ABSTRACT: This paper examines the effects of fertility on the labor supply of women in Ethiopia. An instrumental variable or IV of sibling-sex composition is used to estimate the effects of fertility on the labor supply of married women. Can you define IV in one or two sentences and insert here? The rationalization for this methodology is the fact that most Ethiopian families prefer male children due socio-cultural reasons. Most of the studies undertaken to estimate the effect of fertility on the labor supply of married women find a negative correlation between the two variables. This negative correlation between fertility and the labor supply of women is plausible for developed countries because children go to school at an early age, and women face a relatively higher opportunity cost from child rearing. In low income developing countries such as Ethiopia, children start working in the home quite early which enables the mother to work for pay outside the home or engage in alternative employment opportunities. Therefore, in this case there may not be a negative relationship between fertility and labor supply of married women. The purpose of this paper is to test the hypothesis that the relationship of fertility and labor supply of married women using data from Ethiopia. What type of data? Describe in two or three sentences?

* An earlier draft of this was prepared for submission in a Ph.D. Course in Labor Economics taught by Dr. Jean Kimmel. I appreciate her valuable comments. I also appreciate the valuable contribution of Professor Sisay Asefa to the current draft.
1. Introduction

The past few decades have witnessed a substantial increase in the labor force participation of women in many parts of the world. Some Western industrial economies have labor force participation of married women quickly approaching those of men, while other, mostly developing low income countries have been plagued with low participation rates for married women with a noticeable further withdrawal from the labor market with the presence of children. This relationship between fertility\(^1\) and female labor supply is one of the longstanding topics in labor economics. Due to this longstanding interest in the relationship between fertility and labor supply of women, there is a wide theoretical and empirical literature attempting to estimate the effect of fertility on the labor supply of women. Most of the research finds a negative correlation between fertility and the labor supply of women in general. That is, as the number of young children in the house increases, the less likely that the mother will work outside the home. This negative correlation between fertility and the labor supply of women is plausible for most developed or industrial countries because children go to school at an early age due to the fact that school attendance is compulsory. As for the developing low income countries, children start working in the home quite early, which helps the mother to work for pay outside of the home. Therefore in this case, the result of a negative relationship between fertility and labor supply of married women might not work so well.

To our knowledge, there is no empirical study done to test this relationship in Ethiopia, and other African countries??.

Therefore this paper studies and tests the hypothesis about the relationship between fertility and labor supply of married women in Ethiopia.

\(^1\) Fertility in this paper is defined as ‘the ability to produce young’, or childbearing.
When exploring the relationship between fertility and married women’s labor force participation, a possible endogeneity problem must be accounted for between these two decisions made by married women (Nakamura and Nakamura, 1992). Much effort has been made to disentangle the causal mechanisms linking fertility and female labor supply. The use of the econometric methodology of instrumental variables or IV is a way fertility while being exogenous to the labor supply decision is a way to get rid of this endogeneity problem??.

For the purpose of this paper, we use the sibling-sex composition following Angrist and Evans (1998). These authors use of parental preferences for a mixed sibling-sex composition to construct instrumental variable (IV) estimates of the effect of childbearing on labor supply. In Ethiopia, and many African countries parents have a preference for male children due to social and economical reasons, therefore the rationalization of using the sibling-sex composition an instrumental variable or IV is different from Angrist and Evans rationalization. Consequently, families whose first two children are female are more likely to have more kids until they get a son. Consequently, sibling-sex composition seems like a good IV for Ethiopia. For example, china’s strict policy of two children policy and followed by one child policy has resulted in some sad consequences in terms of the impact of female children. It is reported in some rural areas of China, couples decide to murder children if a first born child is also followed by another female child in search for a male child. (This is true Blen, can you find a reference and insert here?)

The paper is organized as follows: the first section presents the introduction. The second section reviews the literature that explores the relationship between fertility and
the labor supply of married women. The third section explores fertility and labor supply trends, and also the determinants of labor supply in Ethiopia. The fourth section presents the econometrics model to be used in this paper. The fifth section briefly describes the data. The sixth section will give the expected results of the study. Finally the seventh and the final section will give conclusions and draw policy implications.

II. Review of Literature

This section presents the theoretical literature on fertility decisions of the household. In addition, the empirical literature exploring the relationship between fertility and the labor supply of women from various countries is presented.

