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## An Empirical Analysis for Austria

Helmut Mahringer, Christine Zulehner

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### Abstract

The availability of affordable institutional child-care is increasingly discussed as an important determinant of the labour force participation of parents, particularly of mothers. This paper examines the impact of child-care costs on the employment rates of mothers with children younger than 15 years. Using data from the 1995 and 2002 Austrian Microcensus, combined with wage information from Austrian tax records, we estimate the impact of net wages and child-care costs on mothers' employment probabilities. In line with theoretical considerations and most of the international sub-literature, we find a negative elasticity of mothers' employment rates to child-care costs as well as positive elasticity with regard to wages. The point estimates for the impact of net-wages and child-care costs are of similar absolute size. Additionally, empirical results indicate that higher family income (without the earned income of the mother) reduces the employment probabilities of mothers.

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# Child-Care Costs and Mothers' Employment Rates

## An empirical analysis for Austria[1]

**Helmut Mahringer*, Christine Zulehner+**

**June 2012**

The availability of affordable institutional child-care is increasingly discussed as an important determinant of the labour force participation of parents, particularly of mothers. This paper examines the impact of child-care costs on the employment rates of mothers with children younger than 15 years. Using data from the 1995 and 2002 Austrian Micro-Census, combined with wage information from Austrian tax records, we estimate the impact of net wages and child-care costs on mothers' employment probabilities. In line with theoretical considerations and most of the international sub-literature, we find a negative elasticity of mothers' employment rates to child-care costs as well as positive elasticity with regard to wages. The point estimates for the impact of net-wages and child-care costs are of similar absolute size. Additionally, empirical results indicate that higher family income (without the earned income of the mother) reduces the employment probabilities of mothers.

JEL Classification: C25, J13, J22

Key words: child-care, labour supply, bivariate sample selection, matched survey and administrative data

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# Contents

# 1 Introduction

As in most European Countries, Austrian female labour force participation has increased over the last few decades. However, the employment rates of mothers are still low: around 50 percent of mothers with children below the age of 15 were employed in Austria in 2002.

Major policy strategies emphasise the importance of a further increase of female employment rates (see, for instance, the EU 2020 strategy, European Commission, 2010). Improving the reconciliation between work and family life is widely accepted as an important factor in enhancing the labour market participation of women, and the availability of affordable child-care facilities is seen as an important aspect of these reconciliation strategies. The OECD points out that "... childcare supports are a key factor in the determination of maternal employment behaviour during the early years. The increase in female labour force participation since the 1960s went hand-in-hand with the development of work/family life balance policies of which access to affordable childcare of good quality is an important element" (OECD, 2011).

International comparison reveals huge country-specific differences in child-care utilisation and employment rates among mothers, which appear to be most striking among mothers with children under the age of 3 years. For this group of mothers, the correlation coefficient between the employment shares and enrolment rates of children in formal child-care is significant, reaching 0.81 for OECD countries[2] in 2008. Austria has lower than OECD-average enrolment rates for children under the age of 3 years and lower employment shares for their mothers (see figure 1 in the Appendix). In an OECD working paper, Jaumotte (2003) provides empirical evidence on the determinants of female labour force participation in OECD countries, concluding that subsidies for formal child-care increase female labour supply and are, from that point of view, superior to transfers for nursing children.

Austria has applied family policies that concentrates expenditures on general monetary transfers to families. Expenditures for family benefits amount to 3 percent of the GDP, which is in the midfield of OECD countries. Most of these benefits (78 percent) are generally available monetary transfers and tax reliefs (7 percent), while only 11 percent are spent on in-kind transfers (Festl et al, 2010). A similar structure can be found in the UK, Luxembourg or Ireland, while most OECD countries spend a higher share of their family expenditures on in-kind transfers (such as the Nordic countries, France and the Netherlands) or on tax reliefs (such as Germany and France). The low employment rate of mothers in Austria gave rise to a discussion on ways to increase employment incentives through family policy. In particular, a

[2] The data source is the OECD family database for 2008, including Slovenia, Sweden, Denmark, Netherlands, Portugal, Cyprus, Belgium, Luxembourg, Canada, Lithuania, Austria, France, Germany, Romania, United Kingdom, Spain, Ireland, Greece, Italy, Finland, Poland, Latvia, Estonia, Bulgaria, Malta, Japan, Slovakia, Czech Republic, Hungary. Employment rates are corrected for mothers who are on parental leave and not actually working.

reduction of child-care costs and an increase in subsidised child-care slots have been discussed and partly implemented.

The aim of this paper is to provide empirical evidence on the impact of reduced child-care costs on the employment behaviour of mothers with dependent children.[3]

We make use of two unique data sets in Austria that combine information on labour force participation, household and family characteristics, personal and family incomes, as well as the utilisation of institutional child-care: the Austrian Microcensus 1995 and the Microcensus 2002, amended with income information from Austrian tax records.

We apply structural employment participation models to estimate the impact of wages and child-care costs on the employment probability of mothers. These estimations are based on predictions of expected net wages and child-care costs, where a potential sample selection bias is accounted for. As in results for the US, Canada, and some European countries and in keeping with theoretical considerations, we find significantly negative employment elasticity with regard to child-care costs. The influence of child-care costs is similar – in absolute size – to the influence of changes in net wages. The wage elasticity of mothers turns out to be considerable, but child-care costs only partly explain the difference in employment rates between mothers and women without dependent children. Additionally, empirical results indicate that higher family income (excluding any income earned by the mother) reduces the employment probabilities of mothers.

In the following chapter we review relevant literature on the impact of child-care costs on the employment probabilities of mothers. Chapter 3 offers a simple theoretical model for the mothers' employment decisions depending on non-maternal child-care cost and quality. Chapter 4 presents the econometric strategy and chapter 5 the underlying data, variable construction and some descriptive results. In chapter 6 we present the estimation results within the context of comparable work for other countries.

## 2 Review of relevant literature

Most empirical studies on the impact of child-care costs on the employment decision of mothers find that increasing child-care costs exert a negative effect on mothers' employment probabilities. However, the estimates of this effect vary considerably across countries, sub-populations and institutional conditions. In one of the earliest studies on this topic, Heckman (1974) found a significantly negative effect of the cost of child-care on female labour supply, using an indirect measure of child-care costs. Since then, a number of studies have analysed the impact of child-care costs on mothers' employment rates based on datasets that provided information on the child-care expenditures of families. These studies are based on different research methodologies, data sets and sample restrictions. Therefore, it is not

[3] We restrict our analysis to mothers because we rarely find fathers who hold the main responsibility for bringing up their children.

surprising that the size and significance of estimated effects are diverse: estimated elasticities range from close to 0 to slightly above -1, but in most cases lie between -0.1 and -0.4.

Child-care costs may vary because different types or quality levels of non-maternal child-care are chosen and because subsidies may be granted for certain child-care institutions or types of households. Moreover, support schemes for child-care may differ among regions (Anderson and Levine, 1999). Most of the methodological approaches use variation in child-care costs across individuals, while others exploit regional differences (Blau and Robins, 1988) or use natural experiments (Viitanen, 2011).

Studies relying on survey data on individual child-care and employment behaviour have to apply methods to overcome the problem that (potential) child-care costs and (potential) wages are unknown for women who are not already using paid child-care or are not already employed, respectively. Selection into employment and the utilisation of child-care facilities is usually not random. Therefore, correction for selectivity is an important topic in the economic literature. Most studies – including ours – use control function methods to overcome the problem of unobservable heterogeneity in a sample selection framework (see Heckman, 1979). To estimate an employment participation equation with child-care costs and wages as explanatory variables, auxiliary equations for the wage rate and the child-care costs (per hour worked) have to be specified to obtain estimates of potential wage rates and child-care costs for those mothers who are not already employed or are not already using child-care services. In these first-stage equations corrections have to be made for a potential sample selection bias, since the estimated equations only rely on information on employed mothers or mothers utilising paid child-care. Such sample selection correction terms are – depending on the characteristic of the underlying selection problem – calculated from uni- or bivariate probit models of employment probabilities and probabilities of institutional child-care use. Examples using similar types of methodological approaches are Connelly (1992), Ribar (1992), Kimmel (1995, 1998), Powell (1997), Anderson and Levine (1999) or Jenkins and Symons (2001).

In one of the earlier studies on the effects of child-care costs per hour of work on the labour force participation of married mothers, Connelly (1992) uses a two-stage, tobit-model, correcting for sample selection bias. Her estimate of the elasticity of labour force participation due to a change in the average cost of child-care cost is -0.2. Powell (1997) uses a similar specification to estimate the impact of child-care costs on the labour supply of married mothers for Canada. She applies selection-corrected estimates for child-care costs per hour of work and for wages estimated by OLS. Her estimate of the labour supply elasticity of married mothers is -0.38. Similar results are found, for instance, by Anderson and Levine (1999) and Kimmel (1995). Kimmel (1998) examines the sensitivity of estimates with regard to differences in the set of explanatory variables. Estimates of the child-care cost elasticity of employment vary between -0.97 and -0.42 for married mothers. Anderson and Levine (1999) point out that the elasticities are larger for less skilled mothers and for mothers living in poor or near-poor families. Jenkins and Symons (2001) find a rather low elasticity of -0.09 for single

mothers and conclude that there are several other factors that encourage mothers' labour force participation.

Connelly and Kimmel (2003) extend the analytical framework to the question of whether a reduction in child-care costs could reduce welfare recipiency amongst single mothers. They find that a reduction in child-care costs increases the probability of employment (elasticity 1.0) and reduces welfare recipiency significantly.

Another strand of the child-care literature explicitly considers excess demand for publicly subsidised child-care. It explicitly deals with the fact that in certain countries child-care facilities are financed directly by the public, with the parents' contribution covering only a small share of total costs. Queuing for subsidised child-care may be a problem if the publicly financed supply for child-care falls short of demand. Viitanen and Chevalier (2003) model access restrictions to child-care for the UK. Using a partial observability model, they find evidence for excess demand. Similarly, Wrohlich (2008) studies the excess demand for subsidised child-care in Germany. She finds evidence of queuing, particularly for child-care slots for children under three years of age.

In the studies by Kornstad and Thorensen (2005) and Wrohlich (2011), demand for child-care and the labour supply decisions of mothers are modelled simultaneously. Both studies find evidence of queuing for subsidised child-care and for a negative impact of child-care costs on the labour supply of mothers. Haan and Wrohlich (2011) additionally incorporate the fertility decision into a structural model of mothers' employment decisions and account for inter-temporal feedback effects between fertility and employment outcomes based on data from the German Socio-Economic Panel. Among other results, they find that an increase in the availability of subsidised child-care for working mothers also increases labour market participation, but they find no significant effect on fertility.

There are a few examples of natural experiments being exploited to estimate the effect of child-care costs on the employment behaviour of mothers. Viitanen (2011) found that the introduction of a voucher for privately provided child-care increased the utilisation of paid child-care as well as the employment rates of mothers in regions with excess demand for publicly provided child-care slots. Schoene (2004) examines the introduction of a cash-for-care compensation for families not using public child-care places. He finds a negative effect on the employment participation of mothers due to the increase of child-care costs relative to maternal care.

## 3 Theoretical framework for the employment decisions of mothers facing child-care costs

Our theoretical framework for analysing the impact of child-care costs on the employment decisions of mothers with young children largely follows Connelly (1992) and Powell (1997). To restrict our analysis to mothers, we assume that they hold the main responsibility for bringing up their children.

We propose a simple utility function for mothers depending on the quality of child-care Q in addition to the consumption of market goods *X* and the consumption of leisure *L*:

*(1)* $U = U(X, L, Q)$

Children are either taken care of by the mother herself or by paid, non-maternal child-care-givers. Hence, the quality of child-care consists of $Q_m$ and $Q_n$, representing the quality of maternal child-care and non-maternal child-care, respectively. The average quality of a combination of the two types of child-care is the sum of the two components of quality, weighted by the time spent in the two types of child-care.

A mother maximises her utility subject to her own time constraints, the time constraint of the children and a budget constraint.

The time constraint of the children is:

(2) $C_m + C_n = 1$

where $C_m$ is the time share spent in maternal care and $C_n$ that in non-maternal care.

