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Children and their parents' labor supply

Evidence from 2012 Dutch data.

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Introduction

For many years politicians have wondered how childbearing and labor supply correlate. These correlations can be used in decisions about policies to influence the labor market. To get a view of this correlation, economists have developed a lot of models linking family size to labor supply. But most of these models largely rely on assumptions and economic theory. To test these models, empirical studies, like the one performed here, can be used (Schultz, 1990). Empirical studies are those based on objective and actual experiments or observations.

Publications of the Central Bureau for the Statistics (CBS) (2013) show that women have been a growing part of the active labor force in the past 10 years. At the same time, the percentage of families that have three or more children has declined over the past 10 years. Perhaps this shift in female labor supply can be explained by the decline in fertility.

A lot of studies have looked at this relationship before. Most of them found a negative correlation between childbearing and female labor supply. Unfortunately, it is proven impossible to say anything about the causal effect (Browning, 1992). Some studies that use childbearing as an explanatory variable to predict the female labor supply, while others use the labor supply to predict the average number of children. This is possibly because childbearing is not an exogenous variable. The number of children people have is not given, but a personal choice, and thus correlated to other factors not included in the model. For that reason, the covariance between the error term and the regressor is not equal to zero, and the Ordinary Least Squares estimate is biased. That is why standard OLS regressions cannot be applied to this relationship.

A solution for this problem is to use Instrumental Variable (IV) regression, but it is proven difficult to find enough well measured exogenous variables that can serve as instruments (Willis, 1987). Angrist & Evans (1998) were the first to use the sex of the first two siblings as an instrument. This instrument seems qualified because it can be measured easily and it is assumed exogenous, since the sex of children is approximately randomly assigned. Its effect on having more than two children is proven by Williamson (1976). In his research, he found that parents who have two siblings of the same sex are more likely to have another child. In their study on American data from 1980 and 1990, Angrist & Evans found that having more than two children has a negative effect on the female labor supply, but they did not find this result for the husbands.

New in this study is that this theory is applied to more recent data on the Dutch population, to see whether the same results are found here or not. Based on the studies prior to this one, female labor supply is expected to decline after having more than two children. Male labor supply will either not change, or rise to cover the female income loss.

Section 1 evaluates why the results from similar studies on American data cannot be applied to the Dutch population. Section 2 describes the used data set, outlines the descriptive statistics and explains the use of this instrument in the first stage. Section 3 describes the calculation of Wald estimates, the reduced form, the construction of the second stage construction and the results of all of these steps. Section 4 concludes this study.

1. Literature review

Over the past years a lot of experiments have been conducted on the relation between fertility and female labor supply. Fertility has been proven to be endogenous, which causes the ordinary least squares estimation of this effect to be biased. To solve this problem, instrumented variable regression can be applied. For this method an instrument is required which highly correlates with the endogenous variable fertility, but does not correlate directly with the female labor supply. Angrist and Evans (1998) were the first to use the sex of siblings as an instrument. After that, many different studies followed. Angrist and Evans found that the having more than two children has a negative effect on the female labor supply. But this experiment was based on data about the American population in 1980 and 1990. Whether or not these results can be applied to the Dutch population, depends on the external validity of the results. External validity means that inferences and conclusions from a statistical study can be generalized from the population and setting studied to other populations and settings (Stock & Watson, 2012, p. 807). The population studied is in this case the female labor supply in the United States of America. The population of interest is in this case the female labor supply in the Netherlands (Stock & Watson, 2012, p.355). The external validity can be threatened by differences in populations and differences in settings. Differences in population include differences in characteristics of the populations, geographical differences or the study might be out of date. Differences in settings include differences in the institutional environment, differences in laws and differences in the physical environment (Stock & Watson, 2012, p. 357).
First of all, the differences in population are analyzed. The Population Reference Bureau (PRB) (2013) has collected a lot of information about characteristics of international populations. One of the factors they have compared is the part of the population that consists of the labor force. In both countries, the labor force is 67% of the total population. Another factor included in the comparison is the total fertility rate. In the United States of America, the total fertility rate was 1,9 in 2013 while it was 1,7 in the Netherlands. A third factor is the life expectancy at birth. The American women are expected to live for 81 years whereas the Dutch women are expected to live for 83 years. Bigger differences can be found when looking at the infant mortality rate. In the United States the infant mortality rate is 5,9 while it is only 3,7 in the Netherlands. The percentage of people living in an urban environment is 81% in the United States, but only 66% in the Netherlands.
Finally, the populations can differ when the study is out of date. The study of Angrist and Evans is based on data of 1980 and 1990. This thesis is based on observations in 2012. This means that there is a gap of at least 22 years. In the past 22 years, a lot of things have changed. In the Netherlands, the government has implemented a policy to stimulate the expansion of the childcare capacity. This

