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Does the cost of child care affect female labor market participation? An evaluation of a French reform of childcare

Abstract

This study evaluates the impact of an increase in childcare subsidies on the use of paid childcare and the participation rate of mothers of preschool children. We use a natural experiment provided by the PAJE, a French reform in family allowances introduced in 2004. This reform temporarily created discrepancies in the childcare subsidies family received according to the year of birth of the children. We apply a difference-in-differences strategy on exhaustive French fiscal data that provide information on gross income as well as on the use of paid childcare services between 2005 and 2008. We find that the new policy resulted in a significant increase in the use of paid childcare services. The effect on the mothers' labour participation is significant but of a smaller magnitude. This suggests that part of the policy resulted in a substitution of informal childcare by formal ones.

Keywords: Mother's labour supply, Child care subsidy, Difference-in-Differences

Résumé

Cette étude évalue l'impact d'une augmentation des allocations de garde d'enfant sur l'utilisation de modes de garde payants et le taux de participation des mères d'enfant d'âge préscolaire. Nous utilisons une expérience naturelle créée par l'introduction de la PAJE en 2004. Cette réforme a introduit temporairement des différences dans les droits aux allocations de gardes auxquelles les familles peuvent prétendre selon l'année de naissance des enfants. Nous utilisons une méthode de différence-de-différences, à partir des données fiscales exhaustives disponibles entre 2005 et 2008. Nos résultats suggèrent que l'augmentation des allocations résultant de la PAJE s'est traduite par une augmentation significative du recours à un mode de garde payant en dehors du domicile. L'impact sur le taux d'activité des mères est significatif mais plus faible. Ceci suggère qu'une partie de la mesure s'est traduite par une substitution de modes de garde informels (par des proches ou non déclarées) par des modes de garde plus formels.

Mots-clés : Offre de travail féminine, Allocation de garde d'enfants, Différence de Différences

Classification JEL : D13, H24, H31.

1 Introduction

This study evaluates the impact of childcare subsidies on the participation rate of mothers of young children and on the use of paid childcare. For the sake of identification we use a quasi-experiment created by a reform of the French system of family allowances occurred in 2004, the introduction of the so-called PAJE. This reform substantially increases childbearing and childcare subsidies for some types of households, in particular those with median earnings. The new scheme concerned all families with a child born after the first January of 2004, while the old scheme still concerned families with a child born prior to this date. We estimate the impact of the new scheme relying on a difference-in-differences strategy. We use a fiscal dataset which provides precise information on yearly earnings of households as well as on the use of paid childcare by families. These data are available since 2005. We use the fact that for a few years, some families with young children are in the old scheme of childcare subsidies while others are in the new one. We observe a positive impact of the increase in childcare subsidies on the use of paid childcare as well as on the participation rate of mothers of young children. However, the magnitude of the impact is small. We find a rise of one percentage point in the participation rate on average. The impact is slightly higher for the use of a paid childcare, suggesting that the rise in childcare subsidies led to a substitution of informal care by paid care.

This paper contributes to the international literature on the responsiveness of mother labour supply to the cost of child care. Policies helping to balance family and work have been considered as the most efficient way of increasing female participation rate in OECD countries (see for instance Jaumotte, 2003). Childcare may represent a substantial cost and it is seen as an obstacle towards labour force participation. The international literature generally confirms the link between women's labour supply and childcare prices, although the estimates are spread across a rather wide range (see for instance Blau and Tekin, 2007 for a review of studies using US data). One challenge for the identification of the impact of childcare costs on participation of mothers lies in its endogeneity. Recent literature thus tries to isolate exogenous variation in childcare costs to identify labor supply responses. For instance, recent papers use the introduction of universal subsidized childcare spaces (Havnes and Mogstad, 2011 in Norway, Lefebvre and Merrigan, 2008 for the province of Quebec in Canada). They find a large impact of the availability of such childcare facilities on labor participation of mothers with children in preschool age. On the contrary, the introduction of policy programs reducing work incentives for parents, such as long parental leaves, or "cash-for-care" programs, has a large negative impact on female participation (see Piketty, 2003 for France and Schøne, 2004 for Norway) which could be long-lasting (Lefebvre, Merrigan and Verstraete, 2009). Besides, career breaks because of children appear to have an impact on wages, but the durability of this effect is still controversial (Lequien, 2012, Lalive and Zweimüller, 2009).

The impact of childcare cost on the use of childcare facilities and the mothers' decision to participate are likely to vary with the characteristics of households as well as with the institutional context. In the United States, evidence suggests that low-income households and single mothers are the most responsive to a change in childcare costs (for instance Gathmann and Sass, 2012, Tekin, 2007). In most European countries, childcare facilities are highly regulated and subsidized, but characterized by a high rationing of demand. Compared to other OECD countries, France has an intermediate position in terms of childcare facilities. A public funded preschool system guarantees a free and high quality childcare for all children above three. However, parents of younger children face a shortage of infant and toddler care. If public low-price nurseries exist for younger children, the number of slots is dramatically lower than the demand. It is complemented

by a system of private qualified childminders. In this case, the cost is partly subsidized by family allowances and childcare subsidies but it can nevertheless be prohibitive for some low-income families. As far as we know, very few empirical studies evaluate the impact of these subsidies on the participation rate of the French women (an exception is Choné et al., 2004).

The next section presents the French system of childcare and the changes introduced by the 2004 reform. Section 3 describes the data and the main statistics, while section 4 explains our identification strategy and our results. We analyse the differentiated impact of the reform according to the households income in the Section 5, using a simple structural model for female participation to illustrate the results of the empirical estimation. Finally, section 6 concludes.

2 A brief description of the French childcare system

The French family policy for children between two or three years old and six years old is based on free full-day preschool programs. In 2009, 100% of three-year-old children and 20% of two-year-old children were enrolled in the non-compulsory preschool programs ("école maternelle"). These preschools (which provide a state mandated curriculum) are completely free of charge for families. Most of the paid childcare for children between 3 months old (the end of the maternity leave) and 3 years old is provided by qualified childminders, who care children at their personal home. They are regulated by the state and must be certified; they are also regularly inspected and have to attend professional training classes. The cost of the daycare is freely determined as an agreement with the family. In 2007, the average costs in counties for a full-time daycare were very different depending on the local density of slots: the cost was on average 477 euros in counties with more than 41 places for 100 children under 3, and 653 euros in those with less than 18 places (gross cost before subsidies and tax cuts, Blanpain, 2009). The number of slots slightly increases over the period (see Figure 1) and corresponds to around one third of young children in 2007. Additionally, publicly funded nurseries provide a high quality childcare for children as young as three months. As the cost is quite modest for low-income families (it is a function of the parents' wage: for one child, it is generally 0.6% of their monthly wages for each day of care)[1] for a high quality of services, it is considered as the favorite childcare by French families. However, the supply is much smaller than the demand. On average, the number of slots per 100 children aged 3 or less is 14 over the period, but could be as small as 4 per 100 children in some French counties (see details in the Appendix A.1). According to a recent survey, two thirds of children under three are mainly cared at home by their parents (see Blanpain, 2009). This does not necessarily mean that parents do not participate in the labor force (for instance in case of adapted work schedules).

Several public programs alleviate the financial burden of child care for families. These financial helps consist in direct subsidies and tax credits. Firstly, a monthly subsidy is provided for low-income families with young children whatever daycare system is used, and even if the child is cared at home by his parents. This so-called "base subsidy" amounts to 165 euros per month in 2005, provided that the total income of the families is under a threshold (see Table 12 in the Appendix A.2 for details). This threshold is reduced by 30% for single-income couples (compared to double-income families or single-parent ones). In addition, an extra subsidy is given to the families who employ a qualified childminder or a in-home nanny. This subsidy ranges from 155 to 362 euros per month in 2005 depending on family income, family size and age of

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[1]The average cost is 166 euros a month for households whose standard of living is under 1,100 euros and 393 euros if their standard of living is higher than 2,300 euros a month, see (Blanpain, 2009). It can be far higher for high-income families. These figures do not take into account tax credits, and subsidies at a local level.
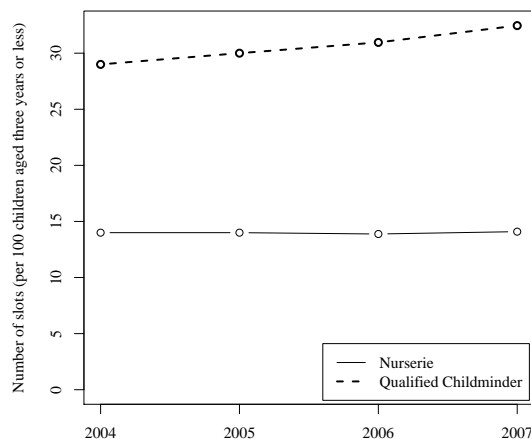
Figure 1: Number of qualified childminders and nursery places for 100 children aged 3 or less (2004-2007)
Source: Statistical services of the Health Ministry (Drees)

children (see Table 13 in the Appendix A.2). Families are also exempted from most of social security contributions for the wage of a qualified childminder. Lastly, all households who use a paid childcare can claim up to a 50% tax credit at the end of the civil year for their childcare expenses.

These subsidies and tax cuts were introduced at different schedules, and before 2004 families faced a complex system. To put an end to this situation, a single-desk for both allowances and social security declarations (for families hiring a qualified childminder) was created in 2004. The new system, called "PAJE" (*Prestation d'accueil du Jeune Enfant*: literally "welcome benefit for the young child"), aims at alleviating the administrative burden for families and creating a streamlined system for all childcare subsidies. All families with a child born after the first January of 2004 benefit from these services until the sixth birthday of this child (the birth of a child in 2004 or after makes the whole family entitled to the new system instead of the old one). This reform sharply increases the complementary subsidies, and reduces the number of income thresholds (from three to two levels). The reform is specifically generous toward median-income families. Figure 2 presents the scheme of the subsidies in the new and old systems according to the household income for double-income families with one child (see Appendix A.2 for details). The fact of having a child born in 2004 rather than 2003 can increase the childcare subsidies perceived in 2005 by as much as 350 euros a month, for a final subsidy which can even in some cases represent the most part of a paid daycare - the law requires that an eligible family pays at least 15 % of the cost. Aside from these subsidies, the program also extends the stay-at-home subsidy (formerly *"Allocation Parentale d'Education"*) to one-child families - it was previously restrained to parents of two or more children. This subsidy can be perceived during six months (while the maximum duration is three years for larger families).

The principle of this measure was announced on April 29th, 2003 at the end of a roundtable about family policy - *"Conférence sur la Famille"*- and was officially implemented by the law 2003-
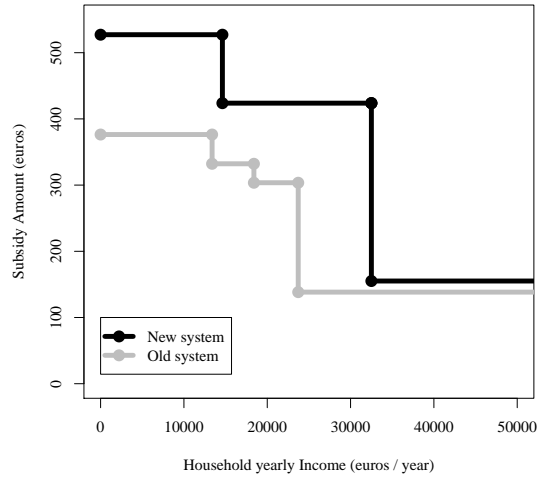
Figure 2: Childcare subsidy schemes in the new and old systems (2007)

1199 of December 18th, 2003. Some public centers (Maternal and Infantile Protection - "PMI") systematically provide information to all families with newborn or small children. Families affected by the new measure were thus aware of the amount of subsidies they could pretend to (this information was also provided by the French Family Benefits Office, "CAF").