Mothers allocate their time between working hours, leisure and child-care:

(3) $H + L + C_m = 1,$

where *H* is the share of daily working time and L that of leisure.

The mother's budget constraint can be written as:

(4) $X + P * C_n = W * H + Y$ ,

where P is the price of non-maternal child-care (the price of X is normed at 1) and *Y* is family income without the mother's labour income *W*H*. Family income (without the mother's income from work), *Y,* is assumed to be exogenous to the employment decision of the mother.

Mothers choose the utility-maximising values for working time *H*, leisure time *L*, and maternal child-care $C_m$, constrained by the budget (4) and the two time constraints (2) and (3). For interior solutions, first order conditions can be derived and are given in equation (5); the marginal rate of substitution between goods and leisure equals the wage and the wage equals the net benefit of maternal care, which depends on the difference in maternal and non-maternal child-care quality, as well as on the price of non-maternal child-care.

$$(5) \qquad \frac{U_L}{U_X} = W = \frac{U_Q}{U_X}(Q_m - Q_n) + P$$

If the quality of maternal child-care is considered higher than that of non-maternal care (i.e., $Q_m - Q_n > 0$), the difference between wage and child-care costs has to compensate for this fact in order to provide a strong enough incentive for mothers to work. To increase the incentive for mothers to work, either improvements in child-care quality $Q_n$ or reductions in the price of non-maternal child-care $P$ (all other things being equal) would be appropriate. In this simple model, a reduction in the price of child-care by one euro should have (all other things being equal) the same effect on employment participation as a one-euro increase in net wages.

This simple model of utility maximisation of mothers child-care suggests that price, as well as quality, of child-care are determinants of the employment decision of mothers with dependent children. In the datasets underlying the following empirical analysis, child-care costs and hours of child-care as well as wages and working hours are observable. As in other datasets frequently used in the international literature, we lack information on child-care quality (such as, for instance, the number of children per teacher). Therefore, the quality-variable has to be dropped in the following econometric strategy and in the estimations.

However, child-care costs are measured net of subsidies received either by the child-care institution or the parents. This is important, because public support for child-care in Austria is very heterogeneous with respect to regions and communities, and in practice lacks transparency. Subsidised child-care institutions may coexist with privately financed institutions, and at the same time families might receive (additional) financial support for their child-care arrangements. These institutional settings are unobserved in the data. In spite of this, any influence of child-care costs on employment behaviour should still be observable; the heterogeneity of support schemes should even add variation to observed child-care costs, compared to a situation with a more homogeneous support scheme.

## 4 Econometric strategy

The estimation method adapts common approaches used in the literature to the data available for Austria. Looking at the above model of mothers' employment decisions we can identify the wage rate $W$, the price of child-care $P$, and child-care quality $Q$ as factors that are expected to influence employment rates.[4] The employment decision of the $i$ –th mother may be captured in the variable $H_i$ (hours of work) and depends on observable determinants

[4] Since we are not able to observe child-care quality in our data, the quality-variable Q will be left out in the following equations.

of the *i* –th mothers and her family, as well as on potentially unobserved variables. The employment decision can be expressed as

$$(6) \qquad H_i = f(W_i, P_i, Y_i, Z_i, \varepsilon_i),$$

where $Y_i$ denotes the family income without the working income of the mother, $Z_i$ is a vector of observed determinants and $\varepsilon$ represents unobserved determinants. As in many other studies (see e.g. Connelly 1992, Jenkins and Symons, 2001), we model the discrete choice between employment and non-employment, rather than that of working hours. One reason for this is that it may be more troublesome, especially for mothers, to organise (re-)entry to the labour market, compared to extending or reducing their working time. Another reason is that there is a concentration of working hours of mothers with young children at around 20 hours a week (28 percent of the cases in our sample work 20 to 25 hours) and full-time employment (55 percent work 38 or more hours). Therefore, the employment decision could also be modelled as a choice between part-time work, full-time work and non-employment (see Powell, 1998, Michalopoulos – Robins, 2000, 2002). Since mothers with small children below the age of three almost exclusively choose between part-time work and non-employment, we restrict our analysis to the binary employment decision. Thus, equation (6) has to be reformulated as an employment participation equation in which $E^*_i$ is the utility-maximising choice between employment and non-employment:

$$(7) \qquad E_i^* = \begin{cases} 1 & if \quad H_i > 0 \\ 0 & otherwise \end{cases}$$

Since we are interested in the impact of child-care costs on the employment rates of mothers, and since theoretical arguments suggest that changes in child-care costs should exert a similar impact on the employment decision as wages, we estimate the probability of employment as a function of child-care costs per hour of work, the wage rate and other covariates such as family net income without the labour income of the mother and variables summarising the characteristics of mothers and their families. Because the employment decision is modelled on the basis of an individualistic utility maximisation problem, wages and income levels have to be captured net of taxes and social security contributions, and subsidies to the families or child-care institutions should not be counted as a part of expenditures on child-care. These are the factors that the individual mother considers when deciding upon her employment activities. In a probit model the probability of employment *E*, conditional on the realised values of the exogenous variables, can be written as a cumulative distribution function *F*:

*(8)* $$\Pr(E_i = 1 | X = X_i) = F(\beta_0 + \beta_1 W_i + \beta_2 P_i + \beta_3 Y_i + \beta_4' Z_i),$$

where *X* summarises the independent variables *W*, *P*, *Y* and *Z*. However, before we can estimate the coefficients of equation (8), we have to solve the problem of unobservable wages and child-care costs: we observe wages only if a person is employed and child-care costs only if paid child-care is used. We do not observe the wage that would be earned if a mother decided to work or the price for child-care that would be paid if child-care institutions were used. Therefore, we estimate expected wages and child-care costs for the entire sample of mothers in order to be able to measure the impact of (potential) wages and child-care costs on the employment decision of mothers.

To estimate potential wages for the whole sample we use the wage information of working mothers to estimate a wage equation and predict expected wages for all mothers;

*(9)* $$\ln W_i = \alpha' D_i + \nu_{W,i},$$

where (9) represents a Mincer-type wage equation with vector $D_i$ of observed characteristics of mothers and $\nu_{w,i}$ is the unobserved variation.

Since working mothers may differ from non-working mothers, not just with respect to their employment position and other observable variables, we cannot assume that selection into the non-working mothers sub-sample is random. Therefore, we need to correct for potential sample selection biases in the wage equation (9). Unfortunately we have an additional problem of non-response in our 1995 sample of mothers: about 30 percent of the working mothers did not respond to the income question in Microcensus 3/1995. Therefore, we face the selection problem described in equation (10) in our 2002 data set and a double selection problem described in equations (10) and (10a) when estimating a wage equation in the 1995 data:

*(10)* $$E_i = \begin{cases} 1 & if \quad employed \\ 0 & else \end{cases}$$

(10a) $$R_i = \begin{cases} 1 & if \quad income \quad questions \quad were \quad answered \\ 0 & else \end{cases}$$

To analyse the effect of child-care costs in a way comparable to that of the wage rate we have to consider expenditures on child-care during working hours. As our data contain information on daily working time and hours of utilisation of paid child-care, we calculate child-care costs per hour of work (see chapter 5 for calculation details). The variables needed to calculate the child-care cost variable are only observable if a mother works and uses paid child-care. To estimate expected child-care costs for the whole sample of mothers, two types of approaches seem to be reasonable. First, expected child-care costs could be calculated according to existing regulations and support schemes for child-care if they are generally valid.[5] Second, we could predict potential child-care costs out of sample in the same way we did for wages. If there were comprehensible rules that determined fees for certain types of families, then the first solution would probably be superior. In Austria we find public or publicly co-financed private child-care facilities where only a part of the costs are covered by fees paid by parents as well as private child-care institutions and care arrangements.[6] For public child-care slots provided by municipalities a variety of different contribution schemes were in place that depended on regional and local regulation in municipalities. No common federal regulation existed. Therefore, fees depended on a family's place of residence as well as the location of the child-care institution.[7] Private care institutions decided the fees they charge, but parents might still have been eligible for partial refunds through subsidies (again depending on the certification of child-care institutions, regional regulations and household characteristics). Additionally, the Public Employment Service offered a child-care allowance of up to 80 percent of child-care costs to some parents (mostly mothers) who needed child-care in order to start a new job. In addition to this heterogeneity in child-care cost schemes, public child-care slots were rare in many Austrian regions, particularly for full day care, for children below the age of 3 or 4 years, and for after-school care. Hence, a variety of support schemes as well as the coexistence of public child-care and private institutions characterise the institutional child-care situation in Austria.

Given the heterogeneity, unobservability and lack of transparency of the support schemes that parents and child-care institutions face, we are unable to construct appropriate rules to define expected child-care costs. Therefore, we estimate child-care costs that individuals face based on regional and local characteristics and household variables, which can be expected to be the main determinants of child-care costs, and predict them out of the sample.

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[5] A calculation of potential child-care costs is, for instance, carried out in Wrohlich (2011) for Germany.

[6] In municipal care facilities, about 14 percent of the costs are covered by parents' contributions (see Ohmacht, Thenner, 1999).

[7] E.g. the City of Vienna charged fees according to family income for child-care slots in municipal kindergartens and provided a subsidy for child-care in certified private child-care institutions (irrespective of location, i.e. including facilities outside the city) before free kindergarten was introduced in 2009. In the province of Lower Austria, kindergarten was free of charge until noon for residents, but only in local public child-care institutions.

$$(11) \qquad P_i = \gamma' M_i + \nu_{P,i},$$

where $P_i$ denote the child-care costs, $M_i$ is a vector of observed regional and household characteristics and the unobserved variation is denoted as $\nu_{P,i}$.

Again, we face a double selection problem. We observe child-care costs per working hour only if mothers work and use paid child-care;

$$(12) \qquad E_i = \begin{cases} 1 & if \quad employed \\ 0 & else \end{cases}$$

$$K_i = \begin{cases} 1 & if \quad u\sin g \quad paid \quad child-care \\ 0 & else \end{cases}$$

Various studies in the economic sub-literature on child-care costs have used a correction for this double selection problem (see Jenkins and Symons (2001) or Powell (1997)), which is discussed in detail by Tunali (1986) (see Appendix 1). Correction terms for the sample selection are included as explanatory variables in the auxiliary wage and child-care cost estimations. To estimate the wage equation for 2002 we use a Heckman selection correction procedure to take possible selectivity into account (Heckman, 1979).

Using the estimated parameters from equations (9) and (11) we generate predicted values for the wage per hour ($W_i$) and the price of child-care per hour worked ($P_i$) for the whole sample of mothers. We use these predictions as explanatory variables in our initial employment decision probit (8).

## 5 Data and descriptive analysis

In order to estimate the impact of wages and child-care costs on the employment rates of mothers, we need a dataset that contains information about employment participation, wages, family characteristics, utilisation and the costs of institutional child-care.

### Data source

In the Austrian Microcensus, a 1 percent sample of Austrian households is covered and questionnaires are completed in face-to-face interviews every three months. The questionnaire comprises the standard program of the Labour Force Survey (LFS) with comprehensive information on employment participation and family characteristics. In September 2002 and 1995 an additional part of the questionnaire dealt with child-care and housework, which – in connection with the regularly available information on family

characteristics and labour market status and hours worked – provides a unique database with which to study the effects of child-care costs on the employment decisions of mothers in Austria (see Statistik Austria, 2004, Kytir - Schrittwieser, 2003, Hammer, 1997). There is information on about 23,000 households (most households covering not more than one family) and 60,000 persons in the sample. About 7,400 families have children below the age of 15. We restrict our sample to mothers employed for wage or salary and non-working mothers between the ages of 15 and 59, who hold the main responsibility for their children. Our 1995 sample contains information on 5,605 mothers and their families. The 2002 sample comprises 5,033 mothers. Most mothers (86 percent in both years) live together with the father of the children or a male partner.[8]

### Construction of wage and child-care cost variables

Income information is extracted from the Austrian tax records in the 2002 dataset. For 1995, information on monthly net income per person is contained in the additional survey module of the Austrian Microcensus. Family allowance payments to the family are coded separately.[9] The administrative data collection from Austrian tax records used in the 2002 sample is a highly reliable data source, while the reliability of reported data on wages and income in surveys from the 1995 sample is often questioned. Comparing results from otherwise similar data sets may also provide evidence of the quality of the survey data in the Austrian Microcensus.

