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Reconciling Work and Family Life: The Effect of Preschool

Julie Moschion*

In France, the number of children has a negative impact on the labor supply of mothers. This paper addresses the question of whether preschool reduces this effect and thus helps mothers reconcile work and family life. Using the heterogeneity in the geographical distribution of the schooling rate for two-year-olds, we find that preschool helps mothers with college diplomas reconcile work and family responsibilities when the number of their children increases from two to three and more. However, preschool does not help mothers without a college education stay in the labor market as the number of children increases.

CONCILIER VIE FAMILIALE ET VIE PROFESSIONNELLE.
L'EFFET DE LA PRÉSCOLARISATION

En France, le nombre d'enfants a un impact négatif sur l'offre de travail des mères. Cet article pose la question de savoir si la préscolarisation réduit cet effet et favorise ainsi la conciliation entre vie familiale et vie professionnelle. En utilisant l'hétérogénéité géographique des taux de scolarisation à 2 ans, nous trouvons que la préscolarisation aide les mères diplômées du supérieur à concilier leurs responsabilités familiale et professionnelle lorsqu'elles passent de deux à plus de deux enfants. En revanche, la préscolarisation ne permet pas aux mères moins diplômées de se maintenir en activité lorsque le nombre d'enfants augmente.

Classification JEL : J13, J18, J22.

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1. INTRODUCTION

In France, a substantial majority of children are enrolled in school from the age of three. Below this age, only about one in three attends a daycare center or is cared for by a home childcare worker. This deficit in childcare options for children under three years of age may make it difficult for mothers to balance work and family life and may therefore make it more difficult for them to remain in the labor market if they have additional children. For two-years-old children, the provision of state-funded preschool is one alternative to traditional childcare options. This paper examines the question of whether preschool helps mothers balance work and family life by reducing the negative impact of additional children on their labor supply.

To evaluate the difficulties involved in performing this balancing act, Brewster and Rindfuss (1996) conducted an analysis of the relationship between fertility and mothers' labor supply, and found that the negative association between fertility and labor force participation can be expected to fall as the conflict between work and family responsibilities is reduced, whether through a change in the nature of working life, shifts in the social organization of childcare, or a combination of the two.

Thus family policy that helps parents better negotiate family-related and professional responsibilities may have the capacity to reduce the negative relationship between fertility and the presence of mothers in the labor market (Bernhardt 1993; Del Boca et al. 2005). Brewster and Rindfuss (2000) and Thévenon (2009) both use international comparisons to analyze how different family policies are linked to the correlation between fertility and mothers' labor supply.

As an extension of this literature, we will interpret the variation in the impact of fertility on mothers' labor supply by the quantity of preschool options as a measure of the difficulty of balancing work and family life. Measuring the causal relationship between fertility and mothers' labor supply raises a methodological difficulty since fertility may affect mothers' labor supply while the labor supply may also affect fertility. On the other hand, fertility and labor supply are potentially co-determined by latent characteristics of mothers. Thus the causal relationship between fertility and mothers' activity in the labor market is difficult to assess without bias.

Rosenzweig and Wolpin (1980) use twin births as an instrument for estimating the impact of an increase in the number of children on mothers' labor supply. This strategy relies on the fact that twin births cause an unanticipated increase in the number of children and affect participation in the labor market solely because of their impact on fertility. In another study, Angrist and Evans (1998) use the sex of the two eldest children as a source of unpredictable variation in fertility. These two methodologies, which have been replicated in different countries and at different times, have shown temporal and geographic differences (Foley and York 2005) in the negative impact the

number of children may have on mothers' activity.¹ In part, these differences may arise from institutional differences, particularly variation in the availability of childcare in different countries. Using the techniques detailed in this literature, we will examine this question as it applies to France.

In France, the provision of schooling for two-year-old children is not a governmental obligation but rather depends on availability. As a result, the distribution of this service is highly unequal among the country's major administrative districts (*départements*). At the beginning of the 2005 school year, the rate of enrollment of two-year-olds in preschool varied from 4% to 66%. By controlling for other structural differences across districts, we estimate that when parents have a higher access to publicly-funded preschool, the causal relationship between fertility and mothers' activity falls.

The primary goal of this paper is to estimate the effect of the interaction between two preschool systems (strong or weak) along with the impact of the number of children on mothers' participation in the labor market. The hypothesis is that the opportunity cost of working is reduced for mothers living in an area with widely available preschool options since this preschool is offered free of charge.

The data indicate that the negative effect of family size on mothers' participation in the labor market is not lowered in areas with higher access to preschool for mothers with more than one child. Preschool only helps mothers holding a college diploma to balance their family-related and professional responsibilities when the number of children in the family rises from two to three or more. Within this subsample, having more than two children has a negative impact on mothers' participation in the labor market when less preschool is available. However, it has a positive impact when preschool is widely available. Two elements may contribute to this result: changes in preference for certain types of childcare and for part-time work, and greater financial need when the number of children increases.

This paper is structured as follows: Section two provides an overview of the available literature. Section three describes the data. Section four offers some descriptive statistics. Section five discusses hypotheses for identifying the impact of preschool. Section six presents the econometric model. Section seven presents the results. Finally, Section eight offers a conclusion.

2. LITERATURE OVERVIEW

Recent studies show that insufficient childcare options for young children may be an obstacle to reconciling professional and family life (Méda 2006;

1. While fertility has a significant negative impact on mothers' participation in the labor market in the United States (Angrist and Evans 1998), in France (Moschion 2009), and in Canada (Frenette, 2010), this effect is not significant in Sweden (Hirvonen 2008).

Péresse 2007). One trend in the literature measures the effects of the cost¹ and availability of childcare options on both fertility and mothers' participation in the workforce. These publications emphasize the fact that when mothers experience difficulty in finding childcare for children under three years of age, this may result in their reducing or even ending their professional activity in order to care for their children.²

Drawing from Italian panel data, Del Boca (2002) shows that in Italy, insufficient childcare options along with hours of operation for services incompatible with full-time work may explain in part low fertility rates and low rates of participation in the labor market among Italian women. Cascio (2009) makes use of the rapid growth in preschool for five-year-old children in some US states to identify the effect of the public provision of childcare on mothers' labor supply. Difference-in-difference estimates show that preschool options increase employment among mothers in single-parent families but have no effect on employment for married mothers. Herbst and Barnow (2008) present other instruments for identifying the impact of local paid childcare on mothers' participation in the workforce: an indicator of the supply of informal childcare, the proportion of individuals working at home, and the availability of slots in the early-childhood program Head Start. Instrumental variable estimates using US data suggest that an increase of 100 local childcare slots would cause an increase in mothers' labor supply of 1.3 percentage points.

Globally, the more precise the typology of childcare options, the weaker the impact of childcare costs on mothers' labor supply (Perraudin and Pucci 2007). High childcare costs result in substitutions between different childcare options (particularly between formal and informal options) rather than in a reduction in mothers' participation in the workforce. Looking at French data, Choné, Le Blanc, and Robert-Bobée (2004) found that a 10% increase in the price of formal childcare would reduce the use of this option by 0.7 of a percentage point but would not substantially affect mothers' decisions to work.

Using the gradual increase in preschool in France since 1977 as well as its heterogeneous geographic distribution, de Curraize (2005) tried to measure the causal effect of preschool on the labor supply of French mothers of young children. He compared the employment rate for mothers whose youngest child is two years old with that of mothers whose youngest child

1. Blau and Robins (1989) show that in the United States in 1980, the high cost of childcare was associated with lower fertility and lower labor supply among mothers. Other studies of US data confirm the negative effect of childcare costs on mothers' labor supply (Connelly 1992; Ribar 1992). Using data from Canada, Powell (2002) found that childcare costs reduce the probability of mothers working. Using French data, Laroque and Salanié (2008) estimated that a monthly credit of €180 toward the cost of care for each child below three years of age would bring about a 13.4% increase in fertility.