3 Data and descriptive statistics

3.1 Data

We use the exhaustive administrative income tax returns database from 2005 to 2009. This database provides us with accurate information on the gross income of each household member,[2] as well as on the household composition (in particular, the number of children and the year of birth of each member of the household). The individual income (which can be earned income or unemployment benefit) gives a measure of participation to the labor force: we consider a person as active when this yearly income is different from zero. Aggregated data at the household level provide an estimate of the amount of childcare subsidies a family is eligible for (see Appendix A.2 for details). Besides, we have information on the use of childcare services. As childcare expenses are partially refunded by a tax credit, households fill in their tax return the yearly amount of childcare expenses. This variable includes all childcare services outside the house and thus mixes expenses for nurseries and qualified childminders. It represents the amount paid by the household *net* of childcare subsidies - which means that a rise in subsidies mechanically results in a decrease of this amount. Finally, we add information on the supply of paid daycare, using a public annual dataset on the number of daycare places (provided by the French Ministry of

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[2]In France, the members of a household are likely to declare their income separately - this is for example the case of unmarried couples. That is why tax data usually give information at the level of the "tax household", defined by a unique tax return. But here we may rely on a complementary database - local residence tax data - which allows us to reconstruct households when separate tax returns are filled.

Social Affairs). We have information on the number of nurseries and childcare providers per 100 preschooler children at the county level (French "départements").

As we are primarily interested in the participation rate of young children's mothers, we restrict the sample to households including a woman aged 20-55 and whose youngest child is 0, 1, 2, or 3 years old, which approximately represent 6% of households.

3.2 Descriptive Statistics

Subsidy entitlement and net childcare cost

The new scheme of subsidies results in an increase in the amount of childcare subsidies a household can pretend to. This increase affects all households, but may be very substantial for some of them.

To illustrate this, we simulate the amount of childcare subsidies a household can pretend to, using the new and the old schemes respectively. We use the distribution of incomes in 2005, for families having their first child in 2006. Using earnings of families without any child in 2005 (but with a child in 2006) allows us to avoid the impact of one birth on labor market participation. This subsample of households with only one child could be not representative of all households, though. According to this simulation, the new scheme dramatically increases total childcare subsidies on a yearly basis for medium-earnings households (between the sixtieth and eightieth percentiles of the distribution of income in 2005, see Figure 3, left). These households could pretend to 1,600 euros in the old scheme, while this amount is nearly 5,000 euros in the new one. This is mostly due to the rise in the base subsidy threshold, which benefits to some families who did not get this childcare benefit before the reform. The increase appears also impressive for low-income families. However, in practice it can be smaller as households have to pay at least 15% of the childcare expenses.

The change is also perceptible in relative terms. While the subsidy entitlements represent a decreasing proportion of the households' income (see Figure 3, right), the new scheme neatly increases this share for medium-earnings households.

Finally, one can evaluate the change in the average net cost of a paid childcare for households using a qualified childminder. In 2005, the average gross cost of a full-time qualified childminder is 6,180 euros (515 euros a month, according to Blanpain, 2009). We ignore in the simulation any potential feedback effect on this cost due to the reform. In relative terms, the decrease in the net cost would be around 40% for low-income households (Figure 4), around 60% for households between the 20th and the 60th percentile, 80% for the fourth quintile. For high-income households the decrease would be lower than 10%.

Mothers' participation rate and children

We define the participation status as having declared any type of earned income or unemployment benefit during the year. This is a more lenient condition that usual ILO definition, which corresponds to participation at one given date. We also consider more precise definitions on employment, using information on perceived wages (having declared less than half the minimum wage or more than the minimum wage, for example).

Using our main definition, the yearly participation rate of French women aged 20-55 in couple is around 77% on average (see Table 1).[3]

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[3]We restrict the sample to couples for this descriptive statistics in order to have comparable figures for men and women. Using the French LFS, the ILO participation rate of women aged 20-55 in couple is 79.1% at the first quarter 2005 (see Appendix C).
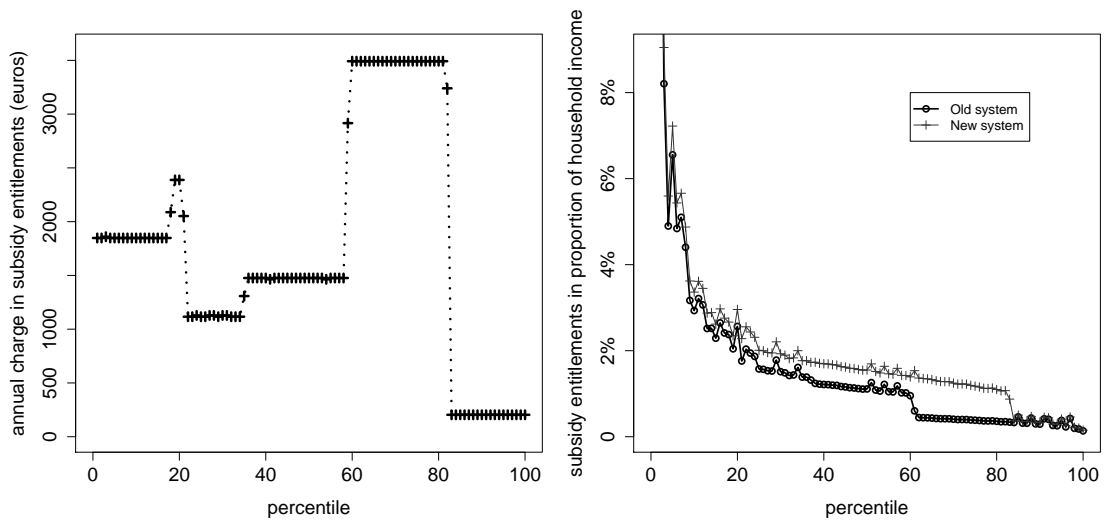
Figure 3: Changes in subsidy entitlements between old and new systems and proportion of subsidy entitlements in household's income, according to the position in the households income distribution in 2005.

Source: Authors' calculation from the Income Tax Return Database.
Scope: Households whose first child is born in 2006. The reference income is 2005 income, before the birth of the first child. Simulation uses a fixed average gross cost of childcare of 6,180 euros a year (Blanpain, 2009).
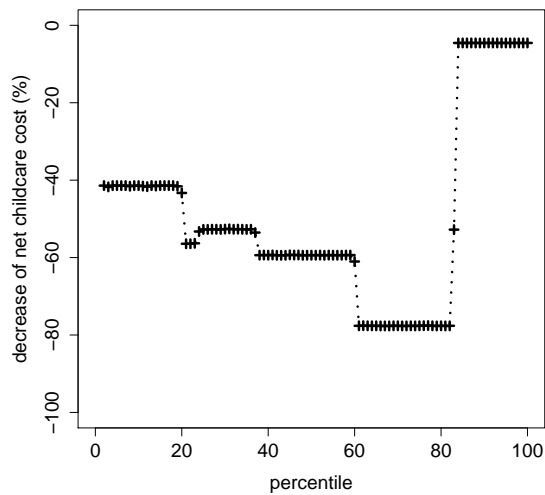

Figure 4: Relative variation in cost induced by the new scheme according to the position in the households income distribution in 2005.

Source: Authors' calculation from the Income Tax Return Database.
Scope: Households whose first child is born in 2006. The reference income is 2005 income, before the birth of the first child. Simulation uses a fixed average gross cost of childcare of 6,180 euros a year (Blanpain, 2009).

Table 1: Participation rate of men and women who are in couple, according to family size (%)

Family size	Share of couples	Women	Men
No child	35.2	82.3	84.9
At least a child	64.8	77.1	93.2
One child	26.0	82.0	91.0
Two children	26.4	80.2	94.1
Three children or more	12.4	61.8	92.2
At least a child, one under 3	21.8	74.5	94.3
One child	8.1	85.5	93.3
Two children	8.7	76.2	95.5
Three children or more	5.1	54.1	94.0
All couples	100.0	77.4	90.3

Source: Author's calculation from the Tax Income Return Database
Scope: Couples with a woman aged 20-55 in 2005.
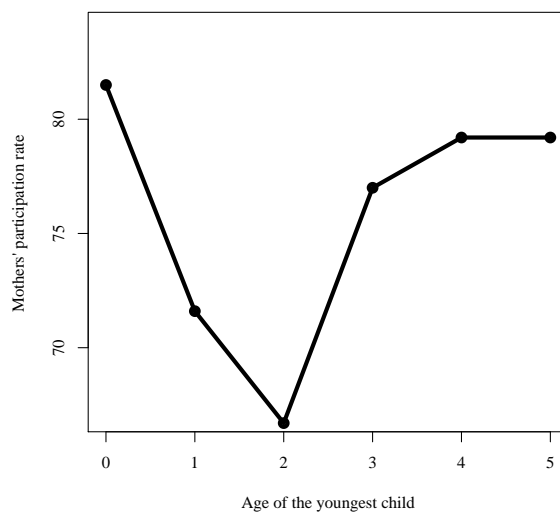
Figure 5: Mothers' participation rate in 2005, depending on the age of the youngest child.
Source: Income Tax Return Database, women aged 20-55.

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The participation rate of mothers of young children (younger than three years old) is smaller by 3 points, however. It also strongly depends on family size. If the first child has no impact on the labor market participation of women, the participation rate of mothers of three children or more drops by 20 points compared to women without any child (from 82% to 62%). The participation rate of mothers of young children amounts to 75%, and only 54% if she has three children with one under three years old. This is partly explained by subsidies providing incentives to parents (in fact mothers) to stay at home, and by a tax system which is favorable to single-income families. These both elements discourage the labor force participation of mothers of young children. Piketty (2003) for instance shows that in 1994, the extension of the stay-at-home subsidy to two-children families (it was previously restricted to families with three children or more) resulted in a drop of the participation rate of affected mothers by at least 10 percentage points.

By contrast, the participation rate of fathers is very high and does not change with the family size and the age of children. It is smaller for men of no-child households. This can be due to the fact that men usually wait for a stable job before having their first child, but also to the fact that men of households with no child are older (and more often over 60) than men of households with children. According to our definition of labor force participation (having declared any earned income or unemployment benefit during the year), most of the impact of childbearing on participation is observable for mothers of a one-year-old child and mothers of a two-year-old child (Figure 5). The child age is indeed measured at the end of the corresponding year. The mothers of a child born during the current year (the so-called "mothers of a 0-year-old child") have usually worked before the birth. Thanks to the public preschool, a large share of the mothers of children aged at least three participates. Maternity leave allowances are included in the earned income. As as consequence, mothers are considered as employed during the sixteen-week legal paid maternity leave. This explains why the participation rate of mothers of a 0-year-old child is so high and why this participation rate is smaller for mothers of a two-year-old child than for mothers of a one-year-old child. As we base our estimation on changes over time, this measurement error due to maternity leave should not impact our result of the impact of the reform of childcare, provided that the distribution of births over the calendar months is not affected by the reform (which seems plausible).

