Testing the Inverseness of Fertility and Labor Supply: The Case of Ethiopia

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DISCUSSION PAPER SERIES

Forschungsinstitut
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Institute for the Study
of Labor

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ABSTRACT

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We test the inverseness of fertility and labor supply for married women in Ethiopia to determine if previous research (focusing on developed countries) that has found an inverse relationship between fertility and labor supply is applicable to least developed countries. The research into fertility and labor supply has relied on a variety of methodologies for addressing the endogeneity of fertility. Using data from the Demographic Health Survey (DHS) of Ethiopia, we use the husband's desire for children to instrument for fertility. Our empirical results fail to support an inverse relationship between fertility and labor