2. According to the National Observatory for Early Childhood (*Observatoire national de la petite enfance*) (2006), "among children living with both parents and whose mother works part time . . . 10% have a mother who works part time due to a lack of childcare services or because these services are too expensive." (p. 17)

is younger than two, juxtaposing the periods of 1969-1976 and 1977-1981. Difference-in-difference estimates suggest that the effect of preschool on mothers' employment rates is significant only at the 10% level.¹

Goux and Maurin (2008) evaluate the effect of preschool on mothers' labor supply by making use of the fact that there is a great deal of variation in preschool rates as a function of a child's birthdate. The idea is that the month in which a child is born is a variable element that affects the probability of a child enrolling in preschool in a given year. For a child born in December 1995, the probability of enrolling in preschool at age three is 90%, while for a child born one month later in January 1996, the probability of enrolling in preschool during the same school year is only 70%. For mothers raising children with a partner, there is no change in the rate of participation in the workforce in March of 1999, whether their child was born in December 1995 or January 1996. For single mothers, however, the probability of participation in the workforce falls from 83% for children born in December 1995 to 79% for children born in January 1996. The hypothesis is that if the child was born in December, the probability of the mother's working would increase precisely because there is a higher probability that the child would enter preschool that year. In sum, preschool has a significant positive effect on single mothers' participation in the workforce, but not so for mothers living with a partner.

Another trend in the literature tries to identify whether specific family policies favor the reconciliation of work and family life by reducing the negative correlation between fertility and mothers' labor supply. At the macroeconomic level, the goal is to determine whether the fact that the correlation between fertility and labor supply becomes less negative or even positive² may be attributed to specific government policies on family and social services. Brewster and Rindfuss (2000) synthesized European and US research on the link between fertility and mothers' labor supply as well as on the effect various family policies may have on this link. They focused their analysis on the reversal of the relationship between fertility and mothers' labor supply at the macroeconomic level, i.e. the fact that fertility rates tend to be higher in countries where the rates of mothers' participation in the workforce is also higher. This suggests that in some countries (though not in all), women manage to combine work and family responsibilities. For countries belonging to the Organization for Economic Cooperation and Development (OECD), Thévenon (2009) studied the link between family policies and their outcomes, particularly concerning fertility and women in the workforce. His results confirm that a high rate of participation in the labor market among women is not incompatible with high fertility but in fact depends on family policy.

1. All other things being equal, employment rates among mothers of two-year-old children and mothers of children under two years of age differ by only 2.5 percentage points during the period of high enrollment among two-year-olds, as compared with the earlier period.

2. The nationwide emergence in the 1990s of a positive correlation between fertility and mothers' labor supply has been documented by various researchers. See, for example, Bernhardt (1993), Brewster and Rindfuss (1996), and Ahn and Mira (2002).

At the microeconomic level, Kögel (2004) found that the strength of the negative link between fertility and work varies over time. In particular, he found that this link decreased after 1985 in a number of European countries, which corresponded to the enactment of policies that favored the balancing of work and family life.

These studies suggest that the link between fertility and mothers' labor supply varies as a function of the family policies in place. Nevertheless, when using comparative analyses between countries to evaluate how family policy may change the link between fertility and mothers' labor supply, these studies do not demonstrate causal relationships. The historical and cultural differences between countries could provide explanations for both the different policies in place as well as for differences in mothers' behaviors in terms of fertility and labor supply. In this context, it is risky to assume a causal link between family policies on the one hand and fertility and working behavior on the other. To avoid this problem, our analysis will focus on one country, France. Another reason is that these studies examine the correlation between fertility and mothers' labor supply rather than any causal effect between them. Thus the results are difficult to interpret. Do mothers with more children have lower employment rates because fertility negatively affects their professional activity (constraint) or because they have preferences and characteristics in common (choice)? To avoid this difficulty, twin births are used as a source of unpredictable variation in fertility and in order to identify the causal effect of fertility on mothers' labor supply.

3. DATA

Data used in this paper were drawn from Labor Force Surveys conducted from 1990 to 2002 by the French National Statistical Institute (*Institut National de la Statistique et des Études Économiques* – INSEE). The sample is representative of the over-15 population living in mainland France in ordinary households ($n = 135,000$, sampling rate = $1/300$). The information for each informant is as follows: date of birth, sex, place of residence, highest level of education, and participation in the workforce. For each household, we also have the number, sex, and birthdate of the children living in the home.

The rates of enrollment for two-year-old children in 1997 and 2003 (Appendix 1) were used to construct two groups of districts: those with low enrollment rates, and those with high enrollment rates. The group with a high rate of preschool enrollment contains the 30 districts that belonged to the top third of all districts in 1997 and 2003 (those districts whose preschool rates dropped sharply between 1997 and 2003 were removed).¹ Similarly, the group with a low rate of preschool enrollment contains the 32 districts

1. These districts were Meurthe-et-Moselle, Rhône, Allier, Alpes-de-Haute-Provence, Aude, and Vienne.

that belonged to the lowest third of all districts in 1997 and 2003 (those districts whose preschool rates dropped or rose sharply between 1997 and 2003 were removed).¹ The districts belonging to each group are listed in Appendix 2.² The French administrative unit of the *département* makes a relevant geographic area for study as its average preschool enrollment rates, which vary greatly from one district to another, are representative of what a parent will experience in that area. At the same time, it is a large enough area to limit parents' choice of district in which to enroll their children.

Our sample is comprised of mothers aged 21 to 35 who live with a partner and had at least one two-year-old child at the time of the study. To examine the impact of having more than one child, the sample comprises mothers of at least one child ($n = 12,501$). Symmetrically, to evaluate the impact of having more than two children, the sample is restricted to mothers of at least two children ($n = 7,726$). In more precise terms, in the first case, we retain mothers whose first child is two years old (if they have only one child) or whose second child is two years old (if they have more than one child). In the second case, we retain mothers of two children whose second child is two years old and mothers of three or more children whose third child is two years old. We selected mothers of at least two children (or three, respectively) based on the age of the second (or third) rather than the youngest child in order to be able to compare mothers' participation in the workforce when the first (or second) and second (or third) child are in the same age range. Furthermore, the age of the youngest child is correlated with the total number of children. That is, when a mother has a higher number of children, her youngest child is younger, and this raises the probability that she will be included in our sample. However, this would bias the sample as mothers with more than two (or three) children would be over-represented relative to mothers with only two (or three) children.

As was the case for Angrist and Evans (1998) and Moschion (2009), because information is only available for children who still live with their parents, the sample is restricted to mothers between 21 and 35 years of age. This prevents us from underestimating the total number of children a mother might have or from introducing errors regarding the children's birth order. Indeed, it is possible for women over the age of 35 to have children who are no longer under age and who therefore have a greater likelihood of having left the family home. Choosing mothers aged 21 to 35 is not a neutral decision, and we verified that the results obtained for mothers aged 21 to 40 were similar.

1. These districts were Aube, Gard, Pyrénées-Orientales, Dordogne, Doubs, and Haute-Saône.

2. Preschool enrollment rates are stable over time (Martin and Papon 2008). The categorization used in this study is very close to that of de Curraize (2005), which used older data, and is consistent with other studies showing that preschool enrollment at age two is higher in the western, northern, and Massif Central regions of France, while it is lower in Île-de-France, Alsace, and the southeast. Furthermore, various analyses were performed in order to test the results' sensitivity to this type of categorization. These included constructing groups using the methods from Martin and Papon (2008) (with district-wide enrollment rates for two-year-olds from 1990 and 1999), excluding those districts where the number of children has a greater impact on mothers' labor supply, and adding those 12 districts that had been excluded because their enrollment rates varied between 1997 and 2003. Yet despite all of these variations, the results did not change.

4. DESCRIPTIVE STATISTICS

Table 1 provides some descriptive statistics. Among mothers with at least one child, roughly 50% have at least two children. Among mothers with at least two children, roughly 30% have at least three. In this sample, just over 50% of mothers have oldest children of the same sex, and about 1% of second births are twin births. First-born twin births (or, respectively, second-born) are defined by the presence of children in first- and second-born position (or, second- and third-born) who have the same birth year and birth month. The estimated number of twins using this method corresponds to the number of twins identified using national census data (Moschion 2009).