Becker and Barro (1988) develop a theoretical model where the utility of parents depends on their own consumption, their fertility, and the utility of each child. Since parents’ utility in this model depends on the utility of each child and the number of children, parents are considered behave in altruistic manner. The utility maximization of parents then requires equality between the marginal benefit of an additional child and the net cost of producing another child. In this model, the cost of producing a child depends on the cost of rearing children and investing in their human capital such as education and health. On the other hand, the benefit of having a child includes the net present value of the lifetime earnings of the child.

Barro and Gordon also consider the fertility and population growth in economies that are linked to an international capital market. They state that ‘fertility in open
economies depends positively on the world’s long-term real interest rate, the degree of altruism, and the growth of child-survival probabilities; and negatively on the rate of technical progress and the growth rate of social security. Barro and Gordon’s paper is a purely theoretical presentation.

Empirical research on the estimation of the consequences of childbearing on the labor supply of women is complicated by the endogeneity of fertility to the labor supply decisions of women. As mentioned in the introduction, some researchers have proposed the idea of using an instrumental variable or IV method as a solution to this problem. Using an IV however does not come without challenges; one of the challenges of using an IV is identifying a variable that affects fertility decision, but does not affect the labor supply decision directly. Rosenzweig and Wolpin (1980) have introduced the idea of using unplanned births, such as the presence of twins. The availability and cost of contraceptive technology has also been thought of as a suitable instrument for fertility by Rosenzweig and Schultz (1985).

Angrist and Evans’ (1998) paper is one of the influential papers written on the effects of childbearing on the labor supply of women. These authors were of the first to use sibling-sex composition as an instrumental variable to disentangle the endogeneity of fertility from labor supply of married women in the United States. Angrist and Evans argument is that ‘because sex mix is virtually randomly assigned, a dummy variable for whether the sex of the second child matches the sex of the first child provides a plausible instrument for further childbearing among women with at least two children’. Their IV method exploits the widely observed phenomenon of parental preferences for a mixed

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2 Becker and Barro, p. 1
3 Angrist and Evans, p. 451
sibling-sex composition in the United States. They state that parents of same-sex siblings are significantly and substantially more likely to have an additional child.

Their model to be estimated deals with the effect of going from a family size of two children to more than two children, on the labor supply of married women. The IV for more than two children is the indicator of same sex. The identification of the effect of fertility on female labor supply relies on the virtually random assignment of same sex.

They utilize Two-Stage Least-Square (2SLS) Method to control for exogenous regressors. Their first stage results link sex-mix and fertility showing that women in 1980 with same sex children, are estimated to be 6.2 percentage points more likely to have a third child. Next, they use the sex mix IV to estimate the effect of more than 2 children on measures of employment. The OLS estimates in the married women sample suggest that the presence of a third child reduces the probability of working by about 17 percentage points.

One of the empirical papers attempting to estimate the effect of fertility on the labor supply of married women in developing countries was written by Guillermo Cruces and Sebastian Galiani (2003). Cruces and Galiani estimate the effect of childbearing on the labor supply of married women in Argentina and Mexico. They use Angrist and Evans (1998) paper as a basis for their estimation and also use same sex as their instrumental variable or IV. The purpose of their paper is to investigate the extent to which the causal link identified in AE???(What does this mean?) can be generalized to the context of developing countries, where fertility is higher, female education levels are much lower and also fewer facilities for childcare relative to the US. Their main question is: does childbearing also lead to a reduction in female labor supply in different
socioeconomic environments? They estimate the causal effect of fertility on labor supply by means of a linear, causal model by including a dummy variable to show if the mother has two children or more. The dependent variable in their econometric model is the labor supply of the mother.

Their model deals with the effect of going from a family size of two children to more than two children on the labor supply of married women. And the same sex IV strategy identifies the average effect (on the labor supply) of having more than two children on those whose fertility decisions are changed by the instrument just like Angrist and Evans.

OLS and Two-Stage least squares (2SLS) are used to estimate the effect of fertility on the labor supply of married women. The dependent variable is work for pay while the regressors are the number of children, more than two children (or the IV same sex) and a set of control variables.

The Wald estimates (obtained as the ratio of the reduced form relationship between worked for pay and same sex and between number of children or more than two children and same sex) results for Argentina imply that an additional child reduces the labor supply of women whose fertility has been affected by their children’s sex mix by about 5-6 percentage points. Having more than two children reduces in Argentina decreases labor supply by about 9-10 percentage points. In Mexico the effects are still significant. These results are quite close to the 1998 US estimates by AE (explain?).