Participation, use of paid childcare and the youngest child's age

We observe a positive trend over the period in the participation rate of mothers (Figure 6), as well as on the proportion of households declaring paid daycare (Figure 8). Over the same period, the participation rate of fathers appears stable. It almost does not vary with time nor with the age of children (Figure 10). Fathers' earnings do not vary either (Figure 11). The participation rates of mothers of respectively one-year-old and two-year-old children evolve in the same way since 2006. Interestingly, we observe however that the participation rate of mothers of a two-year-old child increases more from 2005 to 2006 than its counterpart for mothers of a one-year-old child. In 2005, families with a two-year-old child still depend on the old (less generous) system of childcare subsidies while those with a one-year-old child are already in the new one. In 2006, all these families depend on the new system (see Table 2). The mothers who are in the new system should have more incentive to participate. Our identification strategy relies on this intuition.
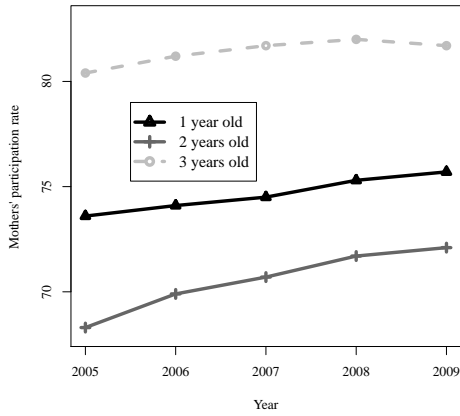
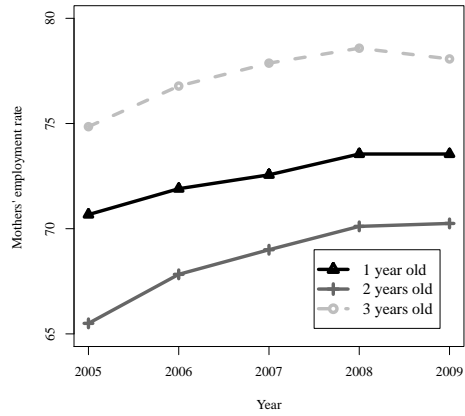Figure 6: Mothers' participation rate
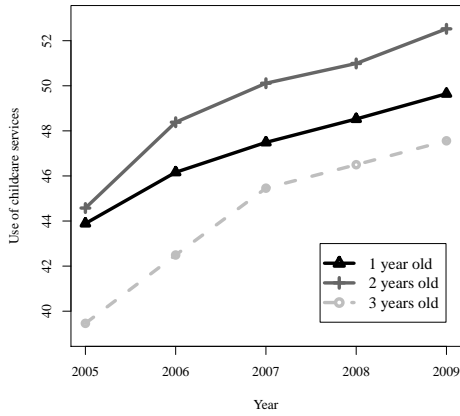

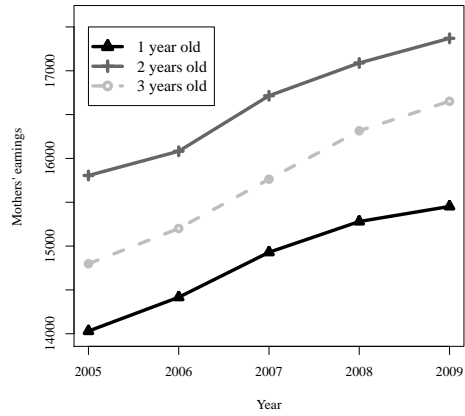
Figure 7: Mothers' employment rate

Figure 8: Use of paid childcare.

Figure 9: Average mothers' earnings
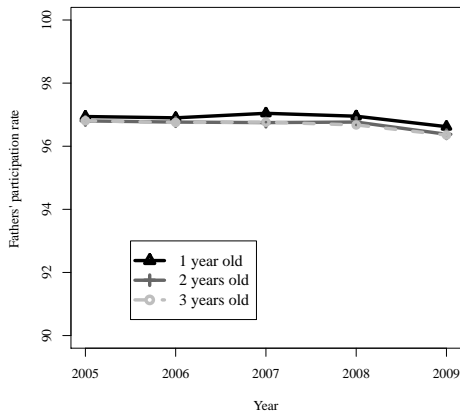
Figure 10: Fathers' participation rate

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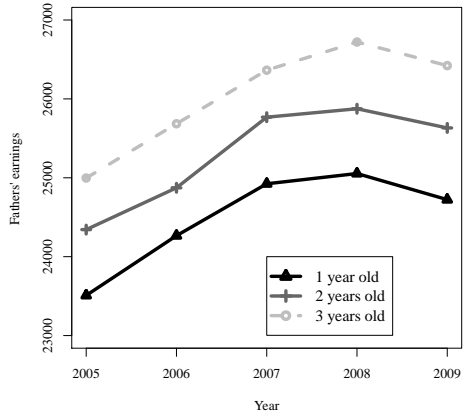
Figure 11: Average fathers' earnings

Table 2: Relevant scheme for childcare subsidies by child age and year

| | Age of the youngest child | |
Year	1 year old	2 years old
2005	NEW	*OLD*
2006	NEW	NEW

Lecture: In 2005, childcare subsidies for households whose youngest child is one year old (respectively two years old) are calculated using the new (respectively old) scheme.

4 Identification Strategy and Results

We estimate the impact of the introduction of a more generous childcare subsidy schedule on the participation rate of mothers of young children, on their wage and their use of paid childcare services, using a difference-in-differences strategy. The introduction of the new schedule of childcare subsidies creates a discrepancy in the amount of the subsidies according to the age of the youngest child. All families with a child born in 2004 or later benefit from the new schedule, while others are still in the old one. In order to evaluate the impact of the policy, we restrict our main analysis to households with a one-year-old or two-year-old child (the most affected by childcare according to previous descriptive results). To take into account the systematic gap in our outcome variable (respectively participation rate, use of childcare services and mother's wage) between mothers of a one-year-old child and a two-year-old child, we compare the change in the outcome variable between 2005 and 2006 for these two populations.[4]

Our base estimation uses parents of a child aged one year and those of a child aged two for the period available in our data which is the closest to the reform (2005-2006). The direct impact of the change in childcare subsidies is indeed most likely to be observed for these populations. For younger children (those born during the current year), we cannot distinguish between labor force participation before and after the birth (because of our definition of participation, see section 3). All parents of a child aged three years benefit from free preschool services and the impact of childcare subsidies is less noticeable. Using periods close to the reform reduces the probability to capture in the estimate the potential feedback effect of the policy on the birth rate. Some families may choose to have another child thanks to the decrease in the childcare cost, but it is unlikely that this effect was immediate. The technical details of the reform (specifically the precise schedule) was not known before the end of 2003. We also perform alternative specifications which are exposed below (see subsection 9).

The underlying assumption is that even if the distribution of unobservables that can alter the choice to participate may be different between the populations of mothers of a one-year-old child and mothers of a two-year-old child, these differences are stable over time. Similarly, some

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[4]This slightly differs from the usual design of a difference-in-differences estimator: usually it compares the change before and after the introduction of a program with the temporal change observed for a control group (who is not affected by the program). In our case we compare the former with the temporal change observed for a group who benefits from the program in both periods.

determinants of participation (the tax system for instance) may have changed over the period, but in the same way for both populations. Let us take the example of the tax credit granted to households who use childcare out of the home: until 2005 it was a 25% refund of the net cost, then the refund was set at 50%. This additional reform affects the two populations in the same way and its effects are expected to be neutralized by the difference-in-differences estimator.

If this identification assumption holds, then a change in the behavior of households with a two-year-old child between 2005 and 2006 which exceeds the one observed for households with a one-year-old child between the same years can be attributed to the new scheme of child subsidies. Figures 6 and 8 support this assumption: between 2006 and 2009, a period when the scheme subsidies evolved in the same way for all households whose youngest child is one or two years old, the evolutions of these outcome variables are very close. The evolution for earnings (Figure 9) is less homogeneous, though.

In practice, we control for some variables which can have an impact on participation rate and whose distribution may have changed over time in different ways within the subsamples. In particular, we use the male income (dummies for the quintiles of male income) and the local number of daycare places (number of nurseries and childcare providers per 100 children under three years old) as a proxy for the cost of paid daycare. We use the level observed the year before in order to prevent reverse effects. We also control for demographic characteristics (number of children aged eighteen or less, aged six or less and under three years old in the family, twins dummy, single-parent-family dummy, woman's age brackets, and couple's age difference brackets). A description of the sample is presented in Appendix B.

As we use exhaustive data, these variables are not expected to vary a lot over the different subgroups because of sample variation. One cannot exclude however that the composition of these subsamples changes if the reform had an impact on the birth rate, and that this effect is specific to some types of households (for instance, those who are more financially constrained). We discuss this point later.

Formally, our assumption states that conditional to these covariates, the average participation rate (respectively use of paid childcare services and female earnings) of mothers of a young child of age a at year t can be additively broken down into a yearly impact and an age effect. In practice, estimates can be simply obtained by standard OLS, using:

$$Y_{it} = \alpha + \beta_a \mathbb{1}_{a_i=2} + \beta_t \mathbb{1}_{t=2006} + \delta \mathbb{1}_{a_i=2,t=2006} + X_{it}\beta + u_{it} \qquad (1)$$

where t denotes the year (t=2005 or 2006) and a the age of the youngest child (a=1 or 2). The impact of the policy is captured by δ.

Basic statistics provide a first insight of our results (see Table 3). The participation rate of mothers of a two-year-old child is 1.6 point higher in 2006 than in 2005, an increase much higher than the 0.5 change observed in the same period for mothers of a one-year-old child. All in all, this suggests an increase of 1.1 percentage point in the participation rate of mothers of young children. We also observe an overall increase of 1.5 point of paid childcare use.

The results are very similar when controlling for observable characteristics. The reform in the subsidy schedule results in an increase in the participation rate of mothers of young children by one point of percentage. This effect is slightly larger when restricting to the employment rate

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Table 3: Participation rate, employment rate and proportion of paid daycare

	PARTICI- -PATION	EMPLOY- -MENT RATE	USE OF PAID DAYCARE	MALE PARTICI- -PATION RATE
2005, 1-year-old child	73.6	70.7	43.9	96.9
2006, 1-year-old child	74.1	71.9	46.2	96.9
2005, 2-year-old child	68.3	65.5	44.6	96.8
2006, 2-year-old child	69.9	67.8	48.4	96.8
Double difference	1.1	1.1	1.5	0.0

Source: Income Tax Return Database
Note: Sample restricted to households present in 2005 and 2006, including a woman aged 20-55 and whose youngest child is one year old or two years old.

(Table 4). The impact on average wages (conditional on working) is negative, consistently with a decrease in the reservation wage of mothers. We discuss this point below (see section 5).