Table 1: *Descriptive statistics: Women aged 21 to 35 living with a partner*

Variable	Mean and (standard deviation)	
	Mothers of at least one child	Mothers of at least two children
Fertility characteristics		
Number of children	1.50 (0.55)	2.30 (0.49)
Mothers of at least one/two children ⁽¹⁾	0.470 (0.499)	0.282 (0.450)
Mothers of two eldest children of the same sex ⁽¹⁾	–	0.506 (0.500)
Mothers of first-born/second-born twins ⁽¹⁾	0.008 (0.090)	0.009 (0.097)
Socio-demographic characteristics		
Age	29.1 (3.4)	30.5 (3.1)
Age at first birth	25.4 (3.5)	23.9 (3.4)
No diploma ⁽¹⁾	0.266 (0.442)	0.339 (0.473)
Diploma < high school diploma ⁽¹⁾	0.469 (0.499)	0.442 (0.497)
Diploma > high school diploma ⁽¹⁾	0.265 (0.441)	0.219 (0.413)
Characteristics of work activity		
Participation in the labor market ⁽¹⁾	0.720 (0.449)	0.522 (0.499)
Hours worked (average per week)	34.5 (9.0)	33.3 (9.6)
Part-time work	0.325 (0.468)	0.428 (0.495)
Number of observations	12,501	7,735

Sample: Women aged 21 to 35 living with a partner. In the first column, the sample is restricted to mothers of at least one child, whose first- or second-born is two years old. In the second column, the sample is restricted to mothers of at least two children, whose second-, or third-born is two years old.

Note (1): These figures are percentages.

Source: INSEE Labor Force surveys, 1990-2002.

The second part of Table 1 provides a number of socio-demographic characteristics. In our first sample, mothers' average age is 29, while the average age at which they had their first child is 25. In this sample, 27% of mothers have no diploma, while about 27% have a college diploma. In the second column, the mothers of at least two children are slightly older and had their first child at a younger age. Fewer of these mothers have diplomas. Compared to the general population, the mothers in our samples had their first child at a younger age as the average age at which a mother had her first child in 1990 in France was 26. Fewer mothers of at least two children had diplomas also. In the period from 1990 to 2002, 28% of women ages 21 to 35 have no diploma, and 27% have a college diploma.

These characteristics are not independent of our research questions and may result either from the fact that we selected mothers of at least two children or from the fact that these mothers are relatively young. We verified that the results did not change when we expanded the sample to include mothers in the 21-40 age range.

The third part of Table 1 provides statistics describing the labor supply. The rate of participation in the labor market corresponds to mothers who are either employed or unemployed (actively looking for work). It is pertinent to include all mothers participating in the labor market (both employed and unemployed) because the objective of this study is to examine how preschool changes the effect of fertility on mothers' decision to work. Thus we may assume that an unemployed mother has decided to work, which is not the case for a mother who is out of the labor force. Though the boundary between these two categories may be fluid, it seems appropriate to consider rates of activity in the labor market rather than employment rates, which would amount to considering mothers' effective employment situation rather than their choice to work. In our samples, the rates of participation in the labor market are 72% for mothers of at least one child and 52% for mothers of at least two children. Concerning the number of hours worked per week, the sample is restricted to mothers who work between 10 and 60 hours per week. Employed mothers work on average 35 or 33 hours per week, respectively.

5. IDENTIFYING THE EFFECT OF PRESCHOOL

The link between rates of enrollment in preschool and the effect of the number of children on a mother's participation in the labor market may prove spurious if this link is in fact caused by other characteristics specific to the district where the mothers live. In the regressions, district indicators are included in order to control for structural differences across districts that might disrupt the analysis. However, the interpretation of the results relies on the hypothesis that the categorization of districts (by high/low enrollment at age two) is independent of time-varying characteristics of the districts

affecting the impact of fertility on mothers' participation in the labor market. To meet this condition, groups of districts were constructed in order to record differences in enrollment rates that are stable over time. If this hypothesis was not verified, it would not be possible to conclude that the preschool enrollment rate is the reason for the geographic variation in the causal effect of fertility on mothers' decision to work.

We propose the following hypothesis:

$$E(y_0 / x = 1, \text{high rate} = 1) - E(y / x = 0, \text{high rate} = 1) \\ = E(y / x = 1, \text{high rate} = 0) - E(y / x = 0, \text{high rate} = 0)$$

where the first term designates the expected rate of activity for mothers (y_0) of at least $n + 1$ children (x) living in a district with a high rate of preschool enrollment under the assumption that the rate of preschool has no effect, the second term designates the observed rate of activity for mothers of n children in districts with a high rate of preschool enrollment, the third term designates this rate for mothers of at least $n + 1$ children living in a district with a low rate of preschool enrollment, and the fourth term designates this rate for mothers of n children. It is not necessary to suppose that the levels of participation in the workforce would be identical. Rather, it is enough to suppose that without the effect of preschool enrollment rates, the difference in participation rates by number of children will be identical in the two types of districts once the structural differences across districts is taken into account.

Moreover, variations in enrollment rates should not be the result of differences in the elasticity of mothers' labor supply to the number of children, and thus of local differences in the demand for preschool. The conditions for two-year-olds' access to preschool does not depend on potential demand or the total number of two-year-olds living in the district. As Blanpain (2006: 2) notes, "the law states that children who turn two on or before the first day of school may be admitted to preschool within the limit of the number of slots available." As the enrollment of two-year-old children is not a requirement of the school system, public services do not adjust the number of preschool slots for two-year-olds to meet demand for those slots. Rather, the rules governing the opening and closing of classes depends on the number of students, without consideration for children under three years of age (Martin and Papon 2008). The objective is to maintain the provision of schooling in rural areas or to improve conditions for the success of students from disadvantaged backgrounds. Article Two of the Education Act of July 1989 states that the minimum age at which a child must be received in school "may be lowered to two, particularly in schools located in socially disadvantaged environments, whether in urban, rural, or mountain areas."¹ According to Caille (2001: 2), "the underlying idea [is] that beginning school at age two may constitute an

1. Code de l'éducation, Partie législative, Première partie : Dispositions générales et communes, Livre 1^{er} : Principes généraux de l'éducation, Titre 1^{er} : le droit à l'éducation, Chapitre III : Dispositions particulières aux enfants d'âge préscolaire, Article L113-1.

effective substitute for a lack of cultural stimulus in the household and thus may reduce social inequalities and low rates of success in school.” In reality, preschool rates at age two are higher in rural areas and in cities of more than 20,000 residents, but not in the priority educational areas that contain the highest numbers of children from disadvantaged backgrounds (Caille 2001; Martin and Papon 2008). Rural areas and small towns could present specific characteristics that are prone to influencing the effect the number of children has on a mother’s decision to work. However, Moschion (2009) shows that this effect does not vary with respect to the size of the urban unit. Additionally, regressions reported in this paper include the size of the urban unit in order to control for possible differences.

Finally, demographic developments have maintained existing territorial disparities. In districts where the population is falling, the rate of preschool enrollment for two-year-olds, which was already high, continued to increase during the 1990s.¹ In particular, the enrollment of two-year-olds is a variable amenable to adjustment that made it possible to avoid shutting down classes in rural areas. Conversely, in districts where the population is rising, enrollment rates for two-year-olds, which were already low, continued to fall (Martin and Papon 2008). Article Two of the Education Act of July 1989 was therefore not applied in a concerted and organized fashion but rather as changes in local demographics permitted. Additionally, there is no reason to assume that the demand for preschool for two-year-olds was stronger in districts where the population fell.

Recent demographic changes confirm that the availability of preschool is not adjusted for parents’ demand as the “baby boom” of 2000 brought about an increase in the number of three-year-olds enrolled in preschool in the 2003 school year. However, this did not result in the opening of additional classes in order to maintain local preschool rates, thus reaffirming the principle that preschool is not an obligation of the French educational system. Consequently, the rate of preschool enrollment among two-year-olds has fallen nationwide since 2003, independently of demand from parents, dropping from an average of 32% for the 2002-2003 school year to 21% for 2007-2008 (Martin and Papon 2008).²

A final element that could potentially bias our evaluations is linked to parents’ endogenous choices. That is, when they go from n to more than n children, working mothers living in a district where preschool is scarce

1. The categorization of districts by preschool enrollment rates is stable over time. Thus changes that maintain the existing regional disparities do not cause problems in our estimates since even if the rates vary, the structural correlation between enrollment rates and other district-level characteristics is taken into consideration by district-level indicators.