policy was implemented from 1990 until 2002. In the same period, companies have made a lot of changes to make childcare more accessible for their employees (The Question Library, 2007, p. 2). Besides differences in populations, there might also be differences in settings which endanger the external validity. The PRB (2013, p. 14) also compares the economic environment between countries. In the United States, the GDP growth is 1,2 between 2007 and 2011. In the Netherlands, the GDP growth was 1,1 in the same period.

In the Netherlands, maternity leave policies are a job-protected time off-work to care for newborns and young children (Brugiavini, Pasini & Trevisan, 2013, p. 51). In the United States, the Family and Medical Leave Act entitles eligible employees of covered employers to take unpaid, job-protected leave for specified family and medical reasons with continuation of group health insurance coverage under the same terms and conditions as if the employee had not taken leave (U.S. Department of Labor, 2013). This means that both settings do not differ much in the legal environment. It has proven that the physical environment in the Netherlands does not differ much from the physical environment in the United States. In both cases, the people face the same amount of toxins and pollutions, noise, crowding, chaos, and housing, school and neighborhood quality (Ferguson et all, 2013, p. 438).

If we take all of these factors together, we can conclude that the results found in the study of Angrist and Evans based on American data cannot be applied to the Dutch data. The settings might not differ substantially, but the population characteristics do. The fertility rate is higher in the United States as well as the infant mortality rate. The biggest difference in the population is the fact that 81% of the American citizens live in urban environments, while only 66% of the Dutch citizens are living in urban environments. For these reasons, the results from the American data are not externally valid.

2. Data, descriptive statistics and First-Stage relationships

Data and descriptive statistics

For this study, data from the DHS survey collected by CentERdata is used. The focus is on the year 2012. This survey collects information about the household, income and work. The variables used come from two different surveys. One survey includes questions about the household and one survey includes questions about income and work. Table 1 shows that the average number of children inside the household is 1.02 for women. But in order to build the instrument on the sex of the first two siblings, families with less than two children are removed from the sample. Both females and males are included, but they are separated to be able to make a comparison. Data on the children are matched to the parents. People with children outside the household are excluded from the sample. These children could be added to their parents' data, but if the children are above a certain age, the number of children probably does not influence the labor supply of the parents anymore. Furthermore, they could be living with only one of both parents after they got divorced. In this case, the labor supply of that parent is unlikely to depend on the number of children as well.

To measure the labor supply of the parents, three variables are used. The first variable indicates whether the parents have a paid job or not. The second indicates whether the parents have a full time job or not. A full time job is equivalent to working 32 hours or more per week. The last variable measures the number of hours per week worked by the parent. If the parents do not have a job, the number of working hours per week is set to zero. The dependent variable fertility is measured in two ways. The number of children in a household is one way, and whether parents have more than two children or not is the other. For the endogenous variable fertility an instrument is used called *Same sex*. This indicates whether the sex of the first two siblings is equal or not. To get a more precise view, this instrument is split up into two instruments. The first is *Two boys*, which indicates whether the first two siblings are both boys, and the second is *Two girls*, which indicates whether the first two siblings are both girls. To minimize the confounding effect of variations in other variables, there are also a few control variables added to the regression model. *Year of birth* of the parent is added, because this influences the labor supply and may affect the fertility. Using the year of birth of the parent and the year of birth of the first child, *Age at the first birth* is calculated. This variable is included because the older parents are at the first birth, the older they will be when they have to decide whether or not to have an additional child.

Table 1: Fertility and labor supply measures

	Men	Women
Mean children inside the household	0.8778004	1.015054
Percent with 2 or more children	30.96	35.48
Percent worked in 2012	71.49	61.29
Observations	491	465

Notes: The data comes from the DHS Survey of 2012, collected by CentERdata, separated for men and women. The data includes only individuals who are either head of the household, spouse or partner. People with children outside the household are eliminated.

Table 2: Descriptive statistics, parents with 2 or more children and no children outside the household.

