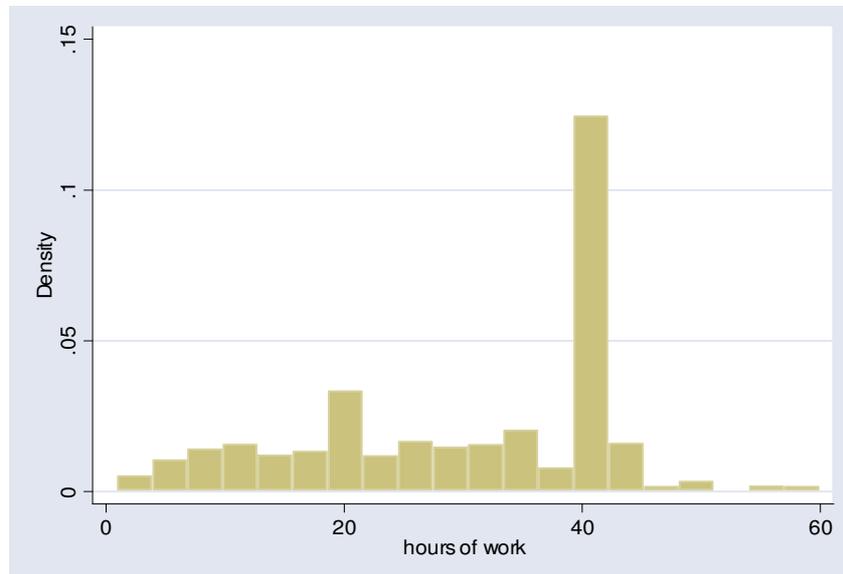
### Appendix A.1: Participation and fertility rates

Evolution of participation rate for women between 15-64 and of fertility rate for some European countries, 1970-2002



Source: Report on families (2004), fertility rate (y axis) ; participation rate (x axis)

### Appendix A.2: Distribution of hours per week for working women



Source: own calculations from SLFS 2003. Women, 25-55.

### *Appendix A.3: the treatment of unobserved wages*

The problem of unobserved wages is solved by replacing the actual observed wage by the expected wage that is obtained by estimating a selectivity-corrected wage equation on workers by OLS. The wage equation is identified from the inclusion of regional characteristics (dummies for 6 regions, dummies for living in a big city and in a rural area) as well as socio-demographic characteristics (age, education and foreign citizenship).<sup>18</sup> In the selection equation, the probit-participation used to compute the inverse Mills ratio includes in addition to the above mentioned variables controls for marital and family status. These latter variables are considered to be instruments, because they influence the working decision and not the hourly wage rate. It is further assumed that the hourly wage rate is not influenced by the number of hours worked. To allow for a non-linear influence of education, two dummies for secondary and tertiary level are included as well as interaction terms involving quadratics and logarithms by combining age and education dummies.

The estimation results of the wage and probit-selection equations are presented below (Table A.3). The results are consistent with those usually found in the labour supply studies. Wages increase with age, with a concave age pattern. According to the product terms, the importance of age increases with education level. If woman has a foreign citizenship, it is estimated that she will receive lower wages. Finally, living in a large city has a positive effect on wages relative to living in a rural region. Turning to the selection equation, being married and having children, especially younger than 6, reduces the probability of working. A last result concerns the error term structure in this 2-step procedure. It turns out that the error terms in the selection and in the regression equations are significantly negatively correlated. This suggests that the wages for women who actually participate are significantly lower than the wages that the non working women would obtain on the labour market.

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<sup>18</sup> regional dummies are for Région Lémanique, Zurich, Northwestern, Eastern, Central and Ticino (reference category is Espace Mitteland). The city size dummies are: living in a big city (more than 100'000 inhabitants), in a rural area (fewer than 10'000 inhabitants) and in a small city (reference category). For foreign citizenship, 2 dummies for B and C work permit are specified.