2. This variation in enrollment rates for two-year-olds is not an exogenous phenomenon and thus cannot be used to identify the ways in which enrollment rates for two-year-olds modify the impact of the number of children on a mother’s decision to work. Rather, it is the result of changes in fertility behavior, which could affect the link between fertility and mothers’ decision to work independently of its consequences on the probability of a mother enrolling her two-year-old child in preschool.

may either enroll their two-year-old in a district with more preschool options, or relocate. However, it is not very plausible that parents would enroll their two-year-old in a school that is far from their home or that they would move and possibly change jobs in order to take advantage of higher preschool rates. Yet we cannot exclude the possibility that women wishing to reconcile work and family life may proactively choose to live in a district with widely available preschool options, even if such mothers are probably in a minority given the constraints on the French job market.

6. ECONOMETRIC MODEL

The model used here was drawn from the one used by Angrist and Evans (1998). This is a linear probability model in two steps, in which the equation for the second step links participation in the labor market to fertility. The variable for participation in the labor market is an indicator given the value 1 if the mother is active (i.e., if she is employed or unemployed and looking for work). The explanatory variables of interest to us here are the variables for the interaction between fertility variables and an indicator showing whether the family resides in a district where the enrollment rate for two-year-olds is high or low. Two variables for fertility (x_{iid}) were studied in succession: *more than one child*, with the value 1 if the mother has two or more children, and *more than two children*, with the value 1 if the mother has three or more children.

The variable for participation in the labor market y_{iid} is linked to fertility ($x_{iid} * high\ rate_{iid}$ and $x_{iid} * low\ rate_{iid}$) and other explanatory variables w_{iid} in the following equation:

$$y_{iid} = \alpha_0 w_{iid} + \alpha_3 high\ rate_{iid} + \beta_1 x_{iid} * high\ rate_{iid} + \beta_2 x_{iid} * low\ rate_{iid} + \varepsilon_{iid} \quad (1)$$

The indicator variable *high rate* has the value 1 if the family lives in a district where the rate of preschool enrollment is high. The interaction variable $x_{iid} * high\ rate_{iid}$ has the value 1 if the mother has at least $(n + 1)$ children and the family lives in a district with widely available preschool options. The coefficient β_1 shows the effect of going from n to $(n + 1)$ children on the probability of being in the workforce for mothers with a high probability of enrolling their two-year-olds in preschool. This coefficient is compared to β_2 , which shows the effect of going from n to $(n + 1)$ children on the probability of being in the workforce for mothers who have a lower probability of enrolling their two-year-olds in preschool. The *high rate* indicator is included on its own in the regressions. The coefficient associated with this variable (α_3) shows the effect of enrollment rates for two-year-olds on mothers' labor supply.

Other explanatory variables are five-year age brackets, the mother's age at the birth of her first child, highest diploma obtained, immigration status, annual and district-wide fixed effects, urban unit size, an indicator for the reform to child benefits of July 1994, and the sex of the oldest child. Immigration status is an indicator variable with the value 1 if the mother is born a French citizen, and the value 0 for all other cases. Annual fixed effects are indicators for each year in our sample (1990-2002), and district-wide fixed effects are indicators for each district included in the analysis. The objective is to control for unobserved heterogeneity in both temporal or geographic terms, which are prone to affecting the effect the number of children may have on a mother's decision to work. The highest diploma obtained is characterized by five indicators showing whether the mother has no diploma, a diploma below high school level, a high school diploma, a diploma corresponding to two years of study beyond high school, or a college diploma.

In models where the fertility variable represents the probability of having more than two children, the explanatory variables also include the difference in age between the two oldest children (in months) and the sex of the second child.

The mother's age at the birth of her first child as well as the difference in age between the two oldest children are both correlated with the probability of having more children (Breton and Prioux 2005). If a mother gives birth to her first child at a young age and there is a short interval between the first two births, this may mean that the mother wishes to have many children. These young mothers may have a specific profile (socioeconomic background, educational level, nationality, etc.). Including these variables allows us to control for certain characteristics that may affect both the probability of having more children and the labor supply.

To correct for endogeneity in fertility and obtain a non-biased estimate of the causal effect the number of children has on mothers' decision to work, two first-step equations link fertility variables to the instruments. The instruments are variables for the interaction between a random shock affecting the number of children and the *high rate* and *low rate* indicators showing whether a family lives in a district where preschool is rare or widely available. We consider various shocks related to fertility, including first-born twin births.¹ The first-step regressions linking fertility variable to the instruments ($tw_{itd} * high\ rate_{itd}$ and $tw_{itd} * low\ rate_{itd}$) are as follows:

$$x_{itd} * high\ rate_{itd} = \pi_0 w_{itd} + \pi_3 high\ rate_{itd} + \gamma_1 tw_{itd} * high\ rate_{itd} + \gamma_2 tw_{itd} * low\ rate_{itd} + \eta_{itd} \quad (2)$$

$$x_{itd} * low\ rate_{itd} = \pi_4 w_{itd} + \pi_7 high\ rate_{itd} + \gamma_3 tw_{itd} * high\ rate_{itd} + \gamma_4 tw_{itd} * low\ rate_{itd} + \upsilon_{itd} \quad (3)$$

1. Although the sex of the two eldest children was also considered as an instrument, it could not be used, as will be explained in the following section.

The interaction variable between *twin-1* (or *twin-2*, respectively) and *high rate* has the value 1 if the mother's first-born children were twins (or second-born children) and the family lives in a district with widely available preschool options. In equation (2), coefficient γ_1 shows the effect of having first-born twins (or second-born children, respectively) on the probability of having more than one (or two) children for mothers with a high probability of enrolling their children in preschool. This coefficient will be compared with γ_4 , which shows the effect of having twins on fertility for mothers with a low probability of enrolling their children in preschool.

Using this linear probability model in two steps is justified by the fact that fertility decisions are endogenous. In this case, ordinary least squares estimates are biased. We solve this problem by using instrumental variables, which affect the number of children without having a direct effect on mothers' activity. When the endogenous explanatory variable is an indicator, another solution consists of using simultaneous equations using a probit model in the first step (Heckman 1978). However, Heckman (1978) recommends the use of the linear probability model. Another argument in favor of the use of a linear probability model is that it is unnecessary to form a hypothesis on the law of residues, and according to Heckman and MaCurdy (1985), its use is justified whenever the instrument, the endogenous explanatory variable, and the dependent variable are indicators. Angrist and Evans (1998) and Conley (2004) use this type of model to estimate the impact of the number of children on mothers' activity.

7. RESULTS

7.1 The Effect on Fertility of Having Twins or of Having Two Eldest Children of the Same Sex

Table 2 displays the results of estimates for equation (2) in the first two columns and equation (3) in the third and fourth columns for different fertility variables and different instruments.

The first part of Table 2 shows that regardless of the preschool enrollment rates in the district, having first-born twins increases the probability of having a second child by 50 percentage points. While mothers of first-born twins all have at least two children, this is only the case for about half of other mothers (Table 1). In the second part of Table 2, the results indicate that having second-born twins increases the probability of having a third child by about 70 percentage points (among mothers of two children, only 30% have more than two, Table 1). However, these effects on fertility brought about by twin births do not differ significantly by local preschool enrollment rates.