	Means and (standard deviations)	
Variable:	Men	Women
Children in household	2,461 (0,062)	2,436 (0,053)
First child is a boy	0,579 (0,040)	0,564 (0,039)
Second child is a boy	0,520 (0,041)	0,527 (0,039)
First two are boys	0,303 (0,037)	0,297 (0,036)
First two are girls	0,204 (0,033)	0,206 (0,032)
First two same sex	0,507 (0,041)	0,503 (0,039)
Year of birth	1965,513	1968,545
Age at first birth	32,217	28,882
Number of observations	152	165

Note: The data comes from the DHS Survey of 2012 collected by CentERdata, separated for men and women. The data includes only individuals who are either head of the household, spouse or partner. People with children outside the household, or less than 2 children are eliminated.

Sex mix and fertility

The relation between the siblings-sex composition and childbearing can be analyzed using the standard quantity/quality model of fertility (Becker & Lewis, 1973). In this model child quantity and child quality, perceived by the parents, are factors that determine the utility function and the budget line of the parents. Child quality is determined by the expenditure of parents' time in home production. Ben-Porath and Welch (1980) stated that the siblings-sex composition is also a determining factor of child quality. Sex mix of siblings can also be entered into the model using state-dependent utility (Angrist & Evans, 1996). Suppose parents already have children and are now deciding whether or not to have additional children. If a mixed siblings-sex composition is preferred, having two children of the same sex lowers the quality of the children already in the house and thus the utility of the parent, but it raises the marginal utility gained from having additional children. This way, the probability of having additional children will be higher when the first two children have the same sex.

First, the effect of the sex of the first child on having a second child is tested. According to Ben-Porath and Welch (1976), these effects should not be significant. Other articles (Williamson, 1976) suggest that parents may have a preference for boys. The results of this test are found in table 3. From this table it follows that there is no significant difference.

After that, the effect of the sex of the first two children on having more than two children is analyzed. Ben-Porath and Welch (1976) found that 56% of the families with two siblings of the same sex had more than two children, while only 51% of the families with two siblings of different sexes had more than two children. As table 3 shows, in this sample for males these percentages are 39% and 29,3% respectively. For women these percentages are 39,8% and 30,5% respectively. The proportions may be different from those found by Ben-Porath and Welch, but they do show that having two children of the same sex more often leads to having more than two children.

Table 3: Fraction of families that had another child by parity and sex of children.

	Men		Women	
Sex of first child in families with 1 or more children	Fraction of sample	Fraction that had another child	Fraction of sample	Fraction that had another child
1. One boy	0,550 (0,034)	0,765 (0,040)	0,541 (0,033)	0,738 (0,039)
2. One girl	0,450 (0,034)	0,681 0,048)	0,459 (0,033)	0,673 (0,046)
Difference (2-1)	-	-0,084 (0.062))	-	-0,065 (0.060)

	Men		Women	
Sex of first children in families with two or more children	Fraction of sample	Fraction that had another child	Fraction that had another child	Fraction that had another child
One boy, one girl	0,493 (0,041)	0,293 (0,053)	0,497 (0,039)	0,305 (0,051)
Two girls	0,204 (0,033)	0,355 (0,087)	0,206 (0,032)	0,265 (0,077)
Two boys	0,303 (0,037)	0,413 (0,073)	0,297 (0,036)	0,490 (0,072)
1. One boy, one girl	0,493 (0,041)	0,293 (0,053)	0,497 (0,039)	0,305 (0,051)
2. Both same sex	0,507 (0,041)	0,390 (0,056)	0,503 (0,039)	0,398 (0,054)
Difference (2-1)	-	0,097 (0.077)	-	0,093 (0.074)

Note: The samples are the same as in table 2. Standard errors are reported in parentheses.

An instrument is qualified if it meets two requirements (Stock & Watson, 2012, p. 481). First of all the instrument must have a significant influence on the endogenous regressor. This requirement is called instrument relevance. This can be examined using a simple test of the weakness of the instrument. When an F-test is performed on the null that the excluded instruments are irrelevant in the first-stage regression, the F-value should be larger than 10. This F-test will be performed in section 3. The second requirement is that the instrument is exogenous, called instrument validity. This demand cannot be tested statistically. To check for exogeneity the differences in values of the covariates can be analyzed. If the difference between *Year of birth* and *Age at first birth* by the siblings-sex composition are not significant, the instrument is assumed to be exogenous. As shown in table 4, these differences are not significantly different from zero. For that reason, instrument validity may be assumed.