Table A.3: Wage and selection equations

Variables	Log-wage equation		Selection equation	
	Coeff.	Std.err.	Coeff.	Std.err.
<b>Socio-demographics</b>				
secondary level of education	0,146	0,127	<b>-0,850</b>	0,248
tertiary level of education	<b>-0,434</b>	0,153	<b>-1,174</b>	0,331
log of age	<b>3,292</b>	0,380	<b>13,267</b>	0,890
log of age squared	<b>-0,431</b>	0,052	<b>-1,929</b>	0,121
secondary level of education*age	0,021	0,034	<b>0,281</b>	0,067
tertiary level of education*age	<b>0,247</b>	0,041	<b>0,445</b>	0,090
foreigner with a B work permit	<b>-0,065</b>	0,018	<b>-0,168</b>	0,036
foreigner with a C work permit	<b>-0,078</b>	0,008	<b>0,151</b>	0,017
<b>Regional characteristics</b>				
Living in a rural area	<b>-0,090</b>	0,010	<b>-0,062</b>	0,020
Living in a large city	<b>0,087</b>	0,008	-0,028	0,017
Région Lémanique	<b>0,054</b>	0,008	<b>-0,135</b>	0,016
Zurich	<b>0,029</b>	0,011	<b>0,046</b>	0,024
North Western	0,011	0,009	<b>-0,066</b>	0,020
Eastern	<b>0,022</b>	0,203	-0,010	0,019
Central	<b>0,036</b>	0,010	<b>-0,080</b>	0,020
Ticino	<b>0,083</b>	0,016	<b>-0,244</b>	0,031
<b>Household composition</b>				
Married			<b>-0,453</b>	0,119
Number of children			<b>-0,133</b>	0,059
Youngest child is less than 6			<b>-0,347</b>	0,149
<b>Constant</b>	<b>-3,262</b>	0,701	<b>-2,857</b>	0,630
<b>Mills ratio</b>	<b>-0,121</b>	0,011		
<b>Std.dev. of error term in wage equation</b>	<b>0,505</b>	0,095		

Notes: own calculations (70381 observations, 21685 persons), LR test for  $\rho = 0$  rejected at 5%.

Source: SLFS 1991-2003.

#### Appendix A.4: Explanatory variables used in the analysis

<b>Variables</b>	<b>Description</b>
<b>Socio-demographics</b>	
<i>Age</i>	4 categories: between 25 and 29, between 30 and 34, between 35 and 39 and older than 40.
<i>Marital status</i>	2 categories: married and not married 2 categories: living without a partner and with a partner
<i>Level of education</i>	3 categories: primary (without education, primary school), secondary (elementary professional training, apprenticeship, full-time professional school, general knowledge school, university entrance qualification), tertiary (professional training with master degree, technical and high professional school, university, high school).
<i>Foreign citizenship</i>	2 categories: non Swiss and Swiss.
<b>Household composition</b>	
<i>Children*</i>	Number of children (from 0 to 4).
<i>Age of children</i>	3 dummies if the youngest child is between 0 and 2; 3 and 6; older than 6.
<i>Gender of children</i>	3 variables: dummy if the first child is a boy; dummy if the second child is a boy; dummy if the first two children are of the same sex.
<b>Regional characteristics</b>	
<i>Region of residence**</i>	7 categories: Ostschweiz, Zentralschweiz, Région Lémanique, Ticino, Nordschweiz, Espace Mittelland, and Zurich.
<i>Urbanisation degree</i>	2 categories: highly urbanised region (ZH, BS and GE), few urbanised (other cantons).
<i>Cantonal birth rate</i>	Cantonal birth rate from the Federal Statistical Office <sup>°</sup>
<i>Cantonal vacancy/unempl. rate</i>	Cantonal vacancy/unemployment rate from the Seco <sup>°°</sup>
<b>Earnings capacity</b>	
<i>Own earnings</i>	Before tax wage rate in logs.
<i>Partner's education level</i>	Dummy if there is a well-educated partner (of tertiary level).
<i>Partner's age</i>	Age of the partner.
<b>Macroeconomic effects</b>	Time trend and time trend squared

*Notes:* \* For the fertility equation, interaction terms between the number and age of the children are used. For the employment equation, the number and age of children is defined for the children already living in the household (excluding the newly born child); \*\* Ostschweiz (East: Schaffhausen, Turgau, Appenzell R, Appenzell I, St.Gal-Zentralschweiz (Center: Luzern, Obwalden, Nidwalden, Uri, Schwyz, Zug), Région Lémanique (South West: Geneva, Vaud, Valais), Nordwestschweiz (North West: Aargau, Basel Land, Basel City), Espace Mittelland (West: Jura, Neuchâtel, Fribourg, Bern, Solothurn); <sup>°</sup> Section Démographie et Migration (DEM); <sup>°°</sup> State Secretariat of Economic Affairs of the Swiss Government (Seco).

*Appendix A.5: Derivation of the likelihood function*

Here, we write the contributions to the likelihood function. There are 5 events that are determinant.

The first event concerns women who do not give birth. This event occurs with the following probability:

$$P(F_i = 0) = P(F_i^* > 0) = P(u_i > -\gamma Z_i) = P(u_i < \gamma Z_i) = \Phi(\gamma Z_i).$$

The other events relate to women who become mothers. In this case, we define 4 events according to the labour force state the woman occupies one year after childbirth. The probability to report *NW* is expressed in the following way:

$$P(F_i = 1, A_i = 1) = P(F_i^* \leq 0, A_i^* \leq \mu_1) = P(u_i \leq -\gamma Z_i, e_i \leq \mu_1 - \beta X_i) = \Phi_2(-\gamma Z_i, \mu_1 - \beta X_i, \rho).$$