We use the income information and the information on the number of hours usually worked per week to calculate a net wage per hour worked. The income information for all family members (including the Austrian family allowance) is used to calculate overall family income and the family income without the wage of the mother, which would be the unearned part of the family income from the perspective of the mother, if we assume that the mother's employment decision is taken based on that of other family members.

Information on child-care costs and utilisation contain the number of hours a child is usually in paid care, and the monthly costs of this child-care for the family. We observe the child-care costs of private child-care arrangements (e.g., private kindergarten, after-school care) as well as publicly provided or subsidised child-care for all children under 15 in a family. Child-care costs are measured net of subsidies received either by the child-care institution or by parents. These net costs are exactly what we need, since we intend to analyse the mothers' reaction to these expenditures. We use these data together with information on working time to calculate child-care costs per hour worked for each mother ($CCH_i$):

- We first compare the daily working time $H_i$ and the time children spend in child-care facilities $CT_i$ to find out if the hours in child-care exceed the daily average working

[8] Survey weights are used for all calculations presented.

[9] Since answering the income module was not obligatory, about 30 percent of the working mothers did not respond to the income question.

time by more than one hour $H_i$+1. Since there is no information on the time spent on commuting and/or taking the children to and from the caregiver we account for the time involved by allowing for this additional 1 hour. If this child-care time exceeds working time by more than one hour per day, we consider only the share of paid child-care time within the working time.[10] This share is 1 if child-care time is equal to or less than daily working time plus 1.

- We calculate the costs of childcare per day $CC_i$ and multiply this by the ratio of child-care time to working time discussed above.
- Then we divide this value by the daily working time and receive a measure for the child-care cost per hour worked,

$$CCH_i = \min\left(\frac{H_i + 1}{CT_i} \;,\; 1\right) \cdot \frac{CC_i}{H_i}.$$

Additionally, we construct a number of explanatory variables characterising

- the family: the number and age of children; the number of adult family members; whether the father of the children (or a male partner of the mother) lives with the family; the family's total net income; the family's total net income without the labour income of the mother, whether paid child-care is used; expenditures on child-care and whether the cost of lunch is included in this expenditures; the participation of family members in child-care activities; the participation of other relatives or friends in caring for the family's children, information on the place of residence (province and type of region).
- the mother: age; education level; employment participation; actual or last occupational status; marital status; foreign or Austrian citizenship; the degree of responsibility for child-care; the wage earned; hours usually worked; whether the mother or some other member of the family responded to income questions; whether income questions were answered.
- the "head of the family" (in the Microcensus data the father is usually coded as the head of the family; mothers are only the head of the family if no father or male partner of the mother is living with the family): age; education level; employment status; occupation; response to income questions.

As mentioned above, we are not able to observe indicators of child-care quality (e.g., the number of children per teacher, the education of teachers, the equipment, the available space per child, or additional activities or courses offered to children).

[10] In about 20% of the cases, child-care hours exceed working time by more than one hour. This may indicate that commuting may take even longer than one hour per day or that mothers pursue other activities while children are in formal child-care.

## Descriptive evidence

Motherhood is accompanied by a low employment rate of women. Women without children below the age of 15 have employment rates that are up to 10 percentage points lower than those of men. In our Microcensus samples from September 2002 and 1995, women aged between 25 and 44 without children under 15 have an employment rate of about 81.5 percent, while men of the same age have an employment rate of 91 percent. The employment rate of mothers with children below the age of 15 years was 46 percent in 1995 and rose to 54 percent in 2002. Mothers' employment rates are strongly related to the age and number of their children. Only 22 percent of mothers with children below the age of 3 were employed in 1995, and 24 percent in 2002. Furthermore, women with more children are less likely to work: 54 percent of mothers with one child below 15 years were in employed in 1995 and 59 percent were employed in 2002, while only 39 percent of mothers with two children under the age of 15 worked in 1995, rising somewhat to 49 percent in 2002. 26 percent of mothers with three children younger than 15 worked in 1995 and the figure was 38 percent in 1995 (see Table 1). Employed mothers use institutional child-care more often than those not employed. In particular, mothers whose children are younger than 3 rarely use institutional care facilities if they are not working (fewer than 3 percent), while the comparable share among working mothers is 20 percent.

Low employment rates for mothers, specifically those with children below 3 years of age, coincide with low participation rates of children in formal child-care. At the same time, the increase in mothers' employment rates between 1995 and 2002 goes hand in hand with higher enrolment in institutional child-care. According to data from Statistic Austria the share of children under the age of 3 years enrolled in formal child-care was 4.6 percent in 1995 and 8.7 percent in 2002, growing to 17.1 percent by 2010. This was clearly below the OECD average of around 30 percent in 2008[11] and 23 percent in 2003 (OECD, 2007). Enrolment rates for the pre-school age between 3 and 6 are considerably higher in both the OECD and Austria: According to OECD data for 2008, enrolment rates were slightly above the OECD average of 77 percent. According to data from Statistic Austria, 80.7 percent of the age group between 3 and 6 years were in institutional child-care in 2002, 70.6 percent in 1995, and 90.7 percent in 2010. For school-aged children, child-care is usually used in the afternoon, since classes end at noon. The enrolment rates for children aged 6 to 9 increased from 7 percent in 1995 to 9.4 percent in 2002 and 16.3 percent in 2010.

We observe child-care expenses net of subsidies to the child-care institutions or paid to the families, which is exactly the kind of information we need to study the impact of child-care costs on mothers' employment decisions. Hourly costs of child-care are slightly below 1 €, which means about 110 € per month for a family using institutional child-care (on average 1.2 children per family are in institutional care). In 1995, hourly costs were about 10 Austrian

[11] The data originate from the OECD family database.

schillings[12] per child, which amounts to about 1,400 Austrian schillings (roughly 100€) per month for a family using institutional child-care. For employed mothers, child-care costs are slightly higher on average because they use more child-care per day and pay higher hourly fees. The child-care costs per hour of paid work of the mother are lower than hourly child-care costs, because in most cases working hours exceed the hours of paid child-care.

Looking at reported child-care costs in more detail, we see that in many cases a payment for lunch is included, which leads to higher child-care expenditures compared to the reported expenditures where payment for lunch is not included. Consequently, child-care costs per hour in cases where no costs for food are reported at around 0.7 euros in 2002 and 6 Austrian schillings (0.44 €) in 1995 for an average family. If costs for lunch are included, these costs increase to 1.3 euros or 14 Austrian schillings (1€). These figures again confirm the fact that parents' monetary contributions to institutional child-care are on average too low to cover the costs of providing the service.

Working mothers earned average net wages of 10 Euro per hour in 2002 and of 100 Austrian schillings in 1995. The average working time was 30 hours in 2002 and 33 hours in 1995. 31 percent of employed mothers worked 20 hours or less per week in 2002; in 1995 it was 23 percent. Another 31 percent worked 40 hours a week or more in 2002; in 1995 it was 43 percent. Hence, higher employment rates are accompanied by higher shares of part-time work.

In most families in our sample, the father or a male partner of the mother lives together with the family (86 percent in both years). About 10 percent of the mothers receive daily help in caring for children from other relatives (not the father, brothers or sisters).

Most mothers are married, while fewer than 20 percent report being unmarried, divorced, or widowed in 1995. In 2002, 22 percent of mothers were unmarried. 54 percent of families have only one child under the age of 15, 37 percent of families have two children under the age of 15, and 10 percent of families have 3 or more children under the age of 15. This distribution did not change much between 1995 and 2002.

[12] The Microcensus 1995 was carried out before the official currency of Austria changed to the euro in 2002. Therefore, we report the monetary variables in Austrian schillings in the year 1995. The fixed exchange rate between Austrian schillings and euros is 13.7603.

*Table 1: Overview of variables: Mothers with children under the age of 15*

| | Sample means | |
|---|---|---|
| | in percent | |
| | 1995 | 2002 |
| Employment rate | 45.54 | 53.86 |
| Employment rate with children between 0 and 2 years | 21.95 | 23.81 |
| Employment rate with one child under 15 | 53.82 | 58.67 |
| Employment rate with two children under 15 | 39.12 | 49.39 |
| Employment rate with three or more children under 15 | 26.15 | 37.68 |
| **Child-care situation within the family** | | |
| Children in institutional care | 33.45 | 35.26 |
| Children in institutional care (if the mother is employed) | 38.57 | 37.93 |
| Father lives with the family | 85.99 | 85.66 |
| **Number and age of children** | | |
| One child younger than 15 years | 52.56 | 53.09 |
| Two children younger than 15 years | 37.41 | 36.96 |
| Three or more younger than 15 years | 10.03 | 9.95 |
| Mothers with children between 0 and 2 years | 33.37 | 26.44 |
| Mothers with children between 3 and 6 years | 42.66 | 36.60 |
| Mothers with children between 7 and 10 years | 42.51 | 39.14 |
| Mothers with children between 11 and 14 years | 40.87 | 37.22 |
| **Marital status** | | |
| Unmarried | 11.49 | 13.44 |
| Married | 80.29 | 77.76 |
| Divorced or widowed | 8.21 | 8.80 |
| **Age of the Mother** | | |
| Under 25 years | 6.62 | 4.41 |
| 25 to 29 years | 22.46 | 14.69 |
| 30 to 34 years | 28.69 | 27.31 |
| 35 to 39 years | 23.07 | 28.99 |
| 40 to 44 years | 12.22 | 16.75 |
| 45 to 49 years | 6.94 | 7.85 |
| **Child-care costs if institutional child-care is used** | **in Austrian Schillings** | **in Euros** |
| Monthly child-care expenses of families (rounded to 100 Austrian Schillings, or to 10 Euros) | 1,400 | 110 |
| Child-care expenses per hour of child-care per family | 11.58 | 1.00 |
| Child-care expenses per hour of child-care per child | 9.75 | 0.95 |
| **Child-care costs, if the mother is employed and institutional child-care is used** | **in Austrian Schillings** | **in Euros** |
| Monthly child-care expenses of families(rounded to 100 Austrian Schillings, or to 10 Euros) | 1,700 | 130 |
| Child-care expenses per hour of child-care per family | 13.87 | 1.06 |
| Child-care expenses per hour of child-care per child | 11.82 | 1.02 |
| **Net wages of employed mothers** | **in Austrian Schillings** | **in Euros** |
| Net wage per hour worked | 96.91 | 10.18 |
| **Child-care duration** | **in hours** | |
| Hours of child-care per day | 5.62 | 5.44 |
| **Child care duration, if the mother is employed and institutional child-care is used** | **in hours** | |
| Hours of child-care per day | 5.66 | 5.82 |
| **Working time in paid dependent employment** | **in hours** | |
| Average usual working time per week | 33.00 | 30.68 |

N(1995) = 5,605, N(2002) = 5.033; calculations apply sample weights. Q: own calculations based on Microcensus 3/1995 and 3/2003, Statistik Austria. Austrian Schillings (ATS) were converted to Euros (€) in 2002 (1 € = 13.7603 ATS).

# 6 Estimation and Results

Following the estimation strategy outlined above, we estimate the impact of child-care costs on the employment rate of mothers. The estimation of the employment participation equation (8) uses predicted wages and child-care costs for the whole sample. As pointed out above, we need to run two auxiliary regressions: one for a wage-equation and another for a child-care costs equation. In both cases we have to take (double) selection problems into account. These selection problems consist of employment participation and response to the income section of the questionnaire in the wages equation and of employment participation and utilisation of institutional child-care in the child-care cost equation.

## 6.1 Identification

The sample selection models for the wage equation and the child-care cost equation need to be identified.

For the identification of the correction for potential selection bias in the wage equation model, we include variables identifying the propensity to participate in paid employment in the first-stage bivariate probit models that influence the participation decision but have no impact on the wage rate. These are

- household income without the earned income of the mother,
- age of the children,
- the support the mother receives in caring for children in her household, including the presence of the father of the children or a male partner of the mother,
- and marital status

Identifying variables in the second bivariate probit part modelling the propensity to answer the questions about wages in the 1995 dataset are:

- whether the mother or another person in the household answered the family-specific questions,
- and marital status.