Table 4: Differences in means for demographic variables by *Same sex*.

	Difference in means (standard error)		
Variable:	All parents	Men	Women
Year of birth	0.976 (0.771)	0.013 (1.098)	1.884* (1.033)
Age at first birth	-0.070 (0.518)	0.203 (0.730)	-0.401 (0.633)

Note: The samples are the same as in Table 2.Sstandard errors are reported in parentheses.

3. Fertility and labor supply

Wald estimates

Before the causal effect of childbearing on labor supply can be calculated, the relationship between the instrument and the labor supply must e examined. Because the instrument *Same sex* is randomly assigned, simple statistical methods can be used. The regression model that is going to be used to estimate the effect of childbearing on labor supply is the following binary model:

$$y_i = \alpha + \beta x_i + \varepsilon_i.$$

In this model y_i is the labor supply of the parents and x_i measures fertility. The binary instrument based on the sex of the first two siblings, denoted z_i is used to estimate the coefficient β. In this method, the effect of the sex mix on labor supply is attributed to the effect of sex mix on childbearing. Using Wald estimates, the effect β can be calculated as follows:

$$\beta_{IV} = \frac{(\bar{y}_1 - \bar{y}_0)}{(\bar{x}_1 - \bar{x}_0)}.$$

Here $\bar{y}_1$ stands for the average of y when the first two siblings have the same sex and $\bar{y}_0$ is the average of y when they have different sexes. The variable $\bar{x}_1$ stands for the average of x when the first two siblings have the same sex, and $\bar{x}_0$ for the average of x when they have different sexes. To calculate these differences in means, simple OLS regression can be applied. The OLS regression models will be as follows:

$$y_i = \rho + \gamma z_i + \epsilon_i \qquad \text{and} \qquad x_i = \tau + \delta z + e_i$$

These regressions are the reduced forms. From these models the IV estimator can be calculated as follows:

$$\beta_{IV} = \frac{\gamma}{\delta}.$$

Normally the coefficients in bivariate models like these are constant. But Imbens and Angrist (1994) have shown that the IV estimator can be used as a local average treatment effect specific to the instrument. This way β_{IV} is the estimate that shows the effect of childbearing on labor supply for those parents of which the sex mix of the first two siblings has an influence on fertility.

The results of the Wald estimates are shown in table 5. The reduced form regression of fertility on the instrument *Same sex* leads to expected estimates. Whether the variable *Number of children* or *More than two children* is used to measure fertility, the mean difference is positive. The coefficient of *More than two children* indicates that the probability of having more than two children will increase if the first two siblings are of the same sex. The coefficient of *Number of children* indicates that the average number of children will be higher for parents whose first two siblings have the same sex. The reduced form regressing labor supply on the instrument *Same sex* does not lead to expected estimates. The estimates that where found can be either positive or negative and the effects are much larger than expected. For example, the probability of having a paid job for women rises with 16,1% when their first two siblings have the same sex. Furthermore, most estimates are not significant.

Table 5: Wald estimates of labor-supply models.

	All parents (317 observations)			Men (152 observations)			Women (165 observations)		
	Mean difference by:								
	Same sex	More than two children	Number of children	Mean difference by same sex	More than two children	Number of children	Mean difference by same sex	More than two children	Number of children
More than 2 children	0.094* (0.053)	-	-	0.096 (0.077)	-	-	0.093 (0.074)	-	-
Number of children	0.092 (0.081)	-	-	0.093 (0.124)	-	-	0.092 (0.106)	-	-
Worked for pay	0.067 (0.045)	-0.025 (-0.047)	-0.039 (0.031)	-0.037 (0.046)	0.072 (0.048)	0.023 (0.030)	0.161** (0.071)	-0.108 (0.075)	-0.114** (0.052)
Worked full time	-0.009 (0.056)	-0.002 (0.059)	-0.005 (0.039)	0.003 (0.053)	0.092* (0.055)	0.026 (0.035)	-0.026 (0.053)	-0.073 (0.055)	-0.060 (0.039)
Hours/week	-0.509 (1.339)	-0.328 (1.409)	0.018 (0.)979	-0.254 (1.215)	0.872 (1.270)	0.242 (0.803)	0.208 (1.542)	-2.27 (1.616)	-2.096 (1.292)

*Note: The samples are the same as in Table 2. Standard errors are reported in parenthesis. The asterisk indicates the level of significance. * indicates that the estimate is significant at 10%, ** indicates that the estimate is significant at 5% and *** indicates that the estimate is significant at 1%.*