The impact on mothers' employment is achieved by an increase in the use of paid child-care, as the reform alleviates the cost of this daycare for families (see Table 5). The effect is higher by 50% than the effect on participation, though. This is probably because the reform has induced a substitution of informal care (by parents' relatives or "black-market" childcare) by formal paid daycare for women who were working anyway. The reform also decreases the average amount of declared daycare cost by 11%. This decrease reflects, at least partly, the fact that our amount of declared childcare cost is an amount after deduction of subsidies: a rise in subsidies mechanically results in a decrease in this amount. As suggested by descriptive evidence, fatherhood has no impact on labor force participation. The reform does not change this situation.

Table 4 suggests that the mothers' participation rate increases with the quintiles of male income. This positive correlation can be explained by the rather high level of homogamy. Marriage is more frequent amongst individuals who are similar to each other in terms, in particular, of socio-economic status and/or qualification level. This suggests that a man with high income is more frequently married with a woman with high potential earnings (because for instance of similar levels of education). She is thus more likely to participate in the labor force.

Table 4: Impact of the reform on mother employment and earnings

	Participation rate	Employment rate	Earnings (Log) (a)
New scheme	0.0108*** (0.0011)	0.0112*** (0.0011)	−0.0100** (0.0039)
Age and year dummies			
1-year-old child	Ref (−)	Ref (−)	Ref (−)
2-year-old child	−0.0549*** (0.0008)	−0.0550*** (0.0008)	0.1683*** (0.0028)
Year 2005 dummy	Ref (−)	Ref (−)	Ref (−)
Year 2006 dummy	0.0026*** (0.0008)	0.0087*** (0.0008)	0.0167*** (0.0027)
Density of childcare places			
Nannies	0.0020*** (0.0000)	0.0021*** (0.0000)	0.0021*** (0.0001)
Collective nurseries	0.0032*** (0.0001)	0.0030*** (0.0001)	0.0144*** (0.0002)
Family nurseries	0.0081*** (0.0001)	0.0082*** (0.0001)	0.0233*** (0.0005)
Number of children under 18			
1	Ref (−)	Ref (−)	Ref (−)
2	−0.2077*** (0.0009)	−0.1941*** (0.0010)	−0.4968*** (0.0035)
3 or more	−0.4192*** (0.0010)	−0.4020*** (0.0011)	−0.9254*** (0.0041)
Number of children under 6			
1	Ref (−)	Ref (−)	Ref (−)
2	−0.0090*** (0.0009)	−0.0078*** (0.0009)	0.1233*** (0.0034)
3 or more	−0.0603*** (0.0016)	−0.0554*** (0.0016)	0.1912*** (0.0069)
Number of children under 3			
1	Ref (−)	Ref (−)	Ref (−)
2 or more	0.0013^{ns} (0.0010)	−0.0055*** (0.0010)	−0.1153*** (0.0038)
Twins dummy	0.0358*** (0.0022)	0.0382*** (0.0023)	−0.0097^{ns} (0.0088)
Single parent family dummy	−0.0613*** (0.0013)	−0.0694*** (0.0013)	−0.2022*** (0.0047)
Male income			
1st quintile	−0.0793*** (0.0013)	−0.0850*** (0.0013)	−0.0218*** (0.0051)
2nd quintile	−0.0350*** (0.0015)	−0.0425*** (0.0016)	−0.0895*** (0.0058)
3rd quintile	Ref (−)	Ref (−)	Ref (−)
4th quintile	0.0407*** (0.0010)	0.0468*** (0.0010)	0.1215*** (0.0036)
5th quintile	0.0722*** (0.0010)	0.0786*** (0.0010)	0.3616*** (0.0036)
Age of mother			
≤25	−0.1541*** (0.0010)	−0.1568*** (0.0011)	−0.8106*** (0.0038)
26-30	−0.0488*** (0.0007)	−0.0491*** (0.0007)	−0.2604*** (0.0025)
31-35	Ref (−)	Ref (−)	Ref (−)
36-40	0.0097*** (0.0008)	0.0076*** (0.0008)	0.1403*** (0.0029)
≥41	−0.0182*** (0.0013)	−0.0224*** (0.0013)	0.1658*** (0.0049)
Couple's age difference			
lower than 5 years	Ref (−)	Ref (−)	Ref (−)
5 to 14 years	−0.0623*** (0.0006)	−0.0641*** (0.0007)	−0.1437*** (0.0024)
15 years or more	−0.2267*** (0.0020)	−0.2226*** (0.0021)	−0.4141*** (0.0092)
Intercept	0.8293*** (0.0017)	0.7868*** (0.0017)	9.0568*** (0.0061)

Source: Income Tax Return Database
Note: Sample restricted to households present in 2005 and 2006, including a woman aged 20-55 and whose youngest child is one year old or two years old.

Table 5: Impact of the reform on the use of paid daycare and father participation rate.

	USE OF PAID DAYCARE	CHILDCARE EXPENSES (LOG) (B)	MALE PARTICI- pation rate
New scheme	0.0175*** (0.0012)	−0.1115*** (0.0043)	0.0001 (0.0005)
Age and year dummies			
1-year-old child	*Ref* (−)	*Ref* (−)	*Ref* (−)
2-year-old child	0.0009 (0.0009)	0.1729*** (0.0031)	−0.0017*** (0.0003)
Year 2005 dummy	*Ref* (−)	*Ref* (−)	*Ref* (−)
Year 2006 dummy	0.0129*** (0.0008)	0.0932*** (0.0030)	−0.0006* (0.0003)
Density of childcare places			
Nannies	0.0036*** (0.0000)	−0.0033*** (0.0001)	0.0004*** (0.0000)
Collective nurseries	0.0029*** (0.0001)	0.0190*** (0.0002)	0.0000 (0.0000)
Family nurseries	0.0032*** (0.0002)	0.0547*** (0.0005)	0.0020*** (0.0001)
Number of children under 18			
1	*Ref* (−)	*Ref* (−)	*Ref* (−)
2	−0.2113*** (0.0010)	−0.3531*** (0.0040)	−0.0032*** (0.0004)
3 or more	−0.4280*** (0.0011)	−0.8001*** (0.0048)	−0.0161*** (0.0005)
Number of children under 6			
1	*Ref* (−)	*Ref* (−)	*Ref* (−)
2	0.0594*** (0.0010)	0.0705*** (0.0039)	0.0024*** (0.0004)
3 or more	0.0739*** (0.0017)	0.0551*** (0.0080)	−0.0042*** (0.0007)
Number of children under 3			
1	*Ref* (−)	*Ref* (−)	*Ref* (−)
2 or more	−0.0008 (0.0011)	0.2159*** (0.0042)	−0.0088*** (0.0004)
Twins dummy	−0.0036 (0.0024)	0.0203** (0.0098)	0.0112*** (0.0010)
Single parent family dummy	−0.0862*** (0.0014)	−0.0821*** (0.0059)	−*** (.)
Male income			
1st quintile	−0.1129*** (0.0014)	−0.0459*** (0.0069)	− (−)
2nd quintile	−0.0625*** (0.0017)	−0.0395*** (0.0075)	− (−)
3rd quintile	*Ref* (−)	*Ref* (−)	*Ref* (−)
4th quintile	0.0864*** (0.0011)	0.1128*** (0.0042)	− (−)
5th quintile	0.2055*** (0.0011)	0.4376*** (0.0041)	− (−)
Age of mother			
<=25	−0.2770*** (0.0011)	−0.5485*** (0.0050)	−0.0105*** (0.0005)
26-30	−0.0825*** (0.0008)	−0.1893*** (0.0027)	0.0003 (0.0003)
31-35	*Ref* (−)	*Ref* (−)	*Ref* (−)
36-40	0.0158*** (0.0009)	0.0723*** (0.0031)	−0.0079*** (0.0004)
>=41	−0.0222*** (0.0014)	0.0663*** (0.0054)	−0.0312*** (0.0006)
Couple's age difference			
lower than 5 years	*Ref* (−)	*Ref* (−)	*Ref* (−)
5 to 14 years	−0.0646*** (0.0007)	−0.0616*** (0.0026)	−0.0149*** (0.0003)
15 years or more	−0.1651*** (0.0022)	−0.1504*** (0.0115)	−0.1185*** (0.0008)
Intercept	0.4378*** (0.0018)	6.6074*** (0.0069)	0.9672*** (0.0007)

Source: Income Tax Return Database
Note: Sample restricted to households present in 2005 and 2006, including a woman aged 20-55 and whose youngest child is one or two years old. (b) for households declaring strictly positive paid daycare.

Table 6: Impact of the reform on participation rate and use of childcare services, by family size

	All Families	One Child only	Two children	Three children or more
Female participation rate	0.0108*** (0.0011)	0.0015^{ns} (0.0013)	0.0157*** (0.0019)	0.0164*** (0.0027)
Female employment rate	0.0112*** (0.0011)	0.0027* (0.0015)	0.0163*** (0.0019)	0.0161*** (0.0027)
Female wage (a)	−0.0100** (0.0039)	0.0048^{ns} (0.0046)	−0.0254*** (0.0069)	−0.0256** (0.0128)
Use of childcare services (b)	0.0175*** (0.0012)	0.0167*** (0.0019)	0.0215*** (0.0020)	0.0116*** (0.0022)
Expenses in childcare services	−0.1115*** (0.0043)	−0.1693*** (0.0056)	−0.0850*** (0.0071)	0.0285** (0.0140)
Male participation rate	$0,0001^{ns}$ (0,0005)	$−0,0004^{ns}$ (0,0007)	$−0,0002^{ns}$ (0,0007)	$0,0012^{ns}$ (0,0012)

Source: Income Tax Return Database
Notes: Sample restricted to households present in 2005 and 2006, including a woman aged 20-55 and whose youngest child is one or two years old. Covariates are the same as in Table 4. Only the coefficient corresponding to the impact of the measure ("New scheme") is reported. (a) Restriction to employed women. (b) Restriction to households who have reported strictly positive childcare expenses.

Results dramatically vary with family size. The program does not appear to affect the average participation rate of one-child mothers (see Table 6). By contrast, according to our results the use of paid daycare increases by 1.6 percentage point for these households. This again can result from a substitution between formal and informal care. The absence of effect on participation seems consistent with the fact that French mothers do not change their employment status after the first child. The participation rate of mothers of one child is indeed very close to the participation rate of women without any child (see Table 1).

Let us note that the PAJE program introduced mixed incentives for mothers of one child. Together with a decrease in the cost of paid childcare, the PAJE reform indeed created a six-month paid parental leave (which allows women to be out of the labor market, but also to work part-time with a subsidy partially compensating the loss of salary). Parents of only one child are thus likely to be out of the labor force because of parental leave during a part of the first year of the child. In our main sample estimates, parents of a one-year-old child are all in the new system: we consequently do not expect to measure a direct impact of this new parental leave in our estimates.[5]

A closer look at the "intensity" of participation (Table 7) reveals that the overall null impact of the PAJE reform on the labor force participation of one-child mothers results from two opposite effects. We indeed observe a 0.8 point increase in the proportion of one-child mothers who declare earnings greater than the minimum wage. By contrast, the proportion of such mothers who declare lower earnings decreases (by 0.2 point of percentage, significant at 5%). Annual earnings lower than the minimum wage correspond to employment which is not full-year or not full-time. While very few women stop working after the birth of their first child - even before the reform -, some tend to reduce their working time to take care of their children. Our results suggest that because of the decrease in childcare cost induced by the reform, some of these mothers chose to keep full-time occupation.