When estimating the linear causation equation by OLS (where dependent variable is worked for pay and the regressors described above) the results are that: a third child reduces the probability of work of married women in Argentina by 7.95-8.28
percentage points and in Mexican married women by 7.57 –8.12 percentage points. But these OLS estimates of the average causal effect of fertility on female labor supply may be biased because of the endogeneity of fertility. Therefore they use IV same sex to instrument more than two children. They find that the values of the coefficients of the instrumented variables are in the same range as their OLS counterparts fluctuating between 6.31 and 8.86 percentage points in Mexico and 7.9 and 9.58 percentage points in Argentina. Most of these coefficients are significantly different from zero at the 5 percent level.

Chun and Oh (2002) estimate the effect of fertility on the labor force participation of married women in Korea. They state that ‘While US households prefer balancing the sex composition of their children, Korean households have a different preference that is known as son preference...if the first child of a Korean couple is a daughter, they will try to have one more child”. Therefore they use the first child’s sex as an instrumental variable (IV). And they say that the approach they used can be applicable to other developing countries where a son preference exists.

They use a two-stage probit regression as an empirical estimation method. This method is used to control for the endogeneity of the number of children and other economic and demographic characteristics. The first stage fertility decision uses OLS to predict the number of children as a function of the sex of the first child and explanatory variables from the second-stage labor force participation equation. They estimate the Wald type IV estimate is calculated by using the grouping method. The findings are that this IV estimate shows that the labor force participation rate difference
between the two groups of households differentiated by the sex of their first child can be explained by the fertility difference between the two groups.

When Chun and Oh (2002) use the first child’s sex IV, the two-stage probit estimate shows that fertility has a large negative effect on the labor force participation of married women. They find that the number of children in a Korean family is strongly related to the first child’s sex. They also show that the IV estimate of the negative effect of fertility on the labor force participation of married women is much higher than the probit estimate.

All of the empirical studies reviewed in the preceding paragraphs have come to the conclusion that there is a negative correlation between the labor supply of married women and their fertility.

In this paper our aim is to test the hypothesis that, in Ethiopia fertility might have a positive correlation with the labor supply of married women. The next section gives a background on the trends and determinants of fertility and labor supply in Ethiopia in addition to laying the basis for why the positive correlation might be plausible in the Country.

3. Background

Ethiopia is one of the least developed countries still with high fertility and low per capital income. Some of the determinants of high fertility in Ethiopia are early marriage (and early childbearing) as well as high levels of infant and child mortality. Low contraceptive prevalence and high economic value of children for subsistence level agriculture also contribute for the high fertility levels. In rural Ethiopia, children do housework or farm work for their household when they are younger, and take care of
their parents economically when they get older, which makes the economic value of children very high. Cockburn (2000) studied the time use of children aged 6 to 15 in rural Ethiopia by using data from detailed surveys of 1477 rural households from 15 villages throughout rural Ethiopia. He found that all of these children participate in household, farm, and domestic work activities. Analysis of this survey of rural Ethiopian households suggests that 92% of children between the ages of 4-15 have at least one household work responsibility and close to half of the children have two or more. Due to this, and lack of access to school, cultural and other reasons, school attendance is extremely low (18%), particularly among girls (14%) (Cockburn, 2000). Since almost all children do some labor activities, he focuses on the choice of a child's main activity, to better capture the child labor-schooling trade-off. From the survey he sees that more than half of all children (and almost 80% of 11- to 15- year old girls) have work as their main activity. Education is not compulsory for children in Ethiopia, therefore they can work inside their households or work for pay outside of the home if jobs are available, proving their high economic value to their parents.

3.1 Fertility and Labor Supply Trends in Ethiopia

The available data confirm the high level of fertility in Ethiopia over the years. According to the Central Statistical Authority sources (CSA, 2000), crude birth rate for
Ethiopia was estimated at about 44 to 46 live births per 1,000 persons between 1984-1994. The overall crude birth rate was at 41.3 in 2000, with marked difference between 30.7 for the urban and 42.9 for the rural population (CSA, 2000).

There are significant differences between rural and urban fertility rates in Ethiopia, as is the case for most developing countries. The Central Statistical Authority reports that, the total fertility rate for urban women is 3.3 while for the rural women total fertility rate is 6.4 children on average, higher than the national average of 5.9.