Based on the results in table 5, Wald estimates for the IV coefficient β_{IV} can be calculated by dividing $\bar{y}_1 - \bar{y}_0$ by $\bar{x}_1 - \bar{x}_0$. Using *More than two children*, these estimates imply that for men the probability of having a paid job will decrease with 38,54 percentage point, the probability of having a full time job will increase with 3,13 percentage point and the number of hours worked per week will fall by 2,65 hours. For women, they imply that the probability of having a paid job will increase with 173,12 percentage point, the probability of having a full time job will decrease with 27,96 percentage point and the number of hours worked per week will increase with 2,24 hours. When the variable *Number of childre*n is used, the effects will be analyzed per child. These Wald estimates are about 1,03 as large for men and 1,01 as large for women. For this reason it does not seem to matter whether the *Number of children* or *More than two children* is used as the endogenous regressor, since the *More than two children* effects can always be converted into per child estimates by multiplying the effect by 1,01 or 1,03.

Two-stage least-squares estimation

Although Wald estimates give a good first impression of the correlation between fertility and labor supply, the two-stage least-squares method is a more precise way to estimate the coefficient. That is because with this method it is possible to control for exogenous covariates. This is useful because there may be other factors that influence the dependent variable. If these variables are not included, the problem of omitted variable bias can arise. Omitted variable bias causes the estimation parameters to be over- or underestimated because independent factors are omitted that correlate with both the dependent variable and the included independent variables (Stock & Watson, 2012, p. 222). Two control variables are used in this model, namely *Year of birth* and the *Age at first birth*. Based on economic theory, both variables are correlated to the labor supply, but also to fertility. For that reason, they should be included. Another advantage of the two-stage least-squares model is the possibility to exploit the fact that the instrument *Same sex* actually consists of two separate instruments. They indicate whether the first two siblings are two boys or two girls. By doing this, it is possible to see whether the instrument *Two boys* has a different effect on having more than two children than *Two girls* does.

The two-stage least-squares model consists of two stages. The first stage correlates the instrument to the endogenous regressor to see if there is a significant effect. The second stage then correlates the predicted values from the first stage to the dependent variable. To construct the instrument, the following formula is used:

$$Same\ sex = s_1 s_2 + (1 - s_1)(1 - s_2)$$

In this formula, s_1 has the value 1 if the sex of the first child is male or 0 if it is female, and s_2 has the value 1 if the sex of the second child is male or 0 if it is female.
Using *Same sex* as an instrument, the first stage relating fertility to the sex mix of siblings is:

$$x_i = \pi + \tau(Samesex)_i + \sigma w_i + \epsilon_i$$

In this regression, w_i is a vector including the covariates *Year of birth* and *Age at first birth*.
If the instrument is split up into two instruments, the formulas will be as follows:

$$Two\ boys = s_1 s_2 \quad \text{and} \quad Two\ girls = (1 - s_1)(1 - s_2)$$

Using the separated instruments, the first stage is

$$x_i = \pi + \tau_1(Two\ boys)_i + \tau_2(Two\ girls)_i + \sigma w_i + \epsilon_i$$

The second stage regresses the labor supply on the predicted values from the first stage. It has the shape

$$y_i = \alpha + \beta x_i + \gamma w_i + \varepsilon_i$$

In this formula x_i is the endogenous regressor substituted by either the instrument *Same sex* or the instruments *Two boys* and *Two girls*.
The IV regression is thus going to be performed using two different instruments.

Two-stage least-squares results

Although the Wald estimates discussed earlier in this section are not significant, they do behave according to the expectations. The next step is to analyze the first stage of the two-stage least-squares estimation method. The first stage shows the causal effect of the first two siblings having the same sex on the number of children the parents have. In this analysis again both the variable *More than two children* and the variable *Number of children* are studied. The results are shown in table 6 and again not significant. However the effects are as expected. For men and women, both the number of children and the probability of having more than two children will rise when the first two siblings have the same sex. Because of the lack of significance, the instrument is being split up into the instruments Two boys and Two girls. These results show that the effect on the number of children is only significant when the first two siblings are both boys. Interesting about this result is that it only counts for women. This effect is not found by Angrist & Evans (1998). Using a specific sample, which cannot be generalized, can cause the effect found here. It is still possible that studies on other samples do find this effect. Because the cause of the difference in effect of having two boys or two girls cannot be investigated, it is not further discussed in this study.