Fersterer and Winter-Ebmer (2003) apply a similar double selection model for datasets also based on the Austrian Microcensus. They choose a similar set of identifying variables in the employment participation equation. However, while they use the employment status and income of a mother's partner in their auxiliary model for double selection, we use family income (excluding any income earned by the mother). Moreover, we cannot use age as an identifying variable, since we use this information in the wage equation. In addition to the information on the age structure of children we use information on the child-care situation, which is only available in this specific dataset of the Microcensus 1995. The number of children cannot be used as an identifying variable, which turns out to have a significant

influence on wages. Similarly to Fersterer and Winter-Ebmer (2003), we use information about the person responding to the interviewer and a typology characterising regional economies as identifying variables in the income response probit.

Additionally, a broad set of variables is used to explain employment participation as well as wages. Among these are educational levels, age, actual or previous occupational status and nationality.

We again use a bivariate probit model to address selection in the child-care cost equation. We model both the propensity to participate in paid employment and the propensity to use institutional child-care. To identify these propensities we use the following variables in both cases:

- measures of child-care support received from family or friends (the presence of a male partner or the children's father in the family; regular help received from friends or relatives),
- marital status, and
- actual (if employed) or last (if not employed) occupational status.

Furthermore, regional characteristics as well as education level and family income, number and age structure of children are used to explain the employment decision as well as the decision to utilise formal child-care.

## 6.2 Results of the wage model with sample selection

In the first step of the sample selection model for wages we estimate a (bivariate) probit for employment participation and response to income questions (see Tables A1 and B1 in the Appendix).

We use the selection correction terms calculated from the (bivariate) probit auxiliary regressions to estimate a wage equation by OLS, correcting for sample selection (see Tables A2 and B2 in the Appendix). We see that the coefficients for the effect of mothers' education have the expected signs and are significant; the higher the educational level, the higher are the coefficients in the wage equation (and most are significant). Coefficients for occupational status (civil servants, white collar workers, and qualified blue collar workers) are significantly positive compared to those for blue collar workers. We also estimate that mothers with foreign citizenship earn less than Austrian mothers.

The wage rates of young mothers are significantly lower than those of the older mothers. Having more children has a negative influence on mothers' wages (in both 1995 and 2002). Non-nationals earn less than Austrians.

The selection correction terms for employment participation and non-responses in the 1995 estimate are insignificant.

Predicted values from the wage equation are used as estimates of potential wages for the whole sample of mothers with children under the age of 15.

## 6.3 Results of the child-care cost model with sample selection

The child-care cost model is estimated in the same type of selection structure as the wage model presented above. In a first step, a bivariate probit model is once again estimated, using employment participation and the utilisation of institutional child-care as dependent variables (see table A3 and B3 in the Appendix).

Child-care costs per hour of paid employment are only observed if mothers are employed and institutional child-care is used. These two conditions apply to some 900 of the 5000 mothers in the two datasets. We use the selection correction terms calculated from the bivariate probit, the number and age structure of children, the education levels, and the province of residence as explanatory variables in estimating an OLS regression model. In addition to those explanatory variables, we use a dummy variable to single out payments for lunch as a component of child-care costs (see table A4 and B4 in the Appendix). In order to receive comparable child-care costs estimates we drop this cost component for the prediction of the child-care costs for the whole sample.

Dummy variables for the province, region and regional characteristics that the family lives in are used to capture heterogeneous regulations of fees. Educational variables may be interpreted as a proxy for different tastes regarding child-care quality, which may be somehow related to the price of child-care. Mothers with education levels above compulsory school spend more on institutional child-care (although some of the differences are insignificant).

Having more children raises the cost of child-care. If children are above 10 years of age, they often do not need institutional care arrangements and the costs are therefore lower.

The selection correction term for employment participation is significant and slightly positive in the 1995 results, indicating that, after controlling for other observables, employed women have higher child-care costs than women who are not employed. The selection correction term for the utilisation of institutional child-care is insignificant.

The estimated child-care cost equation is used to predict potential expenditures for institutional child-care for the whole sample of mothers with children under the age of 15.

## 6.4 Estimating the employment probability of mothers

In a probit model we explain the employment participation of mothers by predicted (potential) child-care costs and (potential) wages. We use family income (less mothers' earnings), variables on the child-care situation within the family, age, number of children, marital status, citizenship, and regional information as additional explanatory variables.

### *The impact of wages and child-care costs on the employment rates of mothers*

The results of the estimation suggest that (potential) wages have a significantly positive impact and child-care costs have a significantly negative impact on the employment probability of mothers in both 1995 and 2002 (see Table 2 column (1) or Tables A5 and B5 in

the appendix). For both years, the magnitude of the estimated effect of child-care costs is larger than the effect of wages. However, the former effect is estimated less precisely than the latter. Moreover, the estimated impact of an increase in net wages on mothers' employment shares is not significantly different from that of a reduction of child-care costs by the same absolute amount.[13] This suggests that mothers account for net wages and child-care costs in a similar way when making their employment decision. This is consistent with the theoretical model discussed above.

Coefficients for the years 2002 and 1995 are quite similar, given the differences in the data on wages (tax records in 2002 and survey information in 1995, see table 2).

*Table 2: Extraction of the estimation of probit models - probability of participation in paid employment*

| | With further covariates+ (1) | | | Only (predicted) wages and child-care costs as covariates (2) | | |
|---|---|---|---|---|---|---|
| | Coefficient | Standard Error (Bootstrap) | | Coefficient | Standard Error (Bootstrap) | |
| **Estimation for the year 2002** | | | | | | |
| Predicted child-care cost per hour of paid employment | -0.432 | 0.147 | *** | -0.775 | 0.049 | *** |
| Predicted wage per hour of paid employment | 0.225 | 0.015 | *** | 0.183 | 0.013 | *** |
| **Estimation for the year 1995** | | | | | | |
| Predicted child-care cost per hour of paid employment | -0.515 | 0.108 | *** | -0.559 | 0.092 | *** |
| Predicted wage per hour of paid employment | 0.396 | 0.024 | *** | 0.331 | 0.018 | *** |

Note: Standard errors in parentheses. *** 1 percent significance level, ** 5 percent significance level, * 10 percent significance level. The coefficients for 1995 are adapted for the change in Austrian currency (the euro was introduced instead of the Austrian schilling) and for the increase of the wage index (Tariflohnindex) between September 1995 and September 2002).

+ Further covariates are family income (less mothers' earnings), variables on the child-care situation within the family, age, number of children, marital status, citizenship, and regional information as additional explanatory variables

Source: Table A5 and B5 in the Appendix.

The marginal effect of wages on employment probabilities shows that an increase in the average predicted wage by one euro per hour would increase the employment probability of the average mother by 13.2 percentage points in 1995 and 8.7 percentage points in 2002.[14] This implies a wage elasticity of the employment rate of mothers of 1.87 in 1995 and

[13] The point estimates of the wage coefficients (in the specification with further covariates) clearly lies within the 95% confidence interval for the coefficient for child-care costs, both in 2002 and 1995. The hypothesis that the difference of estimated coefficients for wages and child-care costs is zero cannot be rejected in a bootstrap sampling test for a difference in the absolute value of coefficients.

[14] Marginal effects are calculated for a mother using mean characteristics.

1.41 in 2002, which is in the upper range of estimates in the international literature. In her study for married mothers in Canada, Powell (1997) reports a wage elasticity of 0.85. Kimmel (1995) estimates a wage elasticity of close to 2 for low-income single mothers and Connelly and Kimmel (2003) one of 1.2 for single mothers. Anderson and Levine report an average wage elasticity of 0.59, which goes up to 0.9 for lower-educated sub-samples. Jenkins and Symons (2001) find an elasticity of 0.25 for their lone mothers' sample. Wrohlich (2004) reports a change of employment probability from a 1-percent change in wages of 0.13 percentage points for West-Germany compared to 0.85 percentage points in our estimate. The low employment rate of mothers and high female labour supply elasticity in Austria (see e.g. Novotny, 1999) are possible explanations for this rather high estimate.

According to the estimates presented in Table A5, the elasticity of the employment rate with respect to child-care costs is -0.16 in 1995 and -0.2 in 2002. This is within the range of the results presented for other countries (see Table 1 and the discussion of the literature above). Using this result to simulate free access to child-care facilities, the employment rate of mothers would increase by nearly 11 percent in the 1995 sample and by 7.5 percentage points in the 2002 sample.

In a second specification we estimate the participation probit with only predicted wages and child-care costs as right-side variables. In both years we obtain significant coefficients with the expected signs (see Table 2, column (2) and Tables A5 and B5 in the Appendix). However, the estimated coefficients for child-care costs are higher and those for net wages are somewhat lower than in the specification with additional control variables. We consider the specification with further covariates to be the superior one, since additional right-side variables control for differences in the employment behaviour not sufficiently captured by wages and child-care costs.[15]

### *The effects of other covariates*

Family income less mother's income (i.e., the extra potential income available if the mother works) has a negative impact on the employment probability of mothers.[16] This result suggests that policies increasing the unearned income component of families (e.g. through family transfers or tax relief for the partner) have to take into account that they may reduce the incentives for mothers to be employed.

The probability that a mother is employed decreases with the number of children she has, and the effect is strongest when the children are younger than 3. Mothers receiving at-home child-care support from family, friends or other relatives have higher employment

[15] Pseudo $R^2$ as well as the shares of correct predictions (as calculated in a following subsection on the quality of estimates) are considerably higher in the specification with additional covariates (see Tables A5 and B5 in the appendix).

[16] In the sample for the year 2002 we do not observe income from the self-employment of other family members. Therefore, the group with the lowest family income may content families with income from self-employment. Consequently, the coefficient estimated for this group reflects its heterogeneous composition and is not significantly different from the reference group (see table A5).

probabilities. The frequency of support from other relatives or friends further increases the employment rate of mothers. The presence of the father does not further ease employment participation.

Mothers above the age of 44 years have (all other things being equal) lower employment rates. The coefficient for mothers with foreign citizenship and divorced or unmarried mothers is significantly positive, indicating higher employment rates than for Austrian mothers and married or widowed mothers, respectively.

Families living in larger cities show significantly higher employment probabilities of mothers in the rest of the Austrian provinces, with the opposite being true for Vorarlberg and Tyrol. The estimated effects are very similar for the two analysed samples of the years 2002 and 1995.

**Quality of the estimates**

To measure the quality of the estimated probit models (see Tables A5 and B5 in the Appendix), we predict the employment probability of every mother. If the probability of employment is above 0.5, we predict employment and otherwise non-employment. We use these predictions and compare them with the observed employment status: 74 percent of the cases in the 1995 sample and 70 percent of those in the 2002 sample are predicted correctly (see table B6 and A6 in the Appendix).

## 7 Conclusion

Theoretical considerations and the empirical evidence for other countries suggest that a reduction of child-care costs increases the employment rate of mothers. The results presented in this paper, which are based on regression models with sample selection correction using data from the Austrian Microcensus (1995 and 2002) and Austrian tax records (2002), confirm the validity of these findings for Austria. The results suggest that the elasticity of the employment participation of mothers with children below the age of 15 is high with respect to wages as well as with respect to child-care costs. The estimated effects are significant and follow the expected direction. Although the point estimates of an increase in net wages by one monetary unit are lower than those of a reduction of child-care costs by the same amount, these effects are not statistically different. These results suggest that the net wages (net of taxes and social contributions and also net of child-care costs) are perceived as an important variable in the employment decision of mothers.

The estimates of the elasticity of employment with respect to child-care costs are in the range of similar studies for the USA, Canada and some European countries. The relatively high employment elasticity with respect to wages reflects the often-stated high female labour supply elasticity in Austria.