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[5]However, this parental leave could have long-lasting effects on careers (see for instance Lequien, 2012 on previous experience of the introduction of a - longer - parental leave for mothers of two children in 1994).

Table 7: Impact on the reform on the intensity of labor force participation of mothers, by family size

	All Families	One Child only	Two children	Three children or more
< 0.5 annual minimum wage	0.0032*** (0.0009)	−0.0029** (0.0015)	0.0057*** (0.0015)	0.0084*** (0.0020)
0.5-1 annual minimum wage	0.0012^{ns} (0.0008)	−0.0028* (0.0015)	0.0033** (0.0013)	0.0041*** (0.0015)
>1 annual minimum wage	0.0069*** (0.0012)	0.0084*** (0.0020)	0.0073*** (0.0020)	0.0034^{ns} (0.0022)

Source: Income Tax Return Database
Notes: Covariates are the same than in Table 4. Only the coefficient corresponding to the impact of the measure is reported.

Results for large families are diametrically opposed. The participation rate of mothers of three children increases by 1.6 percentage point, from an initial level of 42%. This is achieved mostly through an increase in the proportion of low earnings mothers (less than one half of the minimum wage level), in opposite to what is observed for smaller families. This suggests that the reform enticed mothers of large families to participate in the labor force with part-time jobs.

The contrast is also noticeable with respect to the estimated impact on the use of paid childcare. For these large families, the impact on the use of childcare is somewhat smaller at the extensive margin (1.2 point of percentage), but our results suggest an increase at the intensive margin: the average amount increased by 2.9% (significant at 5%) - despite the rise in subsidies which tends to decrease these childcare expenses net of subsidies (see section 3). Even before the reform, staying-at-home mothers in large families were more likely to use paid daycare for small amount of time (to get some spare time for instance), all the more so as the thresholds corresponding to the scheme of childcare subsidies increase with the family size. The reform apparently increased this difference.

All in all, for all families on average the policy results in an increase in both mothers' full-time employment and non-regular employment (with a reduced number of working hours). The reform increased the proportion of mothers earning more than the minimum wage by 0.7 point of percentage (from an initial level of 11%) and that of mothers earning less than half the minimum wage by 0.3 point of percentage (from an initial level of 12%). For intermediate earnings, the positive impact for two-children families is offset by a negative impact on one-child families.

Robustness checks and discussion

Our results appear robust to several robustness checks. The first test uses the same period but an alternative group for controlling for temporal change between 2005 and 2006, the parents of a child aged three (instead of one). The second is a so-called "placebo" test and use an identification strategy which is similar to that of our main specification, but a period not affected by the reform. While in the former case we obtain very similar results to those obtained in the main specification, in the latter we - as expected - do not observe a significant impact on the main outcomes of interest. Finally, an alternative specification suggests that the reform has hardly had any positive impact on the outcomes of families with a three-year-old child, consistently with the existence of free preschool services for these families.

The first robustness test aims at checking that our estimations are not biased by, for instance,

Table 8: Alternative Identification Strategy

	Year	Age of the youngest child	Year	Age of the youngest child
A2		2 years old		3 years old
	2005	*OLD*	2005	*OLD*
	2006	NEW	2006	*OLD*
P1		1 year old		2 years old
	2007	NEW	2007	NEW
	2008	NEW	2008	NEW
A3		2 years old		3 years old
	2006	NEW	2006	*OLD*
	2007	NEW	2007	NEW

a change in the birth rate induced by the reform. The expectation of a decrease in the cost of childcare may indeed lead some women to postpone motherhood. Such effects have been documented in the literature. Using a reform extending the duration of the paid parental leave, Lalive and Zweimüller (2009), for instance, present evidence of such an effect for Austria.[6] As the technical details of the reform (specifically the precise schedule of subsidies) was not known before the end of 2003, it is unlikely to have affected the number of births before 2005. It is possible however that some births can be attributed to the reform after this date. In this case, the composition of the population of parents of a young child aged one in 2006 (thus born in 2005) can be different from its counterpart in 2005 (born in 2004). Put it differently, this effect can challenge our underlying assumption that the impact of the reform on parents of a one-year-old child is the same in 2005 and 2006.

In order to test the robustness of our results, we use an alternative group to control for the temporal evolution in outcomes. More specifically, we use mothers whose youngest child is three years old in 2005 or in 2006. These children were all born before the introduction of the reform and thus cannot be affected by any birth impact. It thus provides an alternative (and more usual) control group for a difference-in-differences estimator. We compare the change in behavior of families whose youngest child is two years old with those whose youngest child is three years old (specification A2 in Table 8). In the period used for the estimation, only one of these four populations is in the new system: the latter group still depends on the old scheme of childcare subsidies, while it is the case for the former group only in the first year. The results appear similar to those obtained in our main specification (see Table 9).

This strengthens our hypothesis of an absence of significant fecundity effect which could have otherwise put the results of our main specification in question. This is also in line with descriptive evidence. The evolution of the birth rate indeed suggests that the impact of the reform was, if any, not detectable before 2006 (see Figure 12).

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[6]For France, Laroque and Salanié (2005) show evidence of the impact of the French tax scheme on fertility but Piketty (2003) does not conclude to a large impact on fertility rate of the introduction of the three-year "stay-at-home" subsidies created in 1993. In terms of financial incentives, the PAJE reform is of small scale compared to the general French tax-benefit system.

Table 9: Impact of the reform on participation rate and use of childcare services, alternative specifications

	Base estimate	Alternative A2	"Placebo"	Alternative A3
Female participation rate	0.0108***	0.0091***	0.0018*	−0.0026**
	(0.0011)	(0.0011)	(0.0011)	(0.0011)
Female employment rate	0.0112***	0.0048***	0.0010	−0.0009
	(0.0011)	(0.0012)	(0.0011)	(0.0012)
Female wage (a)	−0.0100**	−0.0094**	−0.0165***	−0.0004
	(0.0039)	(0.0039)	(0.0038)	(0.0038)
Use of childcare services (b)	0.0175***	0.0100***	−0.0015	0.0135***
	(0.0012)	(0.0013)	(0.0012)	(0.0013)
Expenses in childcare services	−0.1115***	−0.0713***	−0.0056	−0.0419***
	(0.0043)	(0.0048)	(0.0041)	(0.0046)
Male participation rate	0,0001	0.0002	0.0010**	0.0003
	(0,0005)	(0.0005)	(0.0005)	(0.0005)

Source: Income Tax Return Database
Notes: Covariates are the same than in Table 4. Only the coefficient corresponding to the impact of the measure is reported. (a) Among women who are employed. (b) Among households who use paid childcare
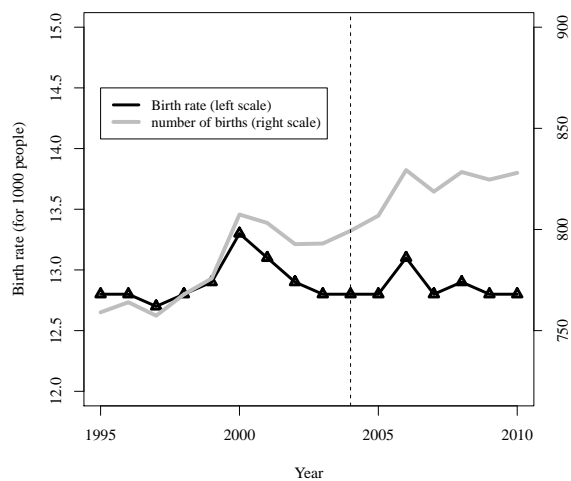
Figure 12: Birth rate and number of births in France, 1995-2010.
Source : Insee

We also apply the same specification as in our main strategy, but using periods with no change in the childcare subsidies system (specification P1). We will thus estimate the effect of a "non-happened" reform. Finding a null effect reinforces our strategy, if it does not prove it (as it concerns a different period of time). This is the case for almost all our variables of interest. However, we observe an impact on the log earnings of the mothers which is negative, and a small positive impact on the male participation rate. These surprising results can be due to the surge in the birth rate observed in 2006 (see Figure 12). For the sake of illustration, let us assume that parents who choose to have another child in 2006 are slightly less well-off than usual. In this case the difference in female log earnings between the as-if treated (families with a two-year-old child in 2008) and their counterpart one year before is downward biased. On the contrary, the difference between families with a one-year-old child in 2008 and their counterpart in 2007 could be upward biased by this composition effect. The difference in difference estimators on earnings using this period thus concludes to a negative effect, because of the cumulative effect of these two biases.[7]

Finally, the reform does not have any impact on the participation of mothers of a three-year-old child (specification A3 in Table 9). As all parents of a child aged three years benefit from a free preschool from September, the increase in childcare subsidies should not make a difference on the labor force participation at the end of the year, and then on the participation as we measure it in our database (we consider a woman as active if her yearly earned income is not zero, see section 3). The estimates are performed comparing parents of two-year-old and three-year-old children in 2006 and 2007 (specification A3 in Table 8). They correspond to the same subpopulations we use in our main specification, but one year later. By contrast, this suggests that the increase in participation rate obtained when these same children are two is not due to specificities in these subpopulations but to the impact of childcare subsidies. We also observe a positive impact on the use of paid childcare. Until September, most parents must indeed find a paid childcare facility. The effect we find is consequently the continuation of the one we found for two-year-old children. Its slightly lower magnitude may be explained by the fact some children enter preschool at the age of two.

5   Male income and female participation to the labor force

As for now, our estimation strategy aims at estimating an average affect of the new scheme of subsidies. As we showed with Figure 2, the new scheme entailed higher subsidy entitlements the the old one, whatever the household income was. Yet the extent of the increase in the subsidies depends on the household income, with a very irregular pattern. In this last part of the paper, we investigate the question of the heterogeneity of the effect. Modelizing the heterogeneity in the level of the "treatment exposure" is not straightforward to estimate, though. The scheme relies on the total income of the households and is thus endogenous to the decision to participate in the labor force. We thus choose to estimate separately the impact of the reform depending on male income. Stylized facts suggest that nor men' decision to participate in the labor force nor men' earnings are affected by the presence of a child (see previous estimates for instance). As the scheme apply to all earnings, the analysis is not straightforward. A simple model of labor market participation of mothers helps to illustrate the link between the scheme of childcare subsidies, the male income, and the individual heterogeneity of mothers. It clarifies the impact of the discontinuities in incentives on mothers to participate in the labor force created by this

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[7]This surge can be due to a delayed impact of the reform of childcare subsidies on birth rate. Further investigations would be necessary to conclude.

scheme. We provide comparative statics for the effect of the subsidies scheme on labor force participation of mothers. We provide estimate using a decomposition of households according to the male income that reflects this difference in incentives created by the new scheme. We find that this reform significantly affects the households respectively in the lowest and the highest brackets, meaning those with relatively low ex ante female participation rate.