The overall weak first stage indicates that the instrument *Same sex* probably does not have a significant effect on the labor supply. A simple test of the weakness of an instrument is to perform an F-test on the null that the excluded instruments are irrelevant in the first-stage regression. This F-value should be larger than 10. The results of these F-test are shown in the bottom row of table 6. These values also indicate that the instrument is weak. The results of the reduced form and the two-stage least-squares estimates are shown in table 7 and table 8 in the appendix. Since the first stage is very weak it is not useful to look at these results.

Table 6: OLS estimates of *More than two children* and *Number of children* equations.

Independent variable:	**More than two children Men** (138 observations)	**More than two children Men** (138 observations)	**More than two children Women** (152 observations)	**More than two children Women** (152 observations)
Same sex	0.124 (0.078)		0.092 (0.076)	
Two boys		0.135 (0.092)		0.190** (0.087)
Two girls		0.107 (0.104)		-0.052 (0.100)
Year of birth	0.007 (0.007)	0.007 (0.008)	0.005 (0.007)	0.008 (0.007)
Age at first birth	-0.024 (0.011)	-0.024** (0.011)	-0.028** (0.012)	-0.026** (0.012)
F-value	2.49	1.27	1.46	3.17

Independent variable:	**Nr of children Men** (138 observations)	**Nr of children Men** (138 observations)	**Nr of children Women** (152 observations)	**Nr of children Women** (152 observations)
Same sex	0.127 (0.130)		0.088 (0.111)	
Two boys		0.176 (0.151)		0.234* (0.127)
Two girls		0.056 (0.172)		-0.125 (0.145)
Year of birth	0.005 (0.012)	0.006 (0.013)	0.007 (0.010)	0.011 (0.010)
Age at first birth	-0.044** (0.018)	-0.043** (0.018	-0.039** (0.017)	-0.036** (0.017)
F-value	0.95	0.68	0.63	2.85

*Note: The samples are the same as in Table 2. Standard errors are reported in parenthesis. The asterisk indicates the level of significance. * indicates that the estimate is significant at 10%, ** indicates that the estimate is significant at 5% and *** indicates that the estimate is significant at 1%.*

Other specification issues

There are other specification issues that will be discussed here. The first issue is the robustness of the results. The regression results are said to be robust if they are insensitive to violations of the underlying assumptions of the model. In this study the assumption was made that *Year of birth* and *Age at first birth* are covariates. If these covariates are eliminated or replaced by other covariates, this should not influence the results. The sex mix of siblings is essentially randomly assigned. This implies that changes in the set of covariates will not affect the results. Since the samples are too small in this data set, testing this explanation by adding more covariates will not lead to significant results. Angrist & Evans (1998) have proved that the results will remain unchanged.

Another specification issue is the generality of the results. There can be doubts about whether the estimate of the effect of fertility on labor supply can be used when going from 1 child to more than 1 child. This is probably not possible, but also not the main interest. Publications of the CBS show that a significant fraction of the change in fertility between 2002-2012 was due to reductions in families having three of more children. The fact that only parents without children outside the household are used can also be considered a problem. The choice of leaving them out of the sample is based on the fact that no information is available on the reason why these children are no longer in the household. If their age is the reason, than the labor supply of the parent is assumed not to correlate to having these children. If these children left the household because the parents got divorced, it also has a different effect on the labor supply, which is not further discussed here.

The last issue is the representativeness of the sample. Although the sample is too small to find significant results, CentERdata claims that the DHS survey is representative for the Dutch population. Therefore, this is not considered a problem.