Given the low employment rate of mothers (53 percent of mothers with children under the age of 15 did not work in 2002, compared to 45.4 percent in1995), policies aimed at reducing the costs of institutional child-care can be expected to increase mothers' employment

participation if the availability of child-care facilities does not restrict the additional consumption of formal child-care. In regions where public or publicly subsidised child-care facilities are rarely available, an increase in availability can be perceived as equivalent to a direct reduction in child-care costs.

The empirical results also indicate that mothers with higher family income (without the labour income of the mother) are less likely to work. This confirms the conclusion that policies to support the availability of affordable child-care are more effective than direct transfers to families when it comes to increasing female labour market participation.

The unobservability of child-care quality presents a limitation in this analysis. Although there are regulations for minimum standards of institutional child-care, regional-level quality may vary considerably. Since these standards are below those of countries with higher participation of children in day care, such as Denmark, this aspect may be important in the decision about labour market participation. Theoretical considerations suggest that an increase in the quality of institutional child-care affects mothers' employment decisions in similarly to a reduction in costs. Therefore, raising the quality of child-care institutions (e.g. by reducing the number of children per kindergarten teacher) without changing the fees should also result in an increase in mothers' employment rates.

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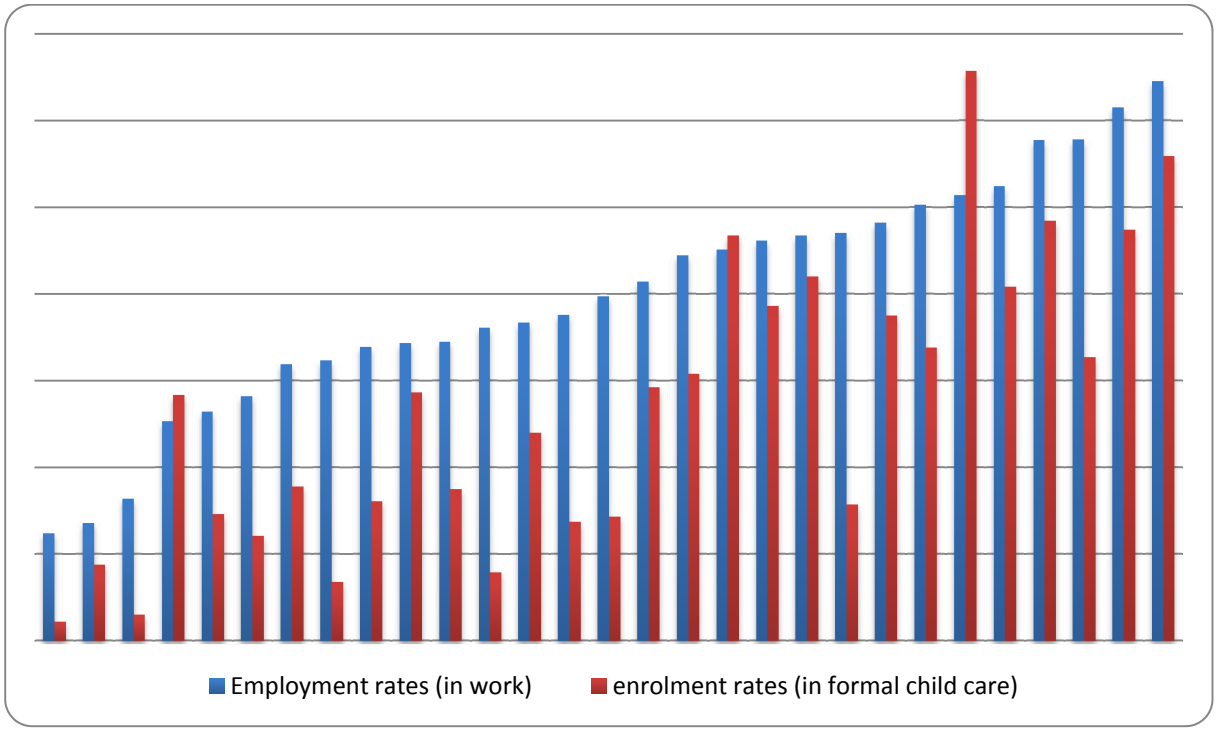
## Appendix A: International comparison and estimation results

*Figure A1: Employment rates of mothers with children under the age of 3 years and enrolment rates of children under the age of 3 years in formal child-care*




Source: OECD Family Database, values for 2008

### Estimations for the year 2002

*Table A1: Probit with participation in paid employment as explained variables*

| | |
|---|---|
| Probit regression | Number of observations = 5,034 |
| | Wald chi2(41) = 806.10 |
| Log pseudolikelihood = -2,776.7309 | Prob > chi2 = 0,000 |
| | Pseudo R2 = 0.2008 |

| | Coefficient | Robust Standard Error | |
|---|---|---|---|
| **Marital status** | | | |
| Unmarried | 0.0632 | 0.0800 | |
| Divorced | 0.1682 | 0.1053 | |
| **Child-care situation within the family** | | | |
| Help from other relatives or friends nearly every day | 0.3942 | 0.0758 | *** |

| | | | |
|---|---|---|---|
| Help from other relatives or friends nearly every week | 0.2186 | 0.0637 | *** |
| Father lives with the family | -0.1485 | 0.0905 | |
| Number of children under 3 years | -1.3753 | 0.0704 | *** |
| Number of children between 3 and 6 years | -0.4634 | 0.0459 | *** |
| Number of children between 7 and 10 years | -0.2426 | 0.0422 | *** |
| Number of children between 11 and 14 years | -0.2152 | 0.0451 | *** |
| **Province** | | | |
| Vienna | 0.2297 | 0.0869 | *** |
| Burgenland | -0.1409 | 0.0955 | |
| Carinthia | 0.0981 | 0.0956 | |
| Upper Austria | -0.0209 | 0.0810 | |
| Salzburg | -0.0438 | 0.0965 | |
| Styria | -0.0522 | 0.0845 | |
| Tyrol | 0.0971 | 0.0844 | |
| Vorarlberg | -0.3006 | 0.0922 | *** |
| Large City | 0.2847 | 0.1065 | *** |
| Foreign citizenship | -0.0010 | 0.0803 | |
| **Family income without earned income of the mother** | | | |
| Less than 850.5 Euros | -0.0272 | 0.0640 | |
| 850.5 to 1,701 Euros | 0.1387 | 0.0695 | ** |
| 2,551.4 to 3,401.9 Euros | -0.1344 | 0.0787 | * |
| 3,401.0 to 4,252.4 Euros | -0.3981 | 0.1175 | *** |
| 4,252.4 to 5,102.9 Euros | -0.3914 | 0.1608 | ** |
| 5,102.0 Euros and more | -0.8161 | 0.2280 | *** |
| **Age of mother** | | | |
| 50 or more | -0.4487 | 0.1514 | *** |
| 45 to 49 | -0.2106 | 0.0921 | ** |
| 40 to 44 | -0.1209 | 0.0618 | * |
| 30 to 34 | 0.1151 | 0.0654 | |
| 25 to 29 | -0.868 | 0.0853 | |
| 15 to 24 | -0.4583 | 0.1382 | *** |
| **Highest level of education** | | | |
| University degree | 0.3583 | 0.1216 | *** |
| University of Applied Sciences | 0.4841 | 0.1424 | *** |
| Technical and vocational colleges | 0.2810 | 0.0922 | *** |
| Secondary academic school | 0.1179 | 0.1156 | |
| Technical and vocational schools | 0.2208 | 0.0799 | *** |
| Apprenticeship | 0.1309 | 0.0672 | * |
| **Occupational status** | | | |
| Apprentice | 0.6848 | 0.6173 | |
| Skilled blue collar worker | -0.0776 | 0.1010 | |
| Civil servant | 0.9015 | 0.1003 | *** |
| White collar worker | 0.4882 | 0.5921 | *** |
| Intercept | 0.4883 | 0.1399 | *** |

Note: Standard errors in parentheses. *** 1 percent significance level, ** 5 percent significance level, * 10 percent significance level. Reference category: Marital status: married or widowed; Child-care situation within the family: At least one additional person in the family who cares for children; Number of children under 15 years; Province: Lower Austria; Family income without earned income of the mother: 1,701 to 2,551.4 euros; Age of the mother: 35 to 39; Highest level of education: not more than compulsory school; Occupational status: blue collar worker.

Source: Microcensus Austria 3/2002, Austrian tax records 2002, own calculations

*Table A2: Wage equation estimated using OLS with selection correction*

| Regression | Number of observations = 2,175 | R-squared = 0,2460 |
|---|---|---|
| | F( 27, 2147) = 20.53 | Root MSE = 0,3238 |
| | Prob > F = 0,0000 | |

| | Coefficient | Robust Standard Error | |
|---|---|---|---|
| Number of children under 15 years | -0.0348 | 0.0143 | ** |
| Foreign citizenship | -0.0972 | 0.0323 | *** |
| **Age of mother** | | | |
| 50 or more | 0.0302 | 0.0615 | |
| 45 to 49 | 0.1343 | 0.0344 | *** |
| 40 to 44 | 0.0237 | 0.0216 | |
| 30 to 34 | 0.0203 | 0.0289 | |
| 25 to 29 | -0.0900 | 0.0290 | *** |
| 15 to 24 | -0.2008 | 0.0598 | *** |
| **Highest level of education** | | | |
| University degree | 0.4719 | 0.0519 | *** |
| University of Applied Sciences | 0.2004 | 0.0482 | *** |
| Technical and vocational colleges | 0.1654 | 0.0326 | *** |
| Secondary academic school | 0.1743 | 0.0389 | *** |
| Technical and vocational schools | 0.1848 | 0.0290 | *** |
| Apprenticeship | 0.0230 | 0.0223 | |
| **Occupational status** | | | |
| Skilled blue collar worker | 0.0144 | 0.0380 | |
| Civil servant | 0.1649 | 0.0346 | *** |
| White collar worker | 0.1490 | 0.0233 | *** |
| **Province** | | | |
| Vienna | 0.0229 | 0.0281 | |
| Burgenland | -0.0327 | 0.0328 | |
| Carinthia | -0.0336 | 0.0316 | |
| Upper Austria | 0.0400 | 0.0262 | |
| Salzburg | 0.0283 | 0.0329 | |
| Styria | -0.0262 | 0.0294 | |
| Tyrol | 0.0015 | 0.0417 | |
| Vorarlberg | 0.0593 | 0.0358 | ** |
| Large City | 0.0405 | 0.0338 | |
| **Selection-correction term** | | | |
| Lambda employment | 0.0347 | 0.0370 | |
| Intercept | 1.9658 | 0.0394 | *** |

Note: Standard errors in parentheses. *** 1 percent significance level, ** 5 percent significance level, * 10 percent significance level. Reference category: Age of mother: 35 to 39; Highest level of education: not more than compulsory school; Occupational status: blue collar worker; Province: Lower Austria.