Let us assume that the utility function U_i of a mother i depends on consumption C and on the fact of staying at home L ($L = 1 - P$, where P is participation to the labor market). For the sake of simplicity we assume that this utility is additively separable into its two components

$$U_i(L, C) = u(\rho_i L) + v(C)$$

ρ_i is a scale parameter that indicates that one individual may valuate more or less the fact of staying at home. We can define $\alpha_i = u(\rho_i) - u(0)$ that may be interpreted as the individual preference for staying at home.

In a static framework, we have the budget constraint:

$$C_i = R_i + \mathbb{1}_{P_i=1}(\tilde{w}_i - D_i + A_1(R_i + \tilde{w}_i)) + (1 - \mathbb{1}_{P_i=1})A_2(R_i)$$

With $\tilde{w}_i$ the wage the mother would earn if she chooses to work outside the house, R_i the other income of the household i (essentially the male earned income, so we design it hereafter as male income), D_i the gross cost of the daycare (before taking into account subsidies), A the amount of childcare subsidies. A depends on the total income of the household, $R_i + \tilde{w}_i$, with a different scheme for double-income families and single-income families (A_1 and A_2 respectively). In accordance with the actual system of childcare subsidies, we assume that single-income couples receive a base subsidy a_0 provided that the single income is under a threshold T_{SI} (we assume they do not use a paid daycare). Double-income families receive this base subsidy if their total income is below a certain income threshold, but they also benefit from a childcare subsidy if they use a paid childcare. In the end, the scheme of subsidies corresponds to K possible amounts of total subsidies[8] a_k ($K = 4$ in the old scheme, $K = 3$ in the new one) corresponding to thresholds T_k, $k = 0..K$.[9] We have $A_1(R_i + \tilde{w}_i) = \sum_{k=1}^{K} a_k \cdot \mathbb{1}_{T_{k-1} < R_i + \tilde{w}_i \leq T_k}$ and $A_2(R_i) = a_0 \cdot \mathbb{1}_{R_i < T^{SI}}$.

A mother participates when the utility of staying at home does not exceed the utility of working, meaning:

$$u(\rho_i) - u(0) \leq v(R_i + \tilde{w}_i - D_i + A_1(R_i + \tilde{w}_i)) - v(R_i + A_2(R_i)) \qquad (2)$$

In order to keep the model tractable, we made several choices. Firstly, we choose not to explicitly model the choice of the amount of working time in case of participation, and to concentrate only on the decision to participate or not to the labor force. Using a continuous variable for working time would lead the calculation to be more complex without changing the main issue. This choice is also consistent with the subsidies scheme, as the threshold for being entitled to the base subsidy increases by more than a third as soon as the mother participates to the labor force. Secondly, for the sake of simplicity we do not model the whole French tax and benefit system (see Laroque and Salanie, 2002, for a complete description of the tax and benefit system and the related incentives). The French personal income tax system can distort the choice of participation for women, as it favors single-income couples compared to double-income ones.

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[8]Sum of base subsidy and childcare subsidy

[9]By convention we denote $T_0 = 0$ and $T_K = +\infty$.

This tax scheme was stable at the time of the reform of childcare subsidies scheme, though. We assume it does not change comparative statics analysis.[10] Finally, consistently with descriptive evidence (see Table 1), we assume that men's decision to participate or not to the labor force is not affected by the presence of a child. The male income R_i is thus considered as exogenous.

It can be shown (see Appendix D) that the participation decision depends on the triplet $(R_i, \tilde{w}_i, \alpha_i)$. We can use this model for comparative statistics. For instance, for a fixed individual preference α_i we part the plan $(R_i, \tilde{w}_i)$ in regions where it is optimal to participate and others where it is not (see Figure 13 for $\alpha_i = 10$). For $T_{k-1} - R_i < \tilde{w}_i < T_k - R_i$, a woman participates provided that her potential earnings $\tilde{w}_i$ is higher than the critical value $\tilde{w}^*_{k,i}$ (see details of the calculation in appendix D). It can be interpreted as a reservation wage.[11] This provides a partition of the space defined by $(\tilde{w}_i, R_i)$ between areas in which the optimal choice is to participate in the labor force (for a given α_i, grey areas in the figure) and other areas in which the optimal choice is to not participate. For each value of k, the reservation wage $\tilde{w}^*_k(\alpha_i, R_i)$ increases with the individual utility of staying at home α_i and with the cost of the paid childcare D_i, and it decreases with the childcare subsidy a_k. For a given value of α_i, the mother's reservation wage is also an increasing function of the male income R_i almost everywhere. The scheme creates some discontinuities, though, as the mother's reservation wage generally increases sharply for male outcome around the thresholds corresponding to the entitlement (or not) of the childcare subsidies. The scheme of subsidies consequently creates disincentive effects around the thresholds. However, it also provides incentive effects, as the threshold for the base subsidy (with this subsidy households approximately get 2,000 euros a year, see Appendix A) is lower for single-income families (we denote it T_{SI}). Indeed, for a range of values of the male income R_i the reservation wage of female labor supply is quite low: it corresponds to values such that single-income households do not benefit from the base subsidy, but would benefit from subsidies if the mother participates to the labor force (the household's income must however stay under the eligibility threshold of double-income households).[12]

The reform of the childbearing subsidies schedule increases the amount of the subsidies a_k (k=1,...,K) as well as the thresholds T_k (k=1,...,K-1). It results in a decrease in the reservation wage almost everywhere (Figure 13, right). The evaluation of the magnitude of this effect is not straightforward, however. It depends on the joint distribution of the male income, the potential wage and the individual preference for staying at home $(R, \tilde{w}, \alpha)$. For instance, if the support of the distribution of the individual preferences for staying at home α is higher than the critical value α^* (over which it is optimal for a woman to stay at home given R and w, see Appendix D) in both schemes for a large range of values of $(R, \tilde{w})$, the reform will hardly have any effect on labor participation.

The joint distribution of the triplet is not known, and its two last terms (α and $\tilde{w}$) are unobservable. The potential wage $\tilde{w}_i$ is indeed observed only for women such that $\alpha_i < \alpha^*(\tilde{w}_i, R_i)$: one cannot directly estimate it thanks to the average observed wage of mothers who choose to

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[10]A more complete modeling of these choices is provided for instance in Choné et al. (2004). More recently, Allègre et al. (2012) provide an accurate estimation of the cost of various childcare and tax schemes and their consequences on the participation of mothers.

[11]By abuse of language: for some values of the male income R (around the thresholds of the subsidy scheme), the support of the values of potential wage for which it is optimal to participate is not compact.

[12]This effect can be mitigated by the French tax system, which increases the actual marginal tax rates for double-income families compared to single-income families.
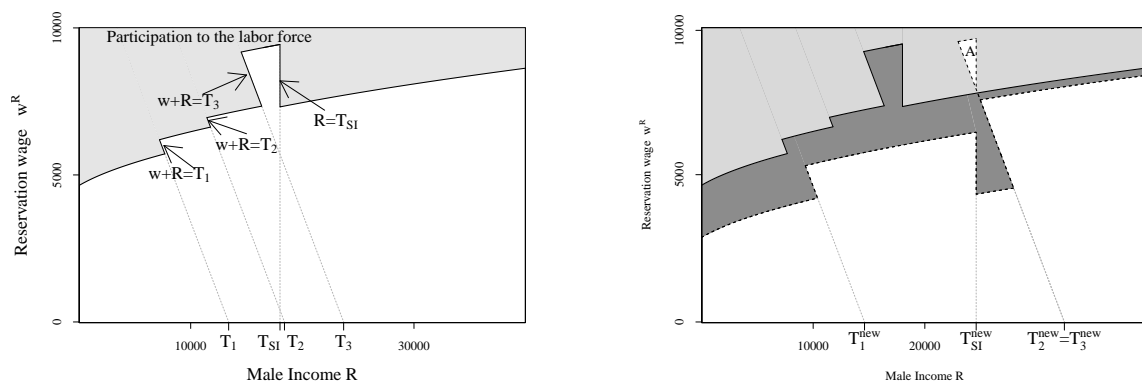
Figure 13: Utility of staying at home according to male income, in the old system (Left) and in both the old and the new systems (Right)

Note: We assume a constant elasticity utility function, $v(C) = C^\rho$, $\rho = 0.5$. The cost of paid childcare is set at its average level in 2005 (515 euros per month, see Blanpain, 2009). The amount of childcare subsidies and the thresholds are those prevailing in 2005 for one-child households, with the youngest child born before 2004 and after 2004 ($T_1^{new} = 14,600$, $T_2^{new} = T_3^{new} = 32,500$ and $T_{SI}^{new} = 24,600$, $a_1^{new} = 6,280$, $a_2^{new} = 5,080$, $a_3^{new} = 1,900$ and $a_0^{new} = 1,980$ euros). The utility of staying at home α_i is fixed and set to 10.

participate in the labor force, as it depends on the endogenous decision to participate.[13]

The values of the male income that determine areas where the incentive to work is more or less important depend on these unobservable parameters (see calculations in Appendix D). As they monotonically increase with the individual preference for staying at home, we can however provide lower bounds of these values by taking $\alpha_i = 0$. We thus evaluate the impact of the reform decomposing the sample according to the brackets for the male income distribution (they are calculated for $\alpha_i = 0$, see Figure 14 and details in Table 16 in Appendix D).

Estimations for the average wage (see Table 10, last column) are in line with the changes in the reservation wage represented in Figure 14. We find for instance a significant decrease in the average female earnings for the first and third brackets. These brackets correspond to areas where the reservation wage is expected to drop thanks to the new scheme. We also observe an important (but hardly significant) decrease for households with male income in the sixth bracket. This bracket corresponds to male income just above the new threshold T_{SI}^{new} (where single-income families do not perceive the base subsidies while double-income families do). The impact is not so clear-cut for other brackets. These brackets are only an approximation of the theoretical ones (as they correspond to a null value for the preference for staying at home α). The actual effect can thus be blurred. Besides, the impact depends on the joint distribution on potential earnings, male income and preference for staying at home.

Estimations suggest that the positive impact of the reform on female labor force participation is due to households in both the lowest and the highest bracket. These households are those where female labor force participation was the lowest before the reform took place (see Table 16 in the appendix). The first bracket corresponds roughly to the median of the distribution of the male

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[13]The participation rate formally corresponds to

$$\int \tilde{w}_i \mathbb{1}_{\alpha_i < v(R_i + (\tilde{w}_i - D_i) + A_1(R_i + \tilde{w}_i)) - v(R_i + A_2(R_i))} dF(R_i, \tilde{w}_i, \alpha_i)$$
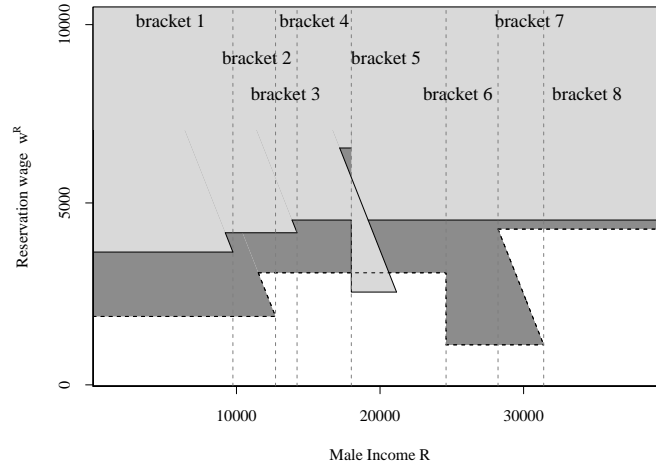
Figure 14: Female reservation wage according to male income, new and old scheme of childcare and childbearing subsidy ($\alpha_i = 0$)

income, while the highest to the 95th percentile of this distribution.