4. Conclusion

A lot of studies are devoted to the relationship between labor supply and fertility. Many of these studies have not been empirically tested. With the IV regression method used in this study, such models can be tested. Because childbearing is not exogenous but a personal choice, it is necessary to replace it by an instrument. The variable *Same sex* is used here because it is proven to correlate with having more than two children, it is essentially randomly assigned and it is easily measured. Based on the results found by Angrist & Evans (1998), the female labor supply was expected to fall when they have more than two children, but the male labor supply was expected to remain the same or even rise to cover the female income loss. Since the results found on this American dataset are not externally valid, the same study was performed on Dutch data. First of all, Wald estimates were calculated based on reduced forms to get a view of the correlation between the instrument, the endogenous regressor and the dependent variable. The results of these estimates were not significant. The effects were as expected, but quite large. To get a more precise view of the relation between fertility and labor supply, the Two-stage least-squares method was applied. This method makes it possible to reduce confounded effects and split the instrument into two instruments, *Two boys* and *Two girls*. The first step in this method was estimating the First stage coefficient, which regresses the endogenous regressor on the instrument. The estimates found here were also as expected, but not significant. Based on this first stage and the fact that the instrument is indeed very weak, it is needless to perform this second stage. That is because if the coefficient estimated by the first stage is not significantly different from zero, the coefficient of the IV regression can basically take on any value. Apparently the instrument does not correlate enough with the endogenous regressor. The reason for this is that the sample used in this study is probably too small. Still it is confirmed that the unexpected results do not depend on the specification. To acquire a causal effect of fertility on labor supply in the Netherlands, this empirical study should be repeated with a larger dataset. Besides testing the effect of fertility on female labor supply in the Netherlands, this thesis is also written to gain knowledge about research methods and acquire research skills. Even though this empirical study does not have an outcome, I have learned a lot about OLS and IV regression techniques. I have learned how research should be shaped. For example, I would like to be able to use data from the Central Planning Office (CPB). The skills I have acquired while writing this thesis are going to be of great utility when writing my master thesis.

Appendix

Table 7: Reduced forms regressing labor supply on the instruments.

	Paid job Men	Paid job Men	Paid job Women	Paid job Women	Full time Men	Full time Men	Full time Women	Full time Women
Same sex	-0.037 (0.046)		0.161** (0.071)		0.003 (0.053)		-0.026 (0.053)	
Two boys		-0.042 (0.053)		0.166** (0.083)		-0.032 (0.061)		-0.003 (0.062)
Two girls		-0.030 (0.060)		0.155* (0.094)		0.055 (0.069)		-0.058 (0.070)

	Hours/week Men	Hours/week Men	Hours/week Women	Hours/week Women
Same sex	-0.254 (1.215)		0.208 (1.542)	
Two boys		0.192 (1.424)		0.157 (1.771)
Two girls		-0.862 (1.580)		0.285 (2.025)

*Note: The samples are the same as in Table 2. Standard errors are reported in parenthesis. The asterisk indicates the level of significance. * indicates that the estimate is significant at 10%, ** indicates that the estimate is significant at 5% and *** indicates that the estimate is significant at 1%. Other covariates in the models are indicators for Year of birth and Age at first birth. The sample Males consists of 138 observations, the sample Females consist of 152 observations.*

Table 8: Two-Stage Least-Squares estimates of labor supply models.

	Paid job Same sex Men	**Paid job Same sex Women**	**Paid job Two boys/Two girls Men**	**Paid job Two boys/Two girls Women**
More than two children	-0.360 (0.498)	1.616 (1.634)	-0.361 (0.492)	0.482 (0.462)
Year of birth	0.004 (0.007)	0.002 (0.017)	0.004 (0.007)	0.009 (0.008)
Age at first birth	0.000 (0.015)	0.075 (0.051)	0.000 (0.015)	0.043** (0.019)

	Full time Same sex Men	**Full time Same sex Women**	**Full time Two boys/Two girls Men**	**Full time Two boys/Two girls Women**
More than two children	-0.002 (0.463)	-0.667 (0.776)	-0.074 (0.468)	-0.049 (0.276)
Year of birth	0.007 (0.006)	0.005 (0.008)	0.007 (0.006)	0.001 (0.005)
Age at first birth	0.016 (0.014)	-0.015 (0.024)	0.014 (0.014)	0.002 (0.011)

	Hours/week Same sex Men	**Hours/week Same sex Women**	**Hours/week Two boys/Two girls Men**	**Hours/week Two boys/Two girls Women**
More than two children	-4.051 (12.077)	-12.006 (440.391)	-2.638 (11.723)	-1.148 (8.198)
Year of birth	0.053 (0.158)	0.059 (1.445)	0.042 (0.155)	0.023 (0.154)
Age at first birth	-0.318 (0.422)	-0.376 (14.679)	-0.274 (0.410)	-0.014 (0.374)

*Note: The samples are the same as in Table 2. Standard errors are reported in parenthesis. The asterisk indicates the level of significance. * indicates that the estimate is significant at 10%, ** indicates that the estimate is significant at 5% and *** indicates that the estimate is significant at 1%. The sample Males consists of 138 observations, the sample Females consist of 152 observations.*

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