Source: Microcensus Austria 3/2002, Austrian tax records 2002, own calculations

*Table A3: Bivariate Probit with participation in paid employment and utilisation of institutional child-care as explained variables*

| | |
|---|---|
| Seemingly unrelated bivariate probit | Number of observations = 5,034 |
| | Wald chi2(89) = 1819.94 |
| Log pseudolikelihood = -749,476.59 | Prob > chi2 = 0.000 |

| | Employment participation | | | Utilisation of institutional child-care | | |
|---|---|---|---|---|---|---|
| | Coefficient | Robust Standard Error | | Coefficient | Robust Standard Error | |
| **Child-care situation within the family** | | | | | | |
| Help from other relatives or friends nearly every day | 0.3940 | 0.0754 | *** | 0.0443 | 0.0789 | |
| Help from other relatives or friends nearly every week | 0.2184 | 0.0636 | *** | 0.1137 | 0.0675 | * |
| Father lives with the family | -0.1465 | 0.0900 | | 0.0642 | 0.0989 | |
| **Marital status** | | | | | | |
| Divorced | 0.1657 | 0.1050 | | 0.3966 | 0.1113 | *** |
| Unmarried | 0.0658 | 0.0780 | | 0.1898 | 0.0843 | ** |
| **Family income without earned income of the mother** | | | | | | |
| Less than 850.5 Euros | -0.0290 | 0.0639 | | -0.0022 | 0.0706 | |
| 850.5 to 1,701 Euros | 0.1393 | 0.0697 | ** | 0.1383 | 0.0729 | * |
| 2,551.4 to 3,401.9 Euros | -0.1325 | 0.0785 | * | 0.0982 | 0.0896 | |
| 3,401.0 to 4,252.4 Euros | -0.3968 | 0.1172 | *** | -0.0187 | 0.1251 | |
| 4,252.4 to 5,102.9 Euros | -0.4068 | 0.1609 | ** | 0.0989 | 0.1971 | |
| 5,102.0 Euro and more | -0.8164 | 0.2291 | *** | -0.2668 | 0.2256 | |
| **Age of mother** | | | | | | |
| 50 or more | -0.4460 | 0.1514 | *** | -0.1934 | 0.1705 | |
| 45 to 49 | -0.2098 | 0.0917 | ** | -0.0953 | 0.1117 | |
| 40 to 44 | -0.1167 | 0.0617 | * | -0.0704 | 0.0721 | |
| 30 to 34 | 0.1170 | 0.0652 | * | 0.0619 | 0.0682 | |
| 25 to 29 | -0.0904 | 0.0851 | | -0.0042 | 0.0916 | |
| 15 to 24 | -0.4689 | 0.1386 | *** | -0.1478 | 0.1416 | |
| Foreign citizenship | -0.0057 | 0.0804 | | 0.0177 | 0.0866 | |
| Number of children under 3 years | -1.3771 | 0.0701 | *** | -0.1912 | 0.0648 | *** |
| Number of children between 3 and 6 years | -0.4663 | 0.0460 | *** | 1.2785 | 0.0595 | *** |
| Number of children between 7 and 10 years | -0.2427 | 0.0423 | *** | 0.1086 | 0.0486 | ** |
| Number of children between 11 and 14 years | -0.2191 | 0.0452 | *** | -0.1290 | 0.0520 | ** |
| **Highest level of education** | | | | | | |
| University degree | 0.3609 | 0.1221 | *** | 0.2106 | 0.1383 | |
| University of Applied Sciences | 0.4765 | 0.1413 | *** | 0.0300 | 0.1442 | |
| Technical and vocational colleges | 0.2732 | 0.0922 | *** | 0.0342 | 0.1060 | |
| Secondary academic school | 0.1107 | 0.1151 | | 0.2875 | 0.1171 | ** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Technical and vocational schools | 0.2204 | 0.0798 | *** | 0.1757 | 0.0915 | * |
| Apprenticeship | 0.1304 | 0.0672 | * | 0.0820 | 0.0764 | |
| **Occupational status** | | | | | | |
| Apprentice | 0.6575 | 0.6320 | | 1.3391 | 0.5641 | ** |
| Skilled blue collar worker | -0.0720 | 0.1011 | | 0.0202 | 0.0983 | |
| Civil servant | 0.8980 | 0.1003 | *** | 0.1785 | 0.1042 | * |
| White collar worker | 0.4903 | 0.0592 | *** | 0.0847 | 0.0682 | |
| **Type of residential region** | | | | | | |
| Agrarian | -0.0259 | 0.0878 | | -0.1338 | 0.1017 | |
| Industrial and agrarian | -0.0746 | 0.0764 | | -0.0591 | 0.0836 | |
| Tourism and industrial | -0.1605 | 0.0754 | ** | -0.3740 | 0.0886 | *** |
| **Province** | | | | | | |
| Vienna | 0.2139 | 0.0894 | ** | 0.3961 | 0.0911 | *** |
| Burgenland | -0.1343 | 0.0952 | | -0.1292 | 0.0975 | |
| Carinthia | -0.0498 | 0.1023 | | -0.1083 | 0.1124 | |
| Upper Austria | -0.0145 | 0.0812 | | -0.1832 | 0.0858 | ** |
| Salzburg | -0.0504 | 0.0977 | | -0.3633 | 0.0995 | *** |
| Styria | -0.0305 | 0.0856 | | -0.4368 | 0.0937 | *** |
| Tyrol | -0.0485 | 0.0904 | | -0.2961 | 0.0993 | *** |
| Vorarlberg | -0.2442 | 0.0999 | ** | -0.0105 | 0.1047 | |
| Large City | 0.2636 | 0.1088 | ** | 0.8019 | 0.1082 | *** |
| Intercept | 0.5051 | 0.1404 | *** | -1.1693 | 0.1563 | *** |
| | | | | | | |
| /athrho | 0.1847 | 0.0330 | *** | | | |
| Rho | 0.1826 | 0.0319 | *** | | | |

Note: Standard errors in parentheses. *** 1 percent significance level, ** 5 percent significance level, * 10 percent significance level. Reference category: Marital status: married or widowed; Child-care situation within the family: at least one additional person in the family who cares for children; Number of children under 15 years; Province: Lower Austria; Family income without earned income of the mother: 1,701 to 2,551.4 euros; Age of the mother: 35 to 39; Highest level of education: not more than compulsory school; Occupational status: blue collar worker; Type of residential region: urban.

Source: Microcensus Austria 3/2002, Austrian tax records 2002, own calculations

*Table A4: Child-care cost per hour of employment estimated using OLS with selection correction*

| | |
|---|---|
| Regression | Number of observations = 886<br>F( 29, 856) = 8.84<br>Prob > F = 0,000<br>R-squared = 0.2351<br>Root MSE = 0.78656 |

| | Coefficient | Robust Standard Error | |
|---|---|---|---|
| Cost for lunch included in the reported child-care fee | 0.4781 | 0.0699 | *** |
| Number of children under 15 years | 0.2046 | 0.0788 | *** |
| Number of children between 11 and 14 years | -0.2146 | 0.0816 | *** |
| **Family income without earned income of the mother** | | | |
| Less than 850.5 Euros | 0.0096 | 0.0811 | |
| 850.5 to 1,701 Euros | 0.0133 | 0.0763 | |
| 2,551.4 to 3,401.9 Euros | -0.0520 | 0.1096 | |
| 3,401.0 to 4,252.4 Euros | -0.0279 | 0.1769 | |
| 4,252.4 to 5,102.9 Euros | -0.0174 | 0.2547 | |
| 5,102.0 Euros and more | 0.2430 | 0.4459 | |
| **Highest level of education** | | | |
| University degree | 0.3468 | 0.2035 | * |
| University of Applied Sciences | 0.0240 | 0.1435 | |
| Technical and vocational colleges | 0.1343 | 0.1240 | |
| Secondary academic school | 0.2224 | 0.1307 | * |
| Technical and vocational schools | 0.1915 | 0.1062 | * |
| Apprenticeship | 0.0223 | 0.0881 | |
| **Type of residential region** | | | |
| Agrarian | -0.1211 | 0.1142 | |
| Industrial and agrarian | 0.0525 | 0.1698 | |
| Tourism and industrial | -0.0761 | 0.0888 | |
| Large City | -0.0231 | 0.1006 | |
| **Province** | | | |
| Vienna | 0.6030 | 0.1109 | *** |
| Burgenland | -0.0860 | 0.0936 | |
| Carinthia | -0.0320 | 0.1055 | |
| Upper Austria | 0.0378 | 0.1168 | |
| Salzburg | 0.0873 | 0.1348 | |
| Styria | 0.0920 | 0.1032 | |
| Tyrol | -0.0234 | 0.1386 | |
| Vorarlberg | -0.0002 | 0.1368 | |
| **Selection-correction term** | | | |

| | | |
|---|---|---|
| Lambda paid child-care | 0.1014 | 0.1029 |
| Lambda employment | 0.0714 | 0.0827 |
| Intercept | 0.0947 | 0.1607 |

Note: Standard errors in parentheses. *** 1 percent significance level, ** 5 percent significance level, * 10 percent significance level. Reference category: Province: Lower Austria; Family income without earned income of the mother: 1,701 to 2,551.4 euros; Highest level of education: not more than compulsory school; Type of residential region: urban.

Source: Microcensus Austria 3/2002, Austrian tax records 2002, own calculations

*Table A5: Estimation of a probit model - probability of participation in paid employment*

| Probit regression | Number of observations = 5,033<br>Bootstrap Replications = 50<br>Wald chi2(23) = 1860.17 | Probit regression | Number of observations = 5,033<br>Replications = 50<br>Wald chi2(2) = 338.97 |
|---|---|---|---|
| Log likelihood = -1,953.3646 | Prob > chi2 = 0,0000<br>Pseudo R2 = 0.166 | Log likelihood = -3,367.8063 | Prob > chi2 = 0,0000<br>Pseudo R2 = 0.050 |

| | Coefficient | Standard Error (Bootstrap) | | Coefficient | Standard Error (Bootstrap) | |
|---|---|---|---|---|---|---|
| Predicted child-care cost per hour of paid employment | -0.432 | 0.147 | *** | -0.775 | 0.049 | *** |
| Predicted wage per hour of paid employment | 0.225 | 0.015 | *** | 0.183 | 0.013 | *** |
| **Province** | | | | | | |
| Large City | 0.340 | 0.085 | *** | | | |
| Tyrol | -0.108 | 0.057 | * | | | |
| Vorarlberg | -0.430 | 0.085 | *** | | | |
| **Family income without earned income of the mother** | | | | | | |
| Less than 850.5 Euros | 0.037 | 0.055 | | | | |
| 850.5 to 1,701 Euros | 0.179 | 0.057 | *** | | | |
| 2,551.4 to 3,401.9 Euros | -0.151 | 0.069 | *** | | | |
| 3,401.0 to 4,252.4 Euros | -0.157 | 0.065 | ** | | | |
| 4,252.4 to 5,102.9 Euros | -0.595 | 0.162 | *** | | | |
| 5,102.0 Euros and more | -0.716 | 0.177 | *** | | | |
| **Age of mother** | | | | | | |
| 50 or more | -0.518 | 0.117 | *** | | | |
| 45 to 49 | -0.415 | 0.073 | *** | | | |
| Number of children under 3 years | -1.050 | 0.70 | *** | | | |
| Number of children between 3 and 6 years | -0.241 | 0.042 | *** | | | |
| Number of children between 7 and 10 years | -0.049 | 0.045 | | | | |
| **Marital status** | | | | | | |
| Divorced | 0.214 | 0.080 | *** | | | |
| Unmarried | 0.193 | 0.069 | *** | | | |
| Help from other relatives or friends nearly every day | 0.446 | 0.062 | *** | | | |
| Help from other relatives or friends nearly every week | 0.328 | 0.047 | *** | | | |
| Father lives with the family | -0.123 | 0.061 | ** | | | |
| Foreign citizenship | 0.139 | 0.084 | * | | | |
| Intercept | -1.207 | 0.134 | *** | -1.008 | 0.100 | *** |

Note: Standard errors in parentheses. *** 1 percent significance level, ** 5 percent significance level, * 10 percent significance level. Reference category: Marital status: Married or widowed, Family income without earned income of the mother: 1,701 to 2,551.4 euros.