Table 2: *The effect on fertility of having twins or of having two eldest children of the same sex*

(Estimated using ordinary least squares)

Dependent variable:	More than one child * . . .			
	. . . High rate		. . . Low rate	
The first or second child is two years old				
<i>Twins-1 * High rate</i>	0.514*** (0.057)	0.498*** (0.051)	0.000 (0.077)	0.025 (0.060)
<i>Twins-1 * Low rate</i>	0.000 (0.034)	-0.043 (0.030)	0.546*** (0.046)	0.510*** (0.036)
<i>R</i> ²	0.3873	0.5247	0.2385	0.5474
<i>N</i>	12,501	12,501	12,501	12,501
Dependent variable:	More than two children * . . .			
	. . . High rate		. . . Low rate	
The second or third child is two years old				
<i>Same sex * High rate</i>	0.016 (0.010)	0.010 (0.009)	0.000 (0.013)	-0.005 (0.011)
<i>Same sex * Low rate</i>	0.000 (0.008)	-0.001 (0.007)	0.028*** (0.010)	0.025*** (0.008)
<i>R</i> ²	0.2084	0.3578	0.1242	0.3962
<i>Twins-2 * High rate</i>	0.710*** (0.058)	0.788*** (0.052)	0.000 (0.073)	0.116** (0.060)
<i>Twins-2 * Low rate</i>	0.000 (0.039)	0.060* (0.035)	0.734*** (0.049)	0.828*** (0.041)
<i>R</i> ²	0.2232	0.3765	0.1476	0.4266
<i>N</i>	7,735	7,735	7,735	7,735
The second or third child is between two and ten years old				
<i>Same sex * High rate</i>	0.020*** (0.005)	0.017*** (0.005)	0.000 (0.006)	0.000(0.006)
<i>Same sex * Low rate</i>	0.000 (0.004)	-0.002 (0.004)	0.047*** (0.005)	0.045*** (0.004)
<i>R</i> ²	0.2511	0.3630	0.1515	0.3206
<i>N</i>	35,446	35,446	35,446	35,446
Other variables	No	Yes	No	Yes

Significance: * 10% ** 5% *** 1%

Sample: Women aged 21 to 35 living with a partner. In the first part of the table, the sample is restricted to mothers of at least one child, whose first- or second-born is two years old. In the second part of the table, the sample is restricted to mothers of at least two children, whose second-, or third-born is two years old. In the third part of the table, the sample is restricted to mothers of at least two children, whose second-, or third-born is between two and ten years of age.

Note: Standard deviations are indicated in parentheses. Other explanatory variables are five-year age brackets, the mother's age at the birth of the mother's first child, highest diploma obtained, immigration status, annual and district-wide fixed effects, urban unit size, an indicator for the reform to child benefits of July 1994, and the sex of the oldest child. While the dependent variable is the probability of having more than two children, the explanatory variables also include the difference in age between the two oldest children as well as the sex of the second child. The principal effect of preschool enrollment rates for two-year-olds is also included in the equation.

Source: INSEE Labor Force surveys, 1990-2002.

Next, we consider the cases where the two eldest children are of the same sex as an alternative instrument for measuring the probability of having a third child. In a number of countries, when the first two children born in

a family are of the same sex, this increases the probability of having more than two children (see Breton and Prioux [2005] for the case of France). In particular, this finding has been used to instrument the probability of going from two children to more than two in the United States (Angrist and Evans 1998) and in France (Moschion 2009).

The second part of Table 2 shows that having two eldest children of the same sex increases the probability of having a third child but only when the preschool enrollment rate for two-year-olds is low. As the first-step effect is not significant in districts with high preschool enrollment levels, the instrument *same sex* cannot be used with this sample to identify the effect of fertility on mothers' participation in the labor market. For the larger sample of mothers of at least two children whose second- or third-born child is between two and ten years of age, estimates are more precise. When the two eldest children are of the same sex, the probability of having a third child increases by 1.7 percentage points when preschool is widely available and by 4.5 percentage points when it is scarce. Although the two coefficients are significant at the .01 level, they differ from one another. In instrumental variable regressions, a difference in the effect of the number of children on mothers' activity varying with preschool rates could derive from the differences observed here on the first step effects rather than from the differences in preschool rates. Another drawback of this strategy arises from the fact that the Labor Force survey does not provide the place of residence at the time when the mothers' second or third child was two years old. As they may have moved between the time when the child was two years old and when it was ten, we do not use this strategy to identify the impact of going from two children to more than two children on mothers' activity.

Clearly, the quality of instrumental variable estimates depends on the quality of the instruments. In the fertility variable regressions ($x_{iid} * high\ rate_{iid}$ or, respectively, $x_{iid} * low\ rate_{iid}$) on the instruments ($twin_{iid} * high\ rate_{iid}$, respectively, $twin_{iid} * low\ rate_{iid}$) without other explanatory variables, the first-step Fisher statistics are high: 28 (respectively 91) in the districts where preschool rates are high (respectively low) when the fertility variable is *more than one child* and the instrument is first-born twin births. When the fertility variable is *more than two children* and the instrument is second-born twin births, the first-step Fisher statistics are, respectively, 56 and 138. The value of these statistics is much higher than 10, which is described as the criterion for validity in our reference literature (Bound, Jaeger, and Baker 1995).¹ Thus these instruments prove to be strong, explaining a substantial part of fertility.

In the remainder of this paper, when identifying how preschool changes the impact of fertility on mothers' activity, *twins-1* will serve as the instrument

1. For the same-sex instrument on the extended sample of mothers with a child between the ages of two and ten, first-step Fisher statistics are 6 and 54, respectively. In districts where preschool is widely available, this is insufficient and confirms the validity of the choice of only using twin births as an instrument.

for going from one to more than one child and *twins-2* for going from two to more than two children. This identification strategy relies on the hypothesis that twin births are randomly distributed in the population. In other words, they are independent of the district of residence or of other individual characteristics of mothers.

We verify that there is no bias related to the place of residence of families. That is, families with twins are randomly distributed throughout France. Thus in districts where preschool enrollment rates are high (or low, respectively), the observed number of families with first-born or second-born twins is identical to the expected number¹ (Table 3). In particular, the presence of families with twins is no higher in districts where preschool enrollment rates for two-year-olds are low. If this were not the case, it is possible that the strong negative correlation between twin births and mothers' activity in these districts might prove spurious, in other words, that this correlation may not arise from the low rates of enrollment for two-year-olds but rather from a coincidence of the two phenomena, namely enrollment of two-year-olds being low and mothers' participation in the labor market being low as well (because of an over-representation of families with twins). Since families with twins are randomly distributed across the country, having twins is not correlated to local characteristics.

Table 3: *Expected and observed numbers of families with first-born or second-born twins by preschool enrollment rates for two-year-olds*

	High rate	Low rate
Expected number of twins-1	36	67
Observed number of twins-1	27	76
Chi-square	2,343	1,271
Expected number of twins-2	27	46
Observed number of twins-2	23	50
Chi-square	0.681	0.407

Sample: Women aged 21 to 35, living with a partner. In the first part of the table, the sample is restricted to mothers of at least one child, whose first- or second-born is two years old. In the second part of the table, the sample is restricted to mothers of at least two children, whose second-, or third-born is two years old.

Source: INSEE Labor Force surveys, 1990-2002.

Finally, we examined whether twin births were related to individual characteristics that could explain why mothers of twins work less than other mothers (Table 4).

1. For districts with low enrollment rates for two-year-olds (or high, respectively), the expected number of families with twins corresponds to the observed number of families with twins in the sample, as a proportion of the observations from the group of districts with low enrollment rates for two-year-olds (or high, respectively).

Table 4: Average demographic differences related to twin births

For mothers living in a district with high enrollment rates for two-year-olds

	Age	Age at first birth	Age difference between two eldest	French citizens	Age when finished school	Diploma
Twins-1	29.11 (0.73)	27.11 (0.73)	– –	0.96 (0.04)	19.63 (0.42)	0.22 (0.08)
No twins-1	28.83 (0.05)	25.09 (0.05)	– –	0.96 (0.00)	19.50 (0.09)	0.22 (0.01)
Difference	0.281 (0.728)	2.019*** (0.728)	– –	0.003 (0.093)	0.126 (0.421)	–0.003 (0.081)
Twins-2	29.87 (0.71)	24.13 (0.70)	46.22 (4.76)	1.00 (0.00)	18.13 (0.46)	0.09 (0.06)
No twins-2	30.21 (0.06)	23.74 (0.06)	40.55 (0.44)	0.95 (0.00)	18.73 (0.07)	0.18 (0.01)
Difference	–0.338 (0.715)	0.394 (0.698)	5.671 (4.781)	0.049*** (0.004)	–0.603 (0.468)	–0.095 (0.061)

Significance: *: 10% **: 5% ***: 1%

Sample: Mothers aged 21 to 35 living with a partner in a district with low enrollment rates for two-year-olds. In the first part of the table, the sample is restricted to mothers of at least one child, whose first- or second-born is two years old. In the second part of the table, the sample is restricted to mothers of at least two children, whose second-, or third-born is two years old.