Table 10: Impact of the reform on female participation rate, employment and earnings

	PARTICIPATION RATE	EMPLOYMENT RATE	EARNINGS (LOG) (a)
bracket 1	0.0150*** (0.0016)	0.0150*** (0.0017)	−0.0197*** (0.0063)
bracket 2	0.0059** (0.0028)	0.0060** (0.0029)	0.0134 (0.0097)
bracket 3	0.0017 (0.0035)	0.0023 (0.0036)	−0.0367*** (0.0122)
bracket 4	0.0048 (0.0034)	0.0066* (0.0036)	0.0046 (0.0115)
bracket 5	0.0031 (0.0035)	0.0035 (0.0036)	−0.0056 (0.0119)
bracket 6	0.0059 (0.0071)	0.0101 (0.0074)	−0.0333 (0.0239)
bracket 7	0.0048 (0.0082)	0.0041 (0.0084)	−0.0081 (0.0281)
bracket 8	0.0123*** (0.0044)	0.0134*** (0.0046)	−0.0100 (0.0156)

Source: Income Tax Return Database
Note: Sample restricted to households present in 2005 and 2006, including a woman aged 20-55 and whose youngest child is one or two years old. The estimation includes the same explanatory variables as in the estimation presented in Table 4. (a) for women who are employed

6 Concluding remarks

This paper analyses the impact of a program increasing childcare subsidies that took place in France in 2004. Using a difference-in-differences strategy, we find that the substantial rise in subsidies (the cost decreased by approximately 50% on average) increased the use of paid childcare. The participation of mothers did not react in the same extent, however. This suggests that the rise in subsidies partly resulted in a substitution of informal care (by relatives or on the black market) by a more qualified care.

Besides, the seemingly low elasticity of participation of mothers to childcare subsidies has to be related to rationing in the market of childcare. As the demand for childcare places largely exceeds current supply, price effects on utilization rates and participation decisions can be low (see Boca and Vuri, 2007). In a rationed childcare market, the labor market participation of mothers reacts more to an increase in the number of childcare spots than to a decrease in their cost (for a discussion see Wrohlich, 2006). In the French case, the main observable adjustment in supply was a slight increase in the proportion of qualified childminders. As childminders privately negotiate the pay rate with the parents, it is also likely that the increase in the demand of childcare induced by the subsidies had an inflationary impact on this pay rate. This effect undermines the impact of the policy on childcare costs. Because of these retroactive effects of the decrease in childcare costs on the offer of paid daycare, the long-run impact of this program may be different from the short-run effect we empirically measured here. With the data at hand, we cannot estimate this effect that is left for future research.

Finally, a complete analysis of the measure requires to analyze its impact on the fertility decision. Descriptive evidence suggests that this effect was small for our estimation period. The fertility rate of French mothers was already high in 2004. It was close to two children per mother. We cannot rule out the possibility that the measure has delayed effects, and can explain, for instance the (temporarily) pick in fertility rate observed two years later. This issue is left for further research.

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A   A brief description of the French family policy

A.1   Childcare availability and costs

Table 11: Number of childminder and nursery places for 100 children aged 3 or less in 2007, regional variation in France

	Childminders	Nurseries
Mean	32.5	14.1
Standard error (*)	14.9	6.1
Minimum	6.1	4.0
Maximum	68.7	37.0

Source: Statistical services of the Ministry of Social Affairs (Drees)
Notes: (*) Dispersion measure between the 95 French counties ("départments"). Calculation of the authors.

A.2   Childcare subsidies

The household income taken into account by the French family allowance departments ("CAF" - Caisses d'Allocation Familiale) used for calculation approximatively corresponds to the "taxable income" (the income which is taken into account for income tax) of the household. This taxable income is smaller than the actual perceived yearly income. In 2005, two deductions of 10% and 20% respectively applied to the total declared income, and the taxable income corresponds to only 72% of the total income. The thresholds as well as the amount of subsidies are set according to reference values yearly re-evaluated according to rises in the cost of living index.

Table 12: Threshold levels (in euros) for calculation of the base subsidy in 2005, new and old system, for two-income couples and single-parent families.

Yearly household taxable income	New System	Old System
1 child	32,493	23,714
2 children	37,411	27,309
3 children	43,312	31,616
4 children or more	49,213	35,923

Source: Mémo social
Notes: Families whose youngest child is born after 2004/01/01 depend on the new system, those whose youngest child is born before depend on the old one. In the old system the base subsidy was called APJE ("Allocation Pour Jeune Enfant"), in the new PAJE-AB ("Allocation de Base"). For single-earner households, the amount is reduced by 7,900 € in the new system, 5,930 € in the old one. Because of tax reductions, in 2005 the taxable income corresponds to 72% of the actual declared income.
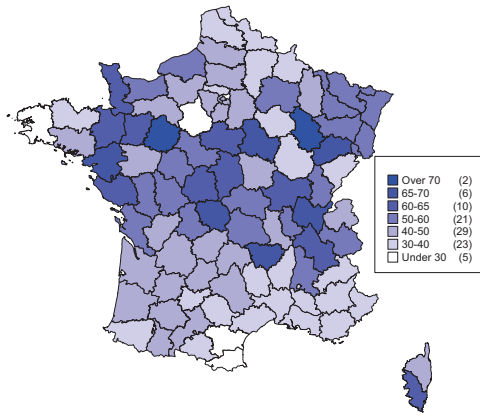
Figure 15: Number of childcare places for 100 children aged 3 or less by county, in 2007. Source: Statistical services of the Health Ministry (Drees), Bailleau (2009)
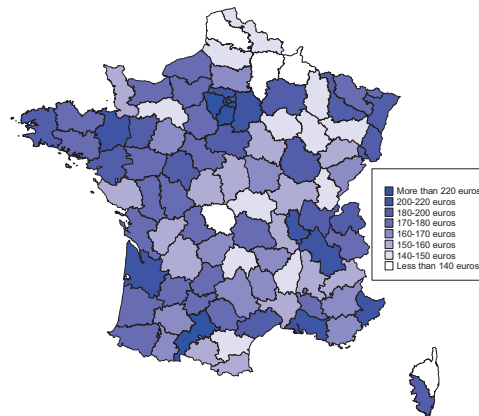
Figure 16: Net monthly childcare cost by county, in 2007 (children under 3 with a paying childcare solution). Source: Calculation of the authors thanks to our fiscal database.

Table 13: Calculation and amount of the childcare subsidy (in euros) in 2005, depending on the new and old system

Yearly household taxable income		New System	Old System
1 child	1st threshold	14,619	13,381
	2nd threshold	32,493	18,399
2 children	1st threshold	16,843	16,468
	2nd threshold	37,411	22,645
3 children	1st threshold	19,486	19,556
	2nd threshold	43,312	26,890
4 children or more	1st threshold	22,145	22,645
	2nd threshold	49,213	31,137
Monthly subsidy amount			
< 1st threshold		362	211
1st - 2nd threshold		259	167
> 2nd threshold		155	138

Source: Mémo social

Notes: Families with the youngest child born after 2004/01/01 depend on the new system, those with youngest child born before depend on the old one. In the old system this childcare subsidy was called AFEAMA ("Aide à la Famille pour l'Emploi d'une Assistante Maternelle"), in the new one PAJE-CMG ("Complément du Mode de Garde"). The subsidy amount is granted before the third birthday of the youngest child; before the sixth birthday family still perceive half of this amount. Because of tax reductions, in 2005 the taxable income corresponds to 72% of the actual declared income.

B Description of the sample

Table 14: Mean of control variables, main sample

Number of children under 18	
1	39.0
2	38.3
3 or more	22.7
Number of children under 6	
1	54.5
2	39.8
3 or more	5.7
Number of children under 3	
1	86.9
2 or more	13.1
Twins dummy	1.7
Single parent family dummy	9.2
Woman's age	
<=25	10.4
26-30	28.8
31-35	36.8
36-40	18.5
>=41	5.5
Couple's age difference	
lower than 5 years	63.1
5 to 14 years	25.8
15 years or more	1.9

Source: Income Tax Return Database
Notes: Sample restricted to households present in 2005 and 2006, including a woman aged 20-55 and whose youngest child is one year old or two years old.

C ILO Participation Rate

With the fiscal database, the participation is defined in a different way from usual ILO definition. Table 15 presents estimates from the LFS 2005 which correspond to those of Table 1. As the French LFS is a quarterly rotating sample, one could track part of the sample all over the year and estimate a participation rate more similar to the definition used for the fiscal database: having participated using the ILO definition at least one quarter during the year.

Table 15: Female participation rate according to family size (%), LFS 2005

| Family Size | ILO participation rate, 2005Q1 | | Participation rate at least one quarter in 2005 | |
	All	At least one child under 3	All	At least one child under 3
No child	82.8	-	84.8	-
At least a child	77.8	62.8	82.5	71.8
1 child	83.6	79.2	87.5	88.7
2 children	79.6	56.4	85.6	69.8
3 children or more	63.0	39.6	68.2	47.0
All couples	79.1		83.1	

Source: French labor Force Survey 2005
Scope: Women aged 20-55 in couple.
Note: The first two columns correspond to ILO participation rates for the first quarter of 2005, the next two columns to the sample of women interviewed all quarters of 2005, and who participated at least one quarter in 2005.

D A simple structural model for mother's participation: details

The notations are those provided in section 5. The optimal choice of a mother is to participate if and only if $\alpha_i < \alpha^*(R_i, \tilde{w}_i)$, for a cutoff value

$$\alpha^*(R_i, \tilde{w}_i) = v(R_i + \tilde{w}_i - D_i + A_1(R_i + \tilde{w}_i)) - v(R_i + A_2(R_i)) \tag{3}$$

As expected, this cutoff value is a decreasing function of the cost.