Source: Microcensus Austria 3/2002, Austrian tax records 2002, own calculations

*Table A6: Predictions from the employment participation equation 2002*

| Observed participation in paid employment | Predicted participation in paid employment | | |
|---|---|---|---|
| | Not employed | Employed | Total |
| Not employed | 1,349 | 1,014 | 2,363 |
| Employed | 517 | 2,154 | 2,617 |
| Total | 1, 668 | 3,168 | 5,605 |
| Share of correct predictions | | | 70 percent |

Source: Microcensus Austria 3/2002, Austrian tax records 2002, own calculations

## Estimations for the year 1995[17]

*Table B1: Bivariate Probit with participation in paid employment and response to the income questions as explained variables*

| | |
|---|---|
| Seemingly unrelated bivariate probit | Number of observations = 5.605 |
| | Wald chi2(71) = 964,480 |
| Log pseudolikelihood = -747043,71 | Prob > chi2 = 0,000 |

| | Coeffi-cient | Robust Standard Error | | Coeffi-cient | Robust Standard Error | |
|---|---|---|---|---|---|---|
| Mother responded to family questions | | | | 0,359 | 0,054 | *** |
| **Marital status** | | | | | | |
| Unmarried | 0,194 | 0,092 | ** | -0,139 | 0,075 | * |
| Divorced | 0,527 | 0,124 | *** | -0,314 | 0,087 | *** |
| **Child-care situation within the family** | | | | | | |
| Help from other relatives or friends nearly every day | 0,490 | 0,076 | *** | | | |
| Help from other relatives or friends nearly every week | 0,278 | 0,061 | *** | | | |
| Father lives with the family | 0,575 | 0,119 | *** | | | |
| Father rarely engaged in child-care | -0,397 | 0,049 | *** | | | |
| Number of children under 3 years | -1,166 | 0,070 | *** | | | |
| Number of children between 3 and 6 years | -0,379 | 0,045 | *** | | | |
| Number of children between 7 and 10 years | -0,306 | 0,045 | *** | | | |
| Number of children between 11 and 14 years | -0,130 | 0,046 | *** | | | |
| **Province** | | | | | | |
| Vienna | 0,092 | 0,087 | | -0,267 | 0,087 | *** |
| Burgenland | 0,048 | 0,087 | | -0,018 | 0,094 | |
| Carinthia | -0,088 | 0,102 | | -0,203 | 0,109 | * |
| Upper Austria | -0,155 | 0,079 | ** | 0,017 | 0,083 | |
| Salzburg | -0,063 | 0,090 | | -0,213 | 0,092 | ** |
| Styria | -0,227 | 0,084 | *** | -0,127 | 0,084 | |
| Tyrol | -0,422 | 0,085 | *** | -0,094 | 0,087 | |
| Vorarlberg | -0,389 | 0,086 | *** | -0,272 | 0,084 | *** |
| Large City | 0,320 | 0,097 | *** | -0,063 | 0,097 | |
| Foreign citizenship | 0,141 | 0,097 | | 0,166 | 0,096 | * |
| **Family income without earned income of the mother** | | | | | | |
| Less than 10,000 Austrian Schillings | 0,587 | 0,088 | *** | | | |
| 10,000 to 20,000 Austrian Schillings | 0,223 | 0,058 | *** | | | |

[17] The Austrian currency in 1995 was the Austrian schilling in 2002 it changed to the euro. 1 euro was 13,7603 schillings. Therefore, the classes correspond to: less than 727 euros, 727 to 1.453 euros, 2,000 to 30,000 Austrian schillings, 2.180 to 2.907 euros, 2.907 to 3.634 euros, 3.634 to 4.360 euros, 4.360 euros or more. Wages and child-care costs are also measured in schillings in 1995.

| | | | | | | |
|---|---|---|---|---|---|---|
| 30,000 to 40,000 Austrian Schillings | -0,215 | 0,068 | *** | | | |
| 40,000 to 50,000 Austrian Schillings | -0,337 | 0,106 | *** | | | |
| 50,000 to 60,000 Austrian Schillings | -0,634 | 0,151 | *** | | | |
| 60,000 Austrian Schillings or more | -0,667 | 0,239 | *** | | | |
| **Age of mother** | | | | | | |
| 50 or more | -0,749 | 0,156 | *** | 0,079 | 0,170 | |
| 45 to 49 | -0,325 | 0,116 | *** | 0,023 | 0,100 | |
| 40 to 44 | 0,034 | 0,077 | | -0,008 | 0,077 | |
| 30 to 34 | 0,020 | 0,063 | | 0,106 | 0,061 | * |
| 25 to 29 | -0,125 | 0,081 | | 0,141 | 0,073 | * |
| 15 to 24 | -0,193 | 0,121 | | 0,129 | 0,111 | |
| **Highest level of education** | | | | | | |
| University degree | 0,409 | 0,147 | *** | -0,081 | 0,135 | |
| University of Applied Sciences | 0,450 | 0,145 | *** | 0,235 | 0,130 | * |
| Technical and vocational colleges | 0,281 | 0,099 | *** | 0,110 | 0,100 | |
| Secondary academic school | -0,033 | 0,118 | | 0,156 | 0,113 | |
| Technical and vocational schools | 0,206 | 0,078 | *** | 0,029 | 0,081 | |
| Apprenticeship | 0,053 | 0,065 | | 0,057 | 0,066 | |
| **Occupational status** | | | | | | |
| Apprentice | -0,056 | 0,423 | | -0,128 | 0,556 | |
| Skilled blue collar worker | -0,160 | 0,100 | | -0,131 | 0,102 | |
| Civil servant | 0,776 | 0,101 | *** | -0,354 | 0,097 | *** |
| White collar worker | 0,351 | 0,061 | *** | -0,231 | 0,063 | *** |
| Intercept | -0,266 | 0,155 | * | 0,765 | 0,095 | *** |

Note: Standard errors in parentheses. *** 1 percent significance level, ** 5 percent significance level, * 10 percent significance level. Reference category: Marital status: married or widowed; Child-care situation within the family: at least one additional person in the family who cares for children; Number of children under 15 years; Province: Lower Austria, Family income without earned income of the mother: 2,000 to 30,000 Austrian schillings; Age of the mother: 35 to 39; Highest level of education: not more than compulsory school; Occupational status: blue collar worker.

Source: Microcensus Austria 3/1995, own calculations.

*Table B2: Wage equation estimated using OLS with selection correction*

| | |
|---|---|
| Regression | Number of observations = 1.720<br>F( 29, 1690) = 23,0<br>Prob > F = 0,0000<br>R-squared = 0,3038<br>Root MSE = 0,2890 |

| | Coefficient | Robust Standard Error | |
|---|---|---|---|
| Number of children under 15 years | -0,046 | 0,017 | *** |
| Foreign citizenship | -0,158 | 0,032 | *** |
| **Age of mother** | | | |
| 50 or more | 0,185 | 0,068 | *** |
| 45 to 49 | 0,031 | 0,040 | |
| 40 to 44 | 0,033 | 0,027 | |
| 30 to 34 | -0,017 | 0,022 | |
| 25 to 29 | -0,071 | 0,028 | ** |
| 15 to 24 | -0,095 | 0,042 | ** |
| **Highest level of education** | | | |
| University degree | 0,190 | 0,073 | *** |
| University of Applied Sciences | 0,215 | 0,040 | *** |
| Technical and vocational colleges | 0,175 | 0,035 | *** |
| Secondary academic school | 0,162 | 0,038 | *** |
| Technical and vocational schools | 0,143 | 0,029 | *** |
| Apprenticeship | 0,051 | 0,024 | ** |
| **Occupational status** | | | |
| Apprentice | 0,088 | 0,237 | |
| Skilled blue collar worker | 0,112 | 0,039 | *** |
| Civil servant | 0,249 | 0,040 | *** |
| White collar worker | 0,203 | 0,025 | *** |
| **Province** | | | |
| Vienna | 0,038 | 0,032 | |
| Burgenland | 0,016 | 0,032 | |
| Carinthia | -0,007 | 0,035 | |
| Upper Austria | 0,030 | 0,028 | |
| Salzburg | 0,042 | 0,036 | |
| Styria | -0,052 | 0,033 | |
| Tyrol | 0,062 | 0,037 | * |
| Vorarlberg | 0,107 | 0,041 | *** |
| Large City | 0,058 | 0,029 | ** |
| **Selection correction terms** | | | |
| Lambda employment | -0,010 | 0,034 | |
| Lambda response | 0,008 | 0,090 | |

| | | |
|---|---|---|
| Intercept | 4,336 | 0,047 *** |

Note: Standard errors in parentheses. *** 1 percent significance level, ** 5 percent significance level, * 10 percent significance level. Reference category: Age of mother: 35 to 39; Highest level of education: not more than compulsory school; Occupational status: blue collar worker; Province: Lower Austria.

Source: Microcensus Austria 3/1995, own calculations.

*Table B3: Bivariate Probit with participation in paid employment and utilisation of institutional child-care as explained variables*

| | |
|---|---|
| Seemingly unrelated bivariate probit | Number of observations = 5.605 |
| | Wald chi2(90) = 1536,35 |
| Log pseudolikelihood = -778017,42 | Prob > chi2 = 0,0000 |

| | Coeffi-cient | Robust Standard Error | | Coeffi-cient | Robust Standard Error | |
|---|---|---|---|---|---|---|
| **Child-care situation within the family** | | | | | | |
| Help from other relatives or friends nearly every day | 0,499 | 0,077 | *** | -0,015 | 0,074 | |
| Help from other relatives or friends nearly every week | 0,291 | 0,062 | *** | 0,124 | 0,069 | * |
| Father lives with the family | 0,549 | 0,113 | *** | 0,067 | 0,110 | |
| Father rarely engaged in child-care | -0,407 | 0,051 | *** | -0,238 | 0,054 | *** |
| **Marital status** | | | | | | |
| Divorced | 0,497 | 0,119 | *** | 0,120 | 0,116 | |
| Unmarried | 0,150 | 0,092 | | 0,013 | 0,097 | |
| **Family income without earned income of the mother** | | | | | | |
| Less than 10,000 Austrian Schillings | 0,655 | 0,088 | *** | 0,126 | 0,082 | |
| 10,000 to 20,000 Austrian Schillings | 0,263 | 0,060 | *** | 0,009 | 0,063 | |
| 30,000 to 40,000 Austrian Schillings | -0,243 | 0,069 | *** | -0,147 | 0,076 | * |
| 40,000 to 50,000 Austrian Schillings | -0,339 | 0,108 | *** | -0,197 | 0,107 | * |
| 50,000 to 60,000 Austrian Schillings | -0,604 | 0,160 | *** | -0,116 | 0,152 | |
| 60,000 Austrian Schillings or more | -0,624 | 0,246 | ** | -0,115 | 0,247 | |
| **Age of mother** | | | | | | |
| 50 or more | -0,755 | 0,157 | *** | 0,170 | 0,184 | |
| 45 to 49 | -0,337 | 0,118 | *** | -0,006 | 0,125 | |
| 40 to 44 | 0,024 | 0,076 | | 0,015 | 0,081 | |
| 30 to 34 | 0,016 | 0,063 | | -0,117 | 0,063 | * |
| 25 to 29 | -0,127 | 0,082 | | -0,227 | 0,081 | *** |
| 15 to 24 | -0,189 | 0,122 | | -0,329 | 0,128 | *** |
| Foreign citizenship | 0,123 | 0,097 | | -0,072 | 0,102 | |
| Number of children under 3 years | -1,197 | 0,071 | *** | -0,132 | 0,058 | ** |
| Number of children between 3 and 6 years | -0,395 | 0,048 | *** | 1,138 | 0,056 | *** |
| Number of children between 7 and 10 years | -0,326 | 0,046 | *** | 0,025 | 0,044 | |
| Number of children between 11 and 14 years | -0,143 | 0,048 | *** | -0,106 | 0,049 | ** |
| **Highest level of education** | | | | | | |
| University degree | 0,389 | 0,145 | *** | 0,076 | 0,134 | |
| University of Applied Sciences | 0,459 | 0,147 | *** | -0,055 | 0,132 | |
| Technical and vocational colleges | 0,284 | 0,099 | *** | 0,228 | 0,100 | ** |
| Secondary academic school | -0,028 | 0,119 | | 0,199 | 0,114 | * |
| Technical and vocational schools | 0,207 | 0,079 | *** | 0,216 | 0,082 | *** |
| Apprenticeship | 0,054 | 0,065 | | 0,230 | 0,073 | *** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Occupational status** | | | | | | |
| Apprentice | -0,170 | 0,468 | | -1,155 | 0,589 | ** |
| Skilled blue collar worker | -0,167 | 0,101 | * | -0,091 | 0,107 | |
| Civil servant | 0,778 | 0,104 | *** | 0,164 | 0,097 | * |
| White collar worker | 0,352 | 0,062 | *** | -0,011 | 0,066 | |
| **Type of residential region** | | | | | | |
| Agrarian | 0,102 | 0,090 | | 0,077 | 0,090 | |
| Industrial and agrarian | 0,002 | 0,081 | | -0,018 | 0,082 | |
| Tourism and industrial | -0,129 | 0,083 | | -0,023 | 0,082 | |
| **Province** | | | | | | |
| Vienna | 0,113 | 0,090 | | 0,214 | 0,090 | ** |
| Burgenland | 0,061 | 0,087 | | -0,042 | 0,082 | |
| Carinthia | -0,027 | 0,108 | | -0,310 | 0,115 | *** |
| Upper Austria | -0,143 | 0,079 | * | -0,079 | 0,077 | |
| Salzburg | -0,037 | 0,092 | | -0,323 | 0,092 | *** |
| Styria | -0,240 | 0,085 | *** | -0,446 | 0,088 | *** |
| Tyrol | -0,350 | 0,093 | *** | -0,276 | 0,095 | *** |
| Vorarlberg | -0,299 | 0,096 | *** | -0,175 | 0,097 | * |
| Large City | 0,327 | 0,099 | *** | 0,411 | 0,101 | *** |
| Intercept | -0,241 | 0,154 | | -0,874 | 0,158 | *** |
| | | | | | | |
| /athrho | 0,192 | 0,035 | *** | | | |
| Rho | 0,190 | 0,034 | | | | |

Note: Standard errors in parentheses. *** 1 percent significance level, ** 5 percent significance level, * 10 percent significance level. Reference category: Marital status: married or widowed; Child-care situation within the family: at least one additional person in the family who cares for children; Number of children under 15 years; Province: Lower Austria; Family income without earned income of the mother: 1.453 to 2.180 euros; Age of mother: 35 to 39; Highest level of education: not more than compulsory school; Occupational status: blue collar worker; Type of residential region: urban.