Note: Standard deviations are indicated in parentheses.

Source: INSEE Labor Force surveys, 1990-2002.

For mothers living in a district with low enrollment rates for two-year-olds

	Age	Age at first birth	Age difference between two eldest	French citizens	Age when finished school	Diploma
Twins-1	29.38 (0.34)	27.38 (0.34)	– –	0.92 (0.03)	19.68 (0.37)	0.28 (0.05)
No twins-1	29.28 (0.04)	25.54 (0.04)	– –	0.87 (0.00)	19.89 (0.09)	0.29 (0.01)
Difference	0.103 (0.338)	1.841*** (0.338)	– –	0.046 (0.031)	–0.208 (0.382)	–0.010 (0.052)
Twins-2	31.12 (0.39)	25.24 (0.40)	46.86 (4.29)	0.92 (0.04)	21.08 (1.70)	0.38 (0.07)
No twins-2	30.61 (0.04)	24.05 (0.05)	42.56 (0.39)	0.84 (0.01)	18.89 (0.08)	0.24 (0.01)
Difference	0.511 (0.389)	1.192*** (0.402)	4.304 (4.312)	0.076* (0.039)	2.192 (1.701)	0.140** (0.070)

Significance: *: 10% **: 5% ***: 1%

Sample: Mothers aged 21 to 35 living with a partner in a district with low enrollment rates for two-year-olds. In the first part of the table, the sample is restricted to mothers of at least one child, whose first- or second-born is two years old. In the second part of the table, the sample is restricted to mothers of at least two children, whose second-, or third-born is two years old.

Note: Standard deviations are indicated in parentheses.

Source: INSEE: Labor Force surveys, 1990-2002.

The probability of having twins increases with age. Accordingly, we found that mothers of twins had their first child later than did other mothers. Mothers of second-born twins are also more frequently French citizens by birth, and they have more advanced diplomas than other mothers of more than two children. All of these characteristics are positively correlated with mothers working and tend to explain why mothers of twins have a higher rate of participation in the labor market rather than lower. These characteristics are introduced in the regressions. Thus, the instrumentation allows us to measure the causal effect of the number of children on mothers' activity and to explain the geographic differences seen in this effect in terms of differences in enrollment rates for two-year-olds.

7.2 The Effect of Fertility on Mothers' Participation in the Labor Market

Table 5 shows ordinary least squares and two-stage least squares estimates of the effect of having more than one / two children on a mothers' labor supply. Mothers' rate of participation in the labor market is practically identical in both types of districts. That is, for mothers of at least two children, this rate is 49.8% in districts with high rates of preschool and 53.6% in districts with low rates.

Table 5: *Effect of having more than one and more than two children on mothers' participation in the labor market*

Estimation technic:	Estimations through ordinary least squares and two-stage least squares	
	Ordinary least squares	two-stage least squares
The first or second child is two years old		
<i>Instrument</i>	–	<i>Twins-1</i>
More than 1 child * High rate	-0.188*** (0.016)	-0.589*** (0.183)
More than 1 child * Low rate	-0.142*** (0.014)	-0.349*** (0.110)
<i>N</i>	12,501	12,501
The second or third child is two years old		
<i>Instrument</i>	–	<i>Twins-2</i>
More than 2 children * High rate	-0.304*** (0.022)	-0.252** (0.128)
More than 2 children * Low rate	-0.297*** (0.019)	-0.269*** (0.083)
<i>N</i>	7,735	7,735

Significance: *: 10% **: 5% ***: 1%

Sample: Women aged 21 to 35 living with a partner. In the first part of the table, the sample is restricted to mothers of at least one child, whose first- or second-born is two years old. In the second part of the table, the sample is restricted to mothers of at least two children, whose second-, or third-born is two years old.

Note: Standard deviations are indicated in parentheses and adjusted for heteroscedasticity as well as for potential autocorrelation across the Labor force survey's spatial units. Other explanatory variables are five-year age brackets, the mother's age at the birth of her first child, highest diploma obtained, immigration status, annual and district-wide fixed effects, urban unit size, an indicator for the reform to child benefits of July 1994, and sex of the oldest child. While the fertility variable is the probability of having more than two children, the explanatory variables also include the difference in ages between the two oldest children as well as the sex of the second child. The principal effect of preschool enrollment rates for two-year-olds is also included in the equation.

Source: INSEE: Labor Force surveys, 1990-2002.

In the first part of Table 5, ordinary least squares estimates indicate that all other things being equal, when mothers go from one to more than one child, their activity rate decreases in districts where preschool is widely available even more than in districts where it is scarce. The birth of a second child is associated with a probability of the mother participating in the labor market that is lower by 18.8 points in districts where preschool rates are high and by 14.2 points where they are low.

When fertility is instrumented by first-born twins, estimations confirm this trend, though the coefficients are not significantly different for low and high preschool rates. Regardless of the district of residence, having more than one child has a negative impact on a mother's decision to work, with estimated coefficient of -0.589 in districts where preschool rates are high and -0.349 where these rates are low. However, the difference between coefficients ($0.240(0.214)$) is not significant. Consequently, state-funded preschool options do not lower the number of mothers who stop working after the birth of their second child.

In the second part of Table 5, ordinary least squares estimates show that regardless of the preschool rate for two-year-olds, mothers of more than two children work less than do mothers of two children (by about 30 percentage points). When *Twins-2* is used as an instrument, the effect of having more than two children is significantly negative in both types of districts, with -0.252 where preschool rates are high and -0.269 where they are low. However, the difference between these coefficients is not significant.¹

Globally, a comparison of the two estimation methods suggests that ordinary least squares underestimate the negative impact on mothers' activity of having more than one child while they overestimate the impact of having two children.

The larger sample of mothers aged 21 to 40 provides first-step effects, ordinary least squares estimates, and instrumental variables with the same sign and identical levels of significance. For example, when *Twins-2* is the instrument used, we see that having more than two children significantly reduces mothers' participation in the labor market by 25.7 percentage points in districts where preschool is scarce (26.9 for mothers aged 21 to 35) and by 25.7 points where it is widely available (25.2 for mothers aged 21 to 35).

7.3 Mothers' Education Levels

The rate of preschool enrollment for two-year-olds may affect the impact of fertility on mothers' activity differently for other education levels. The procedures described above were replicated, with a distinction made between two subsamples: mothers who went no further than a high school diploma, and mothers with a college-level diploma.

1. The difference between the two coefficients is $0.269 - 0.252 = 0.017$, with a standard error of $(0.0832 + 0.1282)^{0.5} = 0.153$.

In the first part of Table 6, ordinary least squares estimates confirm that the negative correlation between having more than one child and mothers' activity rises slightly in districts where preschool enrollment rates are high. As we expected, this correlation is higher for less-educated mothers. In districts where preschool rates are high, the probability is 20 points lower that a mother will participate in the labor market if she has more than one child in the event that she went no further than a high school diploma, while this probability is 14 points lower if she has a college-level diploma.