However, total fertility rate has declined in Ethiopia from its peak of 7.7 children per woman in 1990 to 5.9 in 2000 (CSA 2000). Nevertheless, evidence from the data trend suggests that this decline in fertility levels in the country has been much faster among the urban than the rural population. The DHS 2000 data on age specific fertility rates indicate that in Ethiopia, childbearing begins at early ages; and maximum fertility occurs between ages 25-29 among rural women and 30-34 among urban women. In Ethiopia, voluntary childlessness is rare; only 2 percent of currently married women are primarily infertile (DHS, 2000).

The region of residence and level of education play an important role in the fertility rates of married women in Ethiopia. Comparing the regional total fertility rates, we see that married women that reside in the capital city of Ethiopia (Addis Ababa), have the lowest regional total fertility rates while women that live in Oromiya State have the highest regional total fertility rates. A negative association between higher levels of educational attainment and fertility are also observed. Women with no education in 2000 show a total fertility rate of 6.2, while
women with secondary and higher education show a total fertility rate of 3.1 (DHS, 2000).

The region of residence, age, and fertility affect the labor supply of Ethiopian women. (Please fix this or replace with a full sentence?). The survey shows that women between the ages of 40-49 are the most active group in the labor market? (Explain?), while women under 20 are relatively less active (DHS, 2000). It is also seen that a higher proportion of rural women relative to urban women work. As expected, the survey shows that women with children are also more likely to be working at the time of the survey than women with no children, probably due to the assistance of their children in the home. This survey therefore shows that in the year 2000 fertility increased the labor supply of Ethiopian women.

Some of the factors affecting labor supply of married women in different countries are similar. Some of these are age, years of education, race, religion? and the number of children. But because of country specific differences, some of the factors that affect labor force participation in Ethiopia might be different from the factors that affect labor participation anywhere else. The determinants of labor supply in Ethiopia (for the purpose of this paper) are years of education, rural/urban residence, husband’s earnings, age, age of the mother at first birth, number and sex of children, as well as, other cultural and environmental factors.

Testing the relationship of fertility to the labor supply of married women for Ethiopia is not an easy task. One of the reasons is that women in rural Ethiopia work in agriculture or the informal sector making the data collection and estimation difficult. Yet
another reason is that, only one out of three working women earns cash for her work, while others are paid in kind or not paid at all (DHS, 2000). Nevertheless, by using an econometric model already specified by Angrist and Evans (1998) we can estimate this relationship.

4. The Econometric Model

The econometric model that will be used for the purpose of this paper will closely follow the models utilized by Angrist and Evans (1998) and Cruces and Galiani (2003). The IV of choice for fertility in Ethiopia is sibling-sex composition. This IV is selected because Ethiopian families have a preference for male children due to socio-cultural and economical reasons. Male children grow up to be the head of a household in most cases controlling the household assets. They are therefore in a better position to help their parents than are their female children. Consequently, families whose first two children are female are more likely to have more kids until they get a son.

Following Cruces and Galiani, the model to be estimated for this paper deals with the effect of going from a family size of two children to more than two children. The causing variable (??) in the labor supply reduced-form regressions is the indicator more than two children. And the IV for more than two children is the indicator same sex. The same sex IV strategy identifies the average effect (on the labor supply) of having more than two children on those whose fertility decisions are changed by the instrument.

To formulate the econometric model, we define a dummy variable $D_i$ to be an indicator for women with more than two children in a sample of women with at least two children. And let $Y_{1i}$ be the labor supply of mother $i$, if $D_i$ equals one and let $Y_{0i}$ be her
labor supply otherwise. Then the causal effect of fertility on her labor supply of a married
Ethiopian woman (residing in the rural area) can be estimated by means of a linear,
constant-effects model (Cruces and Galiani, 2003):

$$ E[Y_{oi}] = X_i' \beta \; \; \text{and,} \; \; Y_{ii} = Y_{oi} + \alpha $$

(1)

Where $X$ is a vector of control variables that are exogenous to fertility, such as the age,
age at first birth, number of years of education, region of residence, and husband’s
earnings.

Then by using equation (1) the following linear causal model is arrived at:

$$ Y_i = X_i' \beta + \alpha D_i + \epsilon_i $$

(2)

Where, $Y$ is a dummy variable for worked for pay. Women that earned cash for their
work, or paid in kind are included in our sample.