Similarly, we obtain the following probabilities for the other labour force states:

$$\begin{aligned} P(F_i = 1, A_i = 2) &= P(F_i^* \leq 0, \mu_1 \leq A_i^* \leq \mu_2) = P(F_i^* \leq 0, A_i^* \leq \mu_2) - P(F_i^* \leq 0, A_i^* \leq \mu_1) \\ &= P(u_i \leq -\gamma Z_i, e_i \leq \mu_2 - \beta X_i) - P(u_i \leq -\gamma Z_i, e_i \leq \mu_1 - \beta X_i) \\ &= \Phi_2(-\gamma Z_i, \mu_2 - \beta X_i, \rho) - \Phi_2(-\gamma Z_i, \mu_1 - \beta X_i, \rho) \end{aligned}$$

$$P(F_i = 1, A_i = 3) = P(F_i^* \leq 0, \mu_2 \leq A_i^* \leq \mu_3) = \Phi_2(-\gamma Z_i, \mu_3 - \beta X_i, \rho) - \Phi_2(-\gamma Z_i, \mu_2 - \beta X_i, \rho)$$

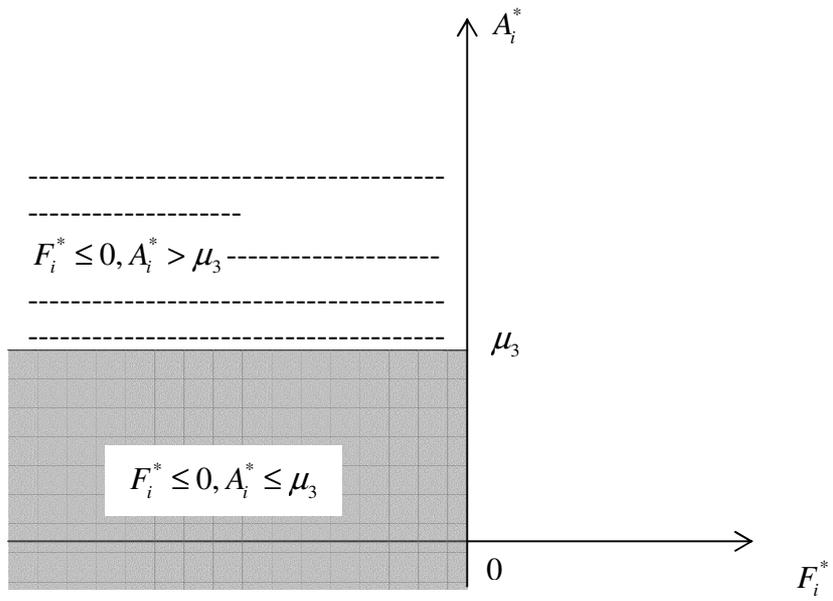
and

$$\begin{aligned} P(F_i = 1, A_i = 4) &= P(F_i^* \leq 0, A_i^* > \mu_3) = P(F_i^* \leq 0) - P(F_i^* \leq 0, A_i^* \leq \mu_3) \\ &= \Phi(-\gamma Z_i) - \Phi_2(-\gamma Z_i, \mu_3 - \beta X_i, \rho) \end{aligned}$$

(see the graph below)

The contribution to the likelihood of woman *i* is thus:

$$L_i = P(F_i = 0)^{1-F_i} \prod_{j=1}^5 P(F_i = 1, A_i = j)^{F_i \cdot 1[A_i=j]}.$$



## Appendix A.6: Specification tests

<b>For birth decision</b>			
<i>Individual tests</i>	Dof	Value of $\chi^2$	(p-value)
<i>Tests on coefficients</i>			
Age dummies	3	143.47	(0.00)
No partner	1	132.77	(0.00)
Education dummies	2	10.43	(0.01)
Age and education interaction dummies	3	8.15	(0.04)
Foreign citizenship	1	0.11	(0.74)
Number and age of children	9	281.58	(0.00)
Gender of children	3	7.19	(0.07)
Boy dummies	2	0.23	(0.89)
First two children of the same sex	1	7.11	(0.01)
Region of residence	6	12.77	(0.04)
Dummy for highly urbanised cantons	1	1.93	(0.16)
Cantonal birth rate	1	0.01	(0.93)
Cantonal vacancy/unemployment rate	1	0.04	(0.85)
Own previous earnings	1	8.27	(0.00)
Partner's education	1	8.46	(0.00)
<i>Tests on interaction terms for Latin part</i>			
Age dummies	3	1.87	(0.60)
No partner	1	0.71	(0.39)
Education dummies	2	1.71	(0.42)
Age*high education	3	2.02	(0.57)
Foreign citizenship	1	0.01	(0.99)
Number and age of children	9	9.02	(0.34)
Gender of children	3	2.08	(0.55)
Dummy for highly urbanised cantons	1	0.14	(0.71)
Cantonal birth rate	1	0.73	(0.39)
Cantonal vacancy/unemployment rate	1	0.14	(0.71)
Own previous earnings	1	0.32	(0.57)
Partner's education	1	2.01	(0.16)
<i>Tests on intercept</i>			
Latin = German	1	0.30	(0.59)
<i>Test on trend</i>			
Latin = German for trend	1	16.44	(0.00)
Latin = German for trend squared	1	10.21	(0.00)
<i>Global Wald test for final specification</i>	30	1269.72	(0.00)

Notes: own computations.