Setting the male income R_i constant, a critical value of the individual preference α_i as a function of the potential wage $\tilde{w}_i$ can be defined. As expressed in (3), the cutoff value in individual preference for staying at home increases with $\tilde{w}_i$ almost everywhere, but the scheme of childcare subsidies creates discontinuities. For a given male income R_i lower than the threshold T_k, we have:

$$\lim_{\tilde{w}_i \nearrow T_k - R_i} \alpha^*(R_i, \tilde{w}_i) - \lim_{\tilde{w}_i \searrow T_k - R_i} \alpha^*(R_i, \tilde{w}_i) > 0$$

This is illustrated by Figure 17 (left). Assuming that the parameter α_i corresponding to individual preference for staying at home is continuously distributed conditionally to income and wage $(R_i, \tilde{w}_i)$, the cutoff value α^* defines a region where the optimal choice of a mother is to participate (grey areas in the figure).
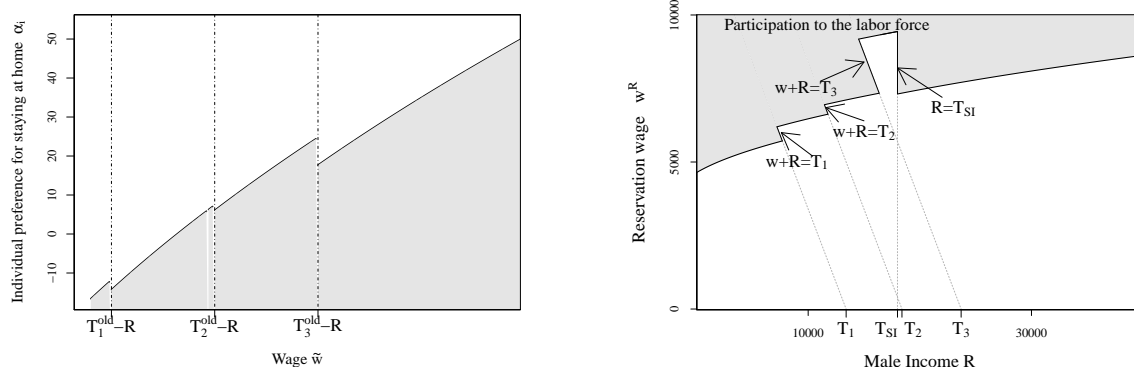
Figure 17: Impact on consumption utility of staying at home according to potential female wage (left) and on the female reservation wage according to the male income (right).

Note: We assume a constant elasticity utility function, $v(C) = C^\rho$, $\rho = 0.5$. The cost of paid childcare is set at its average level in 2005 (515 euros per month, see Blanpain, 2009). The amount of childcare subsidies and the thresholds are those prevailing in 2005 for one-child households, with the youngest child born before 2004 ($T_1^{old} = 13,400$, $T_2^{old} = 18,400$, $T_3^{old} = 23,700$, and $T_{SI}^{old} = 18,000$, $a_1^{old} = 4,510$, $a_2^{old} = 3,980$, $a_3^{old} = 3,630$, $a_4^{old} = 1,650$ and $a_0^{old} = 1,980$ euros). In the left figure the level of the outcome R_i is fixed and set to $12,000$ euros, in the second one the utility of staying at home α_i is fixed and set to 10.

Alternatively, setting the individual preference for staying at home α_i constant we can determine the respective values of $(\tilde{w}_i, R_i)$ so that the optimal choice of a mother is to participate. We have a relation similar to (3). A mother participates to the labor force if her individual preference for staying at home α_i is smaller than the difference in the utilities of consumption $v(R_i + \tilde{w}_i - D_i + A_1(R_i + \tilde{w})) - v(R_i + A_2(R_i))$. We assume that the utility function is strictly

increasing and invertible. Given the scheme of childcare subsidies, she participates provided that her expected wage w_i and the male income R_i are such that: for $T_{k-1} - R_i < \tilde{w}_i < T_k - R_i$,

$$\tilde{w}_i \geq \tilde{w}_k^*(\alpha_i, R_i)$$

$\tilde{w}_k^*$ can be interpreted as a reservation wage for mothers in households such that $T_{k-1} - R_i < \tilde{w}_i < T_k - R_i$:

$$\tilde{w}_k^*(\alpha_i, R_i) = v^{-1}(\alpha_i + v(R_i + A_2(R_i))) + D_i - R_i - a_k \tag{4}$$

For each k, this reservation wage increases with the individual preference for staying at home α_i, the cost of the paid childbearing D_i and the male income R_i. It decreases with the childcare subsidies a_k.

For a given value of α_i, let us consider the region of the plan $(R, \tilde{w})$ delineated by the lines $\tilde{w} + R = T_{k-1}$ and $\tilde{w} + R = T_k$. The intersections of the function defined by (4) and these lines correspond to :

$$
\begin{aligned}
S_k^{min} = \quad & \mathbb{1}_{R_i \leq T_{SI}} \cdot \min(T_{SI}, v^{-1}(v(T_{k-1} - D_i + a_k) - \alpha_i) - a_0) \\
+ \quad & \mathbb{1}_{R_i > T_{SI}} \cdot \max(T_{SI}, v^{-1}(v(T_{k-1} - D_i + a_k) - \alpha_i))
\end{aligned}
$$

and

$$
\begin{aligned}
S_k^{max} = \quad & \mathbb{1}_{R_i \leq T_{SI}} \cdot \min(T_{SI}, v^{-1}(v(T_k - D_i + a_k) - \alpha_i) - a_0) \\
+ \quad & \mathbb{1}_{R_i > T_{SI}} \cdot \max(T_{SI}, v^{-1}(v(T_k - D_i + a_k) - \alpha_i))
\end{aligned}
$$
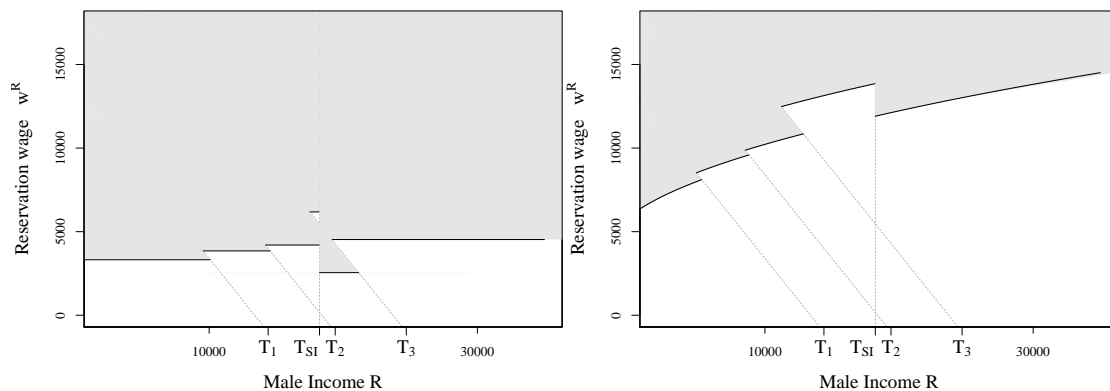
Figure 18: Impact on the female reservation wage according to the male income for $\alpha_i = 0$ (left) and $\alpha_i = 25$ (right).

For each α_i, it provides a partition of the plan defined by $(R, \tilde{w})$ where the optimal choice for a mother is to participate. The utility function of consumption v is assumed isoelastic, $v(x) = x^\rho$ with $\rho = 0.5$. The values of the subsidies scheme correspond to actual values of the previous one for one-child families. This is represented in Figure 17 (right) for $\alpha = 10$. It illustrates the discontinuities in incentives created by the subsidies scheme. Figure 18 gives an idea of the sensibility of this pattern to the values of α_i: Figure 18 (left) presents the reservation wage
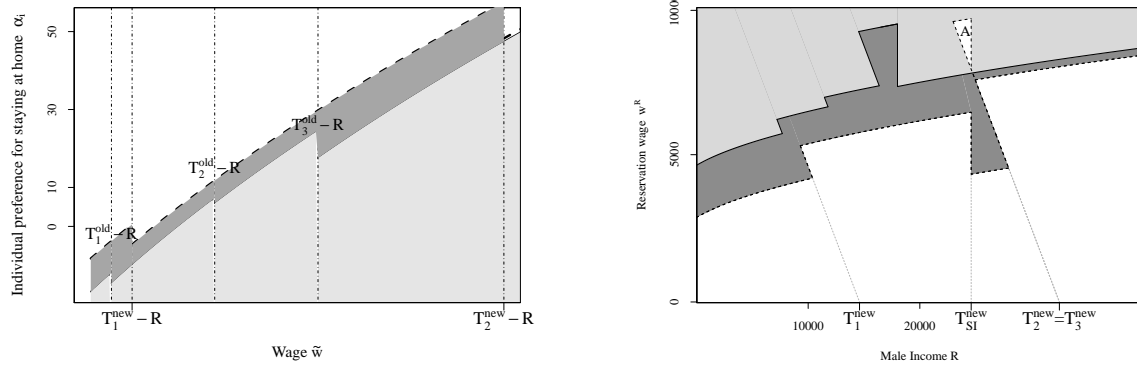
Figure 19: Impact on consumption utility of staying at home according to potential female wage (left) and female reservation wage according to male income (right), new and old scheme of childcare and childbearing subsidy.

Note: We assume a constant elasticity utility function, $v(C) = C^\rho$, $\rho = 0.5$. The cost of paid childcare is set at its average level in 2005 (515 euros per month, see Blanpain, 2009). The amount of childcare subsidies and the thresholds are those prevailing in 2005 for one-child households, with the youngest child born before 2004 and after 2004 ($T_1^{new} = 14,600$, $T_2^{new} = T_3^{new} = 32,500$ and $T_{SI}^{new} = 24,600$, $a_1^{new} = 6,280$, $a_2^{new} = 5,080$, $a_3^{new} = 1,900$ and $a_0^{new} = 1,980$ euros). In the left figure the level of the outcome R_i is fixed and set to $12,000$ euros, in the second one the utility of staying at home α_i is fixed and set to 10.

according to the male income for a mother having a null preference for staying at home ($\alpha = 0$), while Figure 18 (right) corresponds to a preference of $\alpha = 25$.

The reform of the childbearing subsidies schedule increases the amount of the subsidies a_k as well as the threshold T_k. The former increases the range of values of α_i such as it is optimal to participate in the labor force. Because of the latter, this difference in ranges can be substantial for values of $\tilde{w}_i$ between the new and the old threshold. This is illustrated in Figure 19 (left). The reform results in a decrease in the reservation wage almost everywhere (Figure 19, right).

Table 16: Brackets for male income distribution

		Sample Proportion	Female Participation
Bracket 1	$[0; T_1^{old} - (D - a_1^{old} + a_0^{old})]$	45.5	62.3
Bracket 2	$[T_1^{old} - (D - a_1^{old} + a_0^{old}); T_1^{new} - (D - a_1^{new} + a_0^{new})]$	14.9	80.4
Bracket 3	$[T_1^{new} - (D - a_1^{new} + a_0^{new}); T_2^{old} - (D - a_2^{old} + a_0^{old})]$	9.6	75.6
Bracket 4	$[T_2^{old} - (D - a_2^{old} + a_0^{old}); T_{SI}^{old}]$	10.2	82.1
Bracket 5	$[T_{SI}^{old}; T_{SI}^{new}]$	9.7	80.5
Bracket 6	$[T_{SI}^{new}; T_2^{new} - (D - a_3^{new} + a_0^{new})]$	2.3	82.0
Bracket 7	$[T_2^{new} - (D - a_3^{new} + a_0^{new}); T_2^{new} - (D - a_2^{new})]$	1.8	79.3
Bracket 8	$[T_2^{new} - (D - a_2^{new}); +\infty]$	6.1	75.0

Source: Authors' Calculation from the Income Tax Return Database.

Notes: Sample restricted to households present in 2005 and 2006, including a woman aged 20-55 and whose youngest child is one or two years old. The values of the scheme and of the childcare subsidies, that vary with family size, are those provided in the Table 13. The cost of the paid childcare is set at 515 euros per months (its average level in 2005). The notations are those of the model: a_k k=1..K stands for the total subsidies perceived by double-income families (including childcare subsidy), a_0 the base subsidies perceived by single-income families whose incomes are under the threshold T_{SI}. The indexes new and old refer to the scheme of childcare subsidies.

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