Table 6: *Effect of having more than one and more than two children on mothers' participation in the labor market as a function of education level*

Estimations through ordinary least squares and two-stage least squares

Subsamples:	High school diploma		College diploma	
Estimation technic:	Ordinary least squares	Two-stage least squares	Ordinary least squares	Two-stage least squares
The first or second child is two years old				
<i>Instrument</i>	–	<i>Twins-1</i>	–	<i>Twins-1</i>
More than 1 child * high rate	–0.202*** (0.018)	–0.678*** (0.216)	–0.142*** (0.029)	–0.455 (0.444)
More than 1 child * low rate	–0.169*** (0.017)	–0.408*** (0.127)	–0.099*** (0.023)	–0.154 (0.228)
<i>N</i>	9,190	9,190	3,311	3,311
The second or third child is two years old				
<i>Instrument</i>	–	<i>Twins-2</i>	–	<i>Twins-2</i>
More than 2 children * high rate	–0.321*** (0.023)	–0.317** (0.136)	–0.211*** (0.056)	0.276*** (0.094)
More than 2 children * low rate	–0.320*** (0.022)	–0.300*** (0.101)	–0.211*** (0.040)	–0.225* (0.135)
<i>N</i>	6,043	6,043	1,692	1,692

Significance: *: 10% **: 5% ***: 1%

Sample: Women aged 21 to 35 living with a partner. In the first part of the table, the sample is restricted to mothers of at least one child, whose first- or second-born is two years old. In the second part of the table, the sample is restricted to mothers of at least two children, whose second-, or third-born is two years old.

Note: Standard deviations are indicated in parentheses and adjusted for heteroscedasticity as well as for potential autocorrelation across the Labor force survey's spatial units. Other explanatory variables are five-year age brackets, the mother's age at the birth of her first child, highest diploma obtained, immigration status, annual and district-wide fixed effects, urban unit size, an indicator for the reform to child benefits of July 1994, and the sex of the oldest child. While the fertility variable is the probability of having more than two children, the explanatory variables also include the difference in ages between the two oldest children as well as the sex of the second child. The principal effect of preschool enrollment rates for two-year-olds is also included in the equation.

Source: INSEE Labor Force surveys, 1990-2002.

Instrumental variable estimates show that having more than one child has the same impact on a mother's decision to work in both types of districts. That is, it is negative for mothers holding no more than a high school diploma and not significant for mothers with college diplomas. However, the difference

between the coefficients is not significant, being 0.270 (0.251) for the former and 0.301 (0.499) for the latter. Thus preschool does not make it easier for mothers to reconcile work and family life when they go from one to more than one child.

In the second part of Table 6, ordinary least squares estimates confirm that the correlation between having more than two children and mothers' activity does not differ across district types. The results also confirm that the link between the number of children and a mother's activity is higher for mothers with no more than a high school diploma than for mothers with college diplomas. That is, the probability that a mother will participate in the labor market falls by 32 percentage points when she has a third child if she is in the first category and by 21 points if she is in the second.

When *Twins-2* is used as an instrument, the results indicate that the effect of preschool differs by mothers' level of education. For mothers with a college diploma, having more than two children significantly increases their participation in the labor market in districts with high preschool rates (0.276), while participation falls in districts with low rates (-0.225). Thus when it is easier to balance work and family life, the income effect on the number of children prevails, that is, an increase in the number of children raises the total cost of education, and so mothers' labor supply increases. When mothers live in a district where preschool is scarce, balancing work and family life is more difficult, and going from two to more than two children causes mothers to withdraw from the labor market. Here, the difference between coefficients is significant,¹ showing that mothers with college diplomas are particularly sensitive to the possibility of enrolling their children in preschool. For mothers with lower levels of education, having more than two children significantly reduces their participation in the labor market, and this reduction is identical in districts with low preschool enrollment rates (-0.300) and districts with high rates (-0.317).

These results are consistent with a Becker's model of time allocation, wherein the cost of children's education increases as the number of children increases and the trade-off between income effect and substitution effect changes. When the number of children increases, the relative price of childcare increases and the opportunity cost of giving up a salary diminishes (substitution effect). This leads to a decrease in the labor supply. Conversely, lower purchasing power resulting from a rise in the number of children leads to an increase in labor supply (income effect). In sum, mothers face the following decision: to work in order to pay for the increased cost of childcare as well as other costs incurred by a higher number of children, or to not work in order to save on childcare expenses. The net effect depends on the mother's potential salary in the labor market relative to the cost of childcare (and thus preschool options). Our results indicate

1. The difference between the two coefficients is $0.276 + 0.225 = 0.501$, with a standard error of $(0.0942 + 0.1352)^{0.5} = 0.165$.

that for mothers with less education, an increase in the number of children brings about a reduction in the labor supply regardless of the preschool rates and the birth order of the additional child. For these mothers, the cost of giving up a salary must be low enough that the substitution effect prevails on average. For mothers with more education living in a district with low preschool rates, as the number of children increases, the cost of childcare also rises,¹ with a resulting change in the balance between income and substitution effects. Thus, when a mother goes from one to more than one child, the income and substitution effects will balance out on average and having more than one child does not significantly affect the labor supply. On the other hand, when mothers progress to more than two children, the substitution effect takes precedence and some withdraw from the labor market. The case of mothers with college diplomas who live in a district where preschool is widely available is a particular one as, for more mothers, the cost of childcare does not change with the number of children. In the case of preschool, the substitution effect is no longer an influence because an increase in the number of children does not increase the cost of childcare and there is therefore no pressure for the mother to decrease her labor supply. In sum, mothers who have access to preschool do not experience the substitution effect while others do. However, for all mothers, the income effect induces an increase in the labor supply, which grows with the number of children. On average, results indicate that in progressing from one to more than one child, substitution and income effects balance each other out, and having more than one child does not significantly affect the labor supply. However, when mothers have more than two children, the substitution effect, which concerns only a small portion of the population, is inferior on average to the income effect. That is, having more than two children increases the labor supply among mothers with college diplomas in districts where preschool options are widely available.

In sum, preschool options assist mothers with college diplomas to reconcile work and family life when they progress from two to more than two children. In the other cases (mothers without college diplomas, and all mothers progressing from one to more than one child), preschool does not help mothers to remain in work (or return to work) when the number of children increases.

7.4 The Effect of Fertility on Fathers' Participation in the Labor Market

The same analysis was conducted for fathers aged 21 to 35 living with a partner (Table 7).

1. This average cost increases to a greater degree than in districts where preschool enrollment rates are high.

Table 7: *Effect of having more than one and more than two children on fathers' participation in the labor market*

Estimations through ordinary least squares
and two-stage least squares

	Ordinary least squares	Two-stage least squares
The first or second child is two years old		
<i>Instrument</i>	–	<i>Twins-1</i>
More than 1 child * high rate	–0.004 (0.004)	0.021*** (0.008)
More than 1 child * low rate	0.003 (0.004)	0.026*** (0.006)
<i>N</i>	10,650	10,650
The second or third child is two years old		
<i>Instrument</i>	–	<i>Twins-2</i>
More than 2 children * high rate	0.001 (0.005)	0.022*** (0.008)
More than 2 children * low rate	–0.005 (0.006)	–0.073 (0.046)
<i>N</i>	5,935	5,935

Significance: *: 10% **: 5% ***: 1%

Sample: Men aged 21 to 35 living with a partner. In the first part of the table, the sample is restricted to fathers of at least one child, whose first- or second-born is two years old. In the second part of the table, the sample is restricted to fathers of at least two children, whose second-, or third-born is two years old.

Note: Standard deviations are indicated in parentheses and adjusted for heteroscedasticity as well as for potential autocorrelation across the Labor force survey's spatial units. Other explanatory variables are five-year age brackets, the father's age at the birth of his first child, highest diploma obtained, immigration status, annual and district-wide fixed effects, urban unit size, an indicator for the reform to child benefits of July 1994, and the sex of the oldest child. While the fertility variable is the probability of having more than two children, the explanatory variables also include the difference in ages between the two oldest children and the sex of the second child. The principal effect of preschool enrollment rates for two-year-olds is also included in the equation.

Source: INSEE Labor Force surveys, 1990-2002.

In the first part of Table 7, instrumental variable estimates show that progressing from one to more than one child increases fathers' participation in the labor market in both district types, by 2.1 percentage points when preschool rates are high and by 2.6 points when they are low. The effects of the number of children on fathers' labor supply are weak in comparison to the effects on mothers' labor supply (which was over 30 points). That is, since fathers' rates of activity in the labor market are already very high, they can only raise to a limited degree, while mothers' activity decreases sharply as the number of children increases.