Appendix A.6: Specification tests (... continued)

<b>For employment decision</b>			
<i>Individual tests</i>	Dof	Value of $\chi^2$	(p-value)
<i>Tests on coefficients</i>			
Age dummies	2	5.25	(0.07)
Married	1	12.65	(0.00)
Education dummies	2	0.05	(0.97)
Age and education interaction dummies	2	5.30	(0.07)
Foreign citizenship	1	8.06	(0.00)
Number and age of children	6	29.88	(0.00)
Age for 1 already born child	3	14.82	(0.00)
Age for more than 1 child	3	27.25	(0.00)
Dummy for highly urbanised cantons	1	3.97	(0.05)
Cantonal vacancy/unemployment rate	1	0.81	(0.37)
Own previous earnings	1	0.09	(0.76)
Trend and trend squared	2	0.70	(0.70)
Partner's education	1	4.52	(0.03)
<i>Tests on interaction terms for Latin part</i>			
Age dummies	2	0.35	(0.84)
Married	1	0.23	(0.63)
Education dummies	2	1.16	(0.56)
Age and education interaction dummies	2	0.84	(0.66)
Foreign citizenship	1	1.16	(0.28)
Number and age of children	6	9.53	(0.14)
Age for 1 already born child	3	8.98	(0.03)
Age for more than 1 child	3	1.26	(0.74)
Dummy for highly urbanised cantons	1	0.74	(0.39)
Cantonal vacancy/unemployment rate	1	0.01	(0.94)
Own previous earnings	1	2.17	(0.14)
Trend and trend squared	2	0.07	(0.97)
Partner's education	1	4.87	(0.03)
<i>Tests on thresholds</i>			
Latin = German for the 1st threshold	1	0.11	(0.74)
Latin = German for the 2nd threshold	1	27.35	(0.00)
Latin = German for the 3rd threshold	1	13.21	(0.00)

Notes: own computations

Appendix A.7: Marginal effects, difference between the Latin and the German region

Variables	German region				Latin region			
	<i>pNW</i>	<i>pPT<sub>1</sub></i>	<i>pPT<sub>2</sub></i>	<i>pFT</i>	<i>pNW</i>	<i>pPT<sub>1</sub></i>	<i>pPT<sub>2</sub></i>	<i>pFT</i>
<b>Reference probabilities</b>	16,65	37,48	25,99	19,87	16,65	14,34	32,87	36,13
<b>Socio-demographics</b>								
<i>Age (ref: older than 35)</i>								
between 25 and 30	0,054	0,023	-0,027	-0,050	0,054	0,019	-0,002	-0,071
between 31 and 35	0,024	0,012	-0,011	-0,024	0,024	0,009	0,007	-0,033
<i>Marital status</i>								
married ( <i>ref: non married</i> )	0,138	0,033	-0,068	-0,102	0,138	0,036	-0,021	-0,152
<i>Foreign citizenship</i>								
non Swiss ( <i>ref: Swiss</i> )	-0,065	-0,056	0,026	0,095	-0,065	-0,033	-0,020	0,118
<i>Age and education</i>								
25-30 years old and high educated	-0,094	-0,097	0,030	0,160	-0,094	-0,053	-0,044	0,191
31-35 years old and high educated	-0,074	-0,068	0,028	0,114	-0,074	-0,039	-0,026	0,140
<b>Household composition</b>								
<i>Number and age of existing children (ref: no child)</i>								
Second and subsequent child aged 1-2	0,085	0,030	-0,042	-0,073	0,085	0,027	-0,007	-0,105
Second and subsequent child aged 3-6	0,204	0,025	-0,099	-0,130	0,204	0,042	-0,045	-0,201
Second and subsequent child older than 7	0,184	0,029	-0,090	-0,122	0,184	0,041	-0,038	-0,188
<b>Regional characteristics</b>								
highly urbanised areas ( <i>ref: few urbanised</i> )	-0,033	-0,020	0,015	0,038	-0,033	-0,014	-0,035	0,051
<b>Earnings capacity</b>								
partner is highly educated	0,043	0,020	-0,021	-0,042	-0,028	-0,013	-0,005	0,045

Source : own calculations. Effects *in italics* correspond to estimation coefficients that are not significant in Table 6.

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