Source: Microcensus Austria 3/1995, own calculations.

*Table B4: Child-care cost per hour of employment estimated using OLS with selection correction*

| | |
|---|---|
| Regression | Number of observations = 888<br>F( 29, 858) = 16,0<br>Prob > F = 0,000<br>R-squared = 0,3731<br>Root MSE = 7,3755 |

| | Coefficient | Robust Standard Error | |
|---|---|---|---|
| Cost for lunch included in the reported child-care fee | 7,016 | 0,660 | *** |
| Number of children under 15 years | 2,452 | 0,762 | *** |
| Number of children between 11 and 14 years | -1,561 | 0,791 | ** |
| **Family income without earned income of the mother** | | | |
| Less than 10,000 Austrian Schillings | -2,366 | 0,879 | *** |
| 10,000 to 20,000 Austrian Schillings | -1,829 | 0,842 | ** |
| 30,000 to 40,000 Austrian Schillings | 0,263 | 1,327 | |
| 40,000 to 50,000 Austrian Schillings | -4,507 | 1,485 | *** |
| 50,000 to 60,000 Austrian Schillings | -3,112 | 1,140 | *** |
| 60,000 Austrian Schillings or more | 3,064 | 8,115 | |
| **Highest level of education** | | | |
| University degree | 6,050 | 2,906 | ** |
| University of Applied Sciences | 0,591 | 1,200 | |
| Technical and vocational colleges | 0,611 | 1,062 | |
| Secondary academic school | 2,542 | 1,551 | |
| Technical and vocational schools | 1,439 | 0,963 | |
| Apprenticeship | 1,857 | 0,856 | ** |
| **Type of residential region** | | | |
| Agrarian | -2,493 | 0,939 | *** |
| Industrial and agrarian | -2,005 | 1,005 | ** |
| Tourism and industrial | 2,404 | 0,799 | *** |
| Large City | -0,322 | 0,947 | |
| **Province** | | | |
| Vienna | 7,364 | 1,149 | *** |
| Burgenland | -0,183 | 0,883 | |
| Carinthia | -0,734 | 1,078 | |
| Upper Austria | 3,262 | 0,955 | *** |
| Salzburg | 4,477 | 1,107 | *** |
| Styria | 5,424 | 1,139 | *** |
| Tyrol | -0,522 | 1,128 | |
| Vorarlberg | -2,162 | 1,095 | ** |
| **Selection-correction term** | | | |

| | | | |
|---|---|---|---|
| Lambda child-care | -0,008 | 1,466 | |
| Lambda employment | 2,736 | 0,902 | *** |
| Intercept | -2,461 | 1,829 | |

Note: Standard errors in parentheses. *** 1 percent significance level, ** 5 percent significance level, * 10 percent significance level. Reference category: Province: Lower Austria, Family income without earned income of the mother: 2,000 to 30,000 Austrian schillings, Highest level of education: Not more than compulsory school, Type of residential region: Urban.

Source: Microcensus Austria 3/1995, own calculations.

*Table B5: Estimation of a probit model - probability of participation in paid employment*

| Probit regression | Number of observations = 5.605<br>Replications = 50<br>Wald chi2(24) = 2189,62 | Probit regression | Number of observations = 5.605<br>Replications = 50<br>Wald chi2(2) = 497,09 |
|---|---|---|---|
| Log likelihood = -3000,3836 | Prob > chi2 = 0,0000<br>Pseudo R2 = 0,2216 | Log likelihood = -3645,5379 | Prob > chi2 = 0,0000<br>Pseudo R2 = 0,0542 |

| | Coefficient | Standard Error (Bootstrap) | | Coefficient | Standard Error (Bootstrap) | |
|---|---|---|---|---|---|---|
| Predicted child-care cost per hour of paid employment | -0,032 | 0,007 | *** | -0,035 | 0,005 | *** |
| Predicted wage per hour of paid employment | 0,025 | 0,001 | *** | 0,021 | 0,001 | *** |
| **Province** | | | | | | |
| Large City | 0,243 | 0,058 | *** | | | |
| Tyrol | -0,472 | 0,061 | *** | | | |
| Vorarlberg | -0,587 | 0,079 | *** | | | |
| **Family income without earned income of the mother** | | | | | | |
| Less than 727 Euros | 0,645 | 0,075 | *** | | | |
| 727 to 1.453 Euros | 0,192 | 0,052 | *** | | | |
| 2.180 to 2.907 Euros | -0,160 | 0,055 | *** | | | |
| 2.907 to 3.634 Euros | -0,429 | 0,098 | *** | | | |
| 3.634 to 4.360 Euros | -0,579 | 0,129 | *** | | | |
| 4.360 Euros or more | -0,301 | 0,246 | | | | |
| **Age of mother** | | | | | | |
| 50 or more | -1,294 | 0,152 | *** | | | |
| 45 to 49 | -0,364 | 0,083 | *** | | | |
| Number of children under 3 years | -1,025 | 0,047 | *** | | | |
| Number of children between 3 and 6 years | -0,300 | 0,030 | *** | | | |
| Number of children between 7 and 10 years | -0,135 | 0,037 | *** | | | |
| **Marital status** | | | | | | |
| Divorced | 0,442 | 0,076 | *** | | | |
| Unmarried | 0,170 | 0,066 | *** | | | |
| **Child-care situation within the family** | | | | | | |
| Help from other relatives or friends nearly every day | 0,461 | 0,050 | *** | | | |
| Help from other relatives or friends nearly every week | 0,213 | 0,050 | *** | | | |
| Father lives with the family | 0,149 | 0,092 | | | | |
| Foreign Citizenship | 0,522 | 0,080 | *** | | | |
| Intercept | -2,124 | 0,176 | *** | -1,747 | 0,101 | *** |

Note: Standard errors in parentheses. *** 1 percent significance level, ** 5 percent significance level, * 10 percent significance level. Reference category: Marital status: married or widowed; Family income without earned income of the mother: 2,000 to 30,000 Austrian schillings.

Source: Microcensus Austria 3/1995, own calculations.

*Table B6: Predictions from employment participation equation 1995*

| Observed participation in paid employment | Predicted participation in paid employment | | |
|---|---|---|---|
| | not employed | Employed | Total |
| not employed | 2,401 | 694 | 3,095 |
| employed | 785 | 1,725 | 2,510 |
| Total | 3,186 | 2,419 | 5,605 |
| Share of correct predictions | | | 74 percent |

## Appendix B: Two-step estimation with a double selection problem

We will apply this two step estimation method of the wage equation for the Microcensus 1995 date 1995, as well as that of the child-care cost equation for both datasets (1995 and 2002), respectively. In the first stage, we estimate a bivariate probit model for $E_i$ and $K_i$, which captures the correlation between each pair of discrete variables, the employment participation ($E_i$) and the response to the income question ($R_i$) in the first and the use of paid child-care ($K_i$) in the second estimation.

To estimate the wage equation, we first fit a bivariate probit for employment participation $E_i$ and the response to the income question $R_i$:

*(13a)* $E_i = \delta_E' N_{E,i} + \eta_{E,i}$,

*(13b)* $R_i = \delta_R' N_{R,i} + \eta_{R,i}$,

The vectors of explanatory variables $N_{E,i}$ and $N_{R,i}$ include identifying variables which effect the selection but not the wages. These identifying variables are not to be used in the wage equation. The error terms $\eta_{E,i}$ and $\eta_{R,i}$ have correlation $\rho$ and means of zero, and follow a bivariate normal distribution. The bivariate probit is estimated to generate selection correction terms, which are entered as additional regressors in the wage equation. Comparably to the inverse Mill's ratio in the single-selection Heckman-model, the selection correction terms $\lambda_{1,i}$ and $\lambda_{2,i}$ are calculated using the results of the bivariate probit estimation (see Tunali, 1986):

(14a) $C_{1,i} = \hat{E}_i = \delta_E' N_{E,i}$

(14b) $C_{2,i} = \hat{R}_i = \delta_R' N_{R,i}$

and

*(15a)* $C_{1,i}^* = \frac{C_{1i} - \rho C_{2,i}}{(1-\rho^2)^{1/2}}$

*(15b)* $C_{2,i}^* = \frac{C_{2,i} - \rho C_{1,i}}{(1-\rho^2)^{1/2}}$

*(16a)* $$\lambda_{1,i} = \frac{f(C_{1,i})F(C_{2,i}^*)}{G(C_{1,i}, C_{2,i}; \rho)}$$

*(16b)* $$\lambda_{2,i} = \frac{f(C_{2,i})F(C_{1,i}^*)}{G(C_{1,i}, C_{2,i}; \rho)}$$

where $f(C_{1,i})$ and $f(C_{2,i})$ are the standard normal density functions of $C_1$ and $C_2$, $F(C_{1,i}^*)$, $F(C_{2i}^*)$ are the standard normal distribution functions of $C_{1,i}^*$ and $C_{2,i}^*$ and $G(C_{1,i}, C_{2,i}, \rho)$ is the standard bivariate normal distribution function of $C_{1i}$ and $C_{2i}$ with correlation coefficient $\rho$. The selection correction terms $\lambda_{1,i}$ and $\lambda_{2,i}$ are used as additional regressors in the wage equation (9):

*(9a)* $$\ln W_i = \alpha' D_i + \chi_1 \lambda_{1,i} + \chi_2 \lambda_{2,i} + V_{W,i},$$

where $\chi_1$ and $\chi_2$ are the coefficients of $\lambda_{1,i}$ and $\lambda_{2,i}$, and where $V_{W,i}$ is the error term. In the presence of selectivity, conventional estimations would produce biased estimates.

The same procedure can be employed to correct the possible selection bias in the child-care cost equation. Again, we estimate a bivariate probit model for the double selection problem with employment participation as the dependent variable in the first equation and use of paid child-care while working as the dependent variable in the second equation:

*(13c)* $$E_i = \vartheta_E' Q_{Ei} + \iota_{E,i},$$

*(13d)* $$K_i = \vartheta_K' Q_{Ki} + \iota_{K,i},$$

where vectors $Q_{E,i}$ and $Q_{K,i}$ capture variables with impact on the employment probability and the utilisation of paid child-care respectively, $\iota_{E,i}$ and $\iota_{K,i}$ are the error terms.

The selection correction terms $\lambda_{3,i}$ and $\lambda_{4,i}$ for the auxiliary child-care cost equation (10) are calculated in the same way as for the wage equation. Hence, we obtain the child-care cost equation:

*(10a)* $$P_i = \gamma' M_i + \chi_3 \lambda_{3,i} + \chi_4 \lambda_{4,i} + V_{P,i},$$

where $\chi_3$ and $\chi_4$ are the coefficients of $\lambda_{3,i}$ and $\lambda_{4,i}$ and $V_{P,i}$ is the error term. Conventional estimations will again produce inconsistent standard errors if selectivity exists.