Angrist and Evans (1998) have shown that 2SLS estimation, relating labor market
outcomes to fertility and a variety of exogenous regressors can lead to more precise
estimates if the treatment effects are roughly constant across groups. Then, by assuming
that the treatment effects are roughly constant across groups, we can estimate the effect
of fertility on the labor supply of married women by 2SLS and OLS. The 2SLS
estimation identifies the average effect of having more than two children on the labor
supply of the women whose fertility decisions are changed by the instrument.

The use of 2SLS as an estimation technique is superior in this case because, the
same sex interaction term involves the sex of the first two children, and therefore might
be correlated with the sex of either child. However using 2SLS estimation gives us the
opportunity to control for any secular additive effects of child sex when using same sex
as an IV (Angrist and Evans, 1998). The same sex instrument can be decomposed into two instruments, namely two boys and two girls.

5. The Data

The source of data for this paper is The Ethiopian Rural Household Survey dataset. The Economics Department of Addis Ababa University (AAU), collaborating with other international and national institutions, conducted six rounds of surveys for rural Ethiopia beginning from 1989 until 2004. This survey addresses topics such as; household characteristics, health, women’s activities, education, wages, as well as many other topics. This paper studies the labor supply of married women aged 18 to 40 using data from six rounds of detailed surveys of 1477 rural households from 15 villages throughout rural Ethiopia.

The variables of interest from this dataset are; the mother’s age, mother’s age at first birth, number, age, and sex composition of children, husband’s income, number of years of education, the region of residence, and worked for pay.

The sample data is limited to married women between 18 and 40 years old, with at least two children, and whose oldest child was at most 18 years old at the time of the census, women whose second child is younger than a year old are not included.

This is because it is assumed that not too many women have two children below the age of 18. And women above the age of 40 have a higher probability of having children above the age of 20.
Our sample consists of only married women, because most economic theories of household production are formulated to explain the relationship of married women’s decision to work in the home or enter the labor force.

6. Expected Results

The most important result we expect to find is that, the labor supply of married women in rural Ethiopia is positively related to their fertility. The DHS for Ethiopia has shown that in the year 2000 women with children were more likely to work than women with no children. And by using 2SLS estimation, we expect to identify the positive effect of having more than two children on the labor supply of the married women in question. As mentioned before, children in rural Ethiopia help their mothers do household and farm chores, which then frees up the mother’s time for paid work.

7. Conclusions and Policy Implications

This paper attempts to study the effect of fertility on the labor supply of married women in rural Ethiopia. An instrumental variable (IV) of sibling-sex composition is
used to estimate this effect of fertility on the labor supply of married women. We rationalize the importance of this econometric particular method because of the fact that most Ethiopian families prefer male children.

Most of the studies undertaken to estimate the effect of fertility on the labor supply of married women find a negative correlation between fertility and the labor supply of women. This negative correlation between fertility and the labor supply of women is plausible for developed or industrialized countries because children go to school at an early age. As for low income developing countries such as Ethiopia, children start working in the home quite early, which helps the mother to work for pay outside of the home. Therefore, in this case the result of a negative relationship between fertility and labor supply of married women might not be warranted. The results of this paper try to test this hypothesis that the correlation of fertility and labor supply of married women in Ethiopia is positive by using 2SLS estimation technique. The findings of this paper, have, indeed verified the hypothesis.

We conclude this paper by pointing to some policy implications of the findings for Ethiopian and other developing countries especially those in Africa. Assuming that the reduction of fertility is a desirable in high fertility and high population growth rate economies such as Ethiopia, what are the key policies that can be drawn from this study.

First, is to expand access to education especially at the primary and secondary level at the rural areas, as well as vocational education beyond secondary school in the form of two-year community colleges for example.
Second, move toward making primary and secondary education compulsory, and raise the level of education of families especially that of women. Studies show that increase in female education significantly reduces fertility rates. Finally, increase the productivity of subsistence agriculture by investing on key movers of agricultural transformation such as improved technology, better roads, extension, and training of the rural farm populations, and finally invest on farm and non-farm rural enterprises to increase employment of rural women and raise their opportunity costs of having more children, and invest on rural primarily health care in order to reduce infant mortality that is likely to reduce fertility. Success in implanting these rural development policies is likely to make results found in this paper consistent with that of middle and high income developing countries where studies show there is negative relationship between fertility and the supply of female labor, or the observed relationship that greater participation of women will actually reduce fertility and therefore population growth in low income or income-poor developing countries such as Ethiopia.

References:


**Demographic Health Survey.** [http://www.measuredhs.com/countries/country.cfm](http://www.measuredhs.com/countries/country.cfm)