In the second part of Table 7, instrumental variable estimates show that when preschool rates are low, progressing from two to more than two children has no effect on fathers' labor supply. On the other hand, when preschool rates are high, having more than two children increases fathers' participation in the labor market by 2.2 points.

These results confirm the finding that mothers bear the burden of reconciling work and family life. Generally, as the number of children increases, mothers' participation in the workforce decreases to allow for an adjustment between work and family life, while fathers' participation in the workforce increases.

7.5 Discussion

Preschool has a small effect on the reconciliation of work and family life, and it is limited to one specific population, namely mothers with college diplomas who have more than two children.¹

The fact that preschool benefits mothers with more education does not seem to be linked to differences in access. Blanpain (2006) does not find differences in the probability of enrolling children in preschool with respect to the mother's activity and only minor differences with respect to the father's socio-occupational category. The differences in results with respect to the parents' education level could be explained by differences in preference or in attachments to the labor market. It is possible that mothers choose to enroll their children in preschool for different reasons. For example, mothers with less education may enroll their children in order to socialize them, while mothers with more education may do it specifically to reconcile work and family life.

There are three potentially complementary factors that may explain why preschool particularly affects mothers' labor supply when they have more than two children. First, preschool supplements more traditional childcare options and was not in any case intended for two-year-olds. Thus parents may be reticent to use it. However, this reticence may diminish as the number of children increases and the parents become familiar with the school environment as their eldest child attends preschool. In addition, the fact that preschool is free means that the cost of preschool does not increase with the number of children, as opposed to other forms of childcare. Thus as the household's financial needs increase with the number of children, the cost of preschool remains unchanged, and progressing from two to more than two children may lead to a higher income effect and an increase in mothers' labor supply. Finally, the hours of operation of preschools are relatively short, which makes that option more compatible with part-time rather than full-time work. Consequently, preschool is likely to affect the subsamples of mothers for whom the alternative of part-time work and state-funded preschool is more attractive than not working at all. It is possible that this may be even truer for mothers of at least three children, while mothers with fewer children prefer the alternative of working full-time while using traditional childcare options.

1. Among mothers aged 21 to 35 living with a partner, only 19% have a college diploma, and of these, only 11% have more than two children.

8. CONCLUSION

This paper presents a two-step linear regression model in which the interaction between local preschool enrollment rates and fertility (instrumented via twin births), makes it possible to compare the effect of fertility on mothers' participation in the workforce in relation to preschool enrollment rates.

Regarding the progression from one to more than one child, preschool does not help mothers reconcile work and family life. Increasing from one to more than one child has the same impact on mothers' participation in the labor market in districts with low and high preschool enrollment rates. Moreover, this impact is significantly negative for mothers with no more than a high school diploma and not significant for mothers with more education. For fathers, progressing from one to more than one child increases participation in the labor market, but this effect is identical in both district types, as it is for mothers.

When parents progress from two to more than two children, preschool options help mothers with college diplomas balance work and family life. Having more than two children increases their probability of working in districts where preschool is widely available and decreases it in districts where it is scarce. Fathers also seem to draw benefits from preschool since when they progress from two to more than two children, they increase their participation in the labor market only when preschool rates are high.

In all of the scenarios, mothers are the ones who reduce their participation in the labor market to harmonize work and family life. If fathers' activity levels change as the number of children increases, it increases rather than decreases.

In sum, the effect of preschool is low and limited to one particular population, namely mothers with college diplomas who have more than two children (11% of all mothers with college diplomas). These results may be explained by varying parental preferences for different types of childcare, the relative costs of preschool, and hours of operation of preschools that do not coincide with the full-time workday. The development of low-cost childcare for children under three years of age with more flexible operating hours could have a more substantial effect on mothers' efforts to balance work and family life by encouraging those who do not wish to enroll their children in preschool to remain in the labor market as the number of children in the family increases.

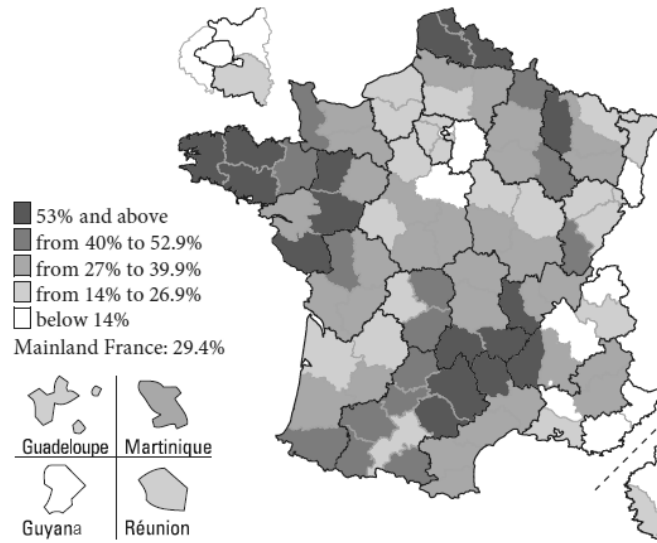
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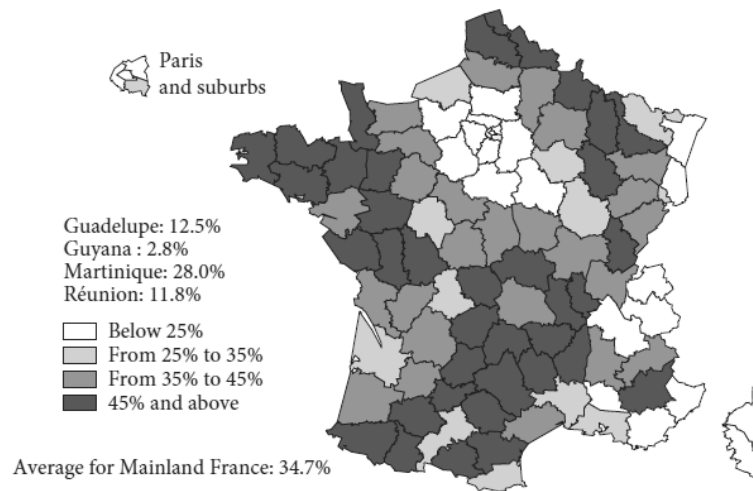
APPENDIX 1:

Preschool enrollment rates for two-year-olds in 2003



Source: Ministry of Education: <http://media.education.gouv.fr/file/06/7/3067.pdf>

Preschool enrollment rates for two-year-olds in 1997



Source: Ministry of Education: <http://media.education.gouv.fr/file/06/7/3067.pdf>

APPENDIX 2:

Districts where the rate is greater than or equal to 45% in 1997
and greater than or equal to 40% in 2003.

07: Ardèche	48: Lozère
08: Ardennes	49: Maine-et-Loire
09: Ariège	50: Manche
12: Aveyron	52: Haute-Marne
15L Cantal	53: Mayenne
19: Corrèze	55: Meuse
22: Côtes-d'Armor	56: Morbihan
23: Creuse	59: Nord
29: Finistère	62: Pas-de-Calais
32: Gers	64: Pyrénées-Atlantiques
35: Ille-et-Vilaine	65: Hautes-Pyrénées
39: Jura	79: Deux-Sèvres
42: Loire	81: Tarn
43: Haute-Loire	82: Tarn-et-Garonne
46: Lot	85: Vendée

Districts where the rate is below 35% in 1997
and below 27% in 2003

06: Alpes-Maritimes	73: Savoie
13: Bouches-du-Rhône	74: Haute-Savoie
2A: Corse-du-Sud	75: Paris
2B: Haute-Corse	76: Seine-Maritime
21: Côte-d'Or	77: Seine-et-Marne
27: Eure	78: Yvelines
28: Eure-et-Loir	83: Var
31: Haute-Garonne	84: Vaucluse
33: Gironde	87: Haute-Vienne
37: Indre-et-Loire	89: Yonne
38: Isère	90: Territoire de Belfort
45: Loiret	91: Essonne
57: Moselle	92: Hauts-de-Seine
60: Oise	93: Seine-Saint-Denis
67: Bas-Rhin	94: Val-de-Marne
68: Haut-Rhin	95: Val-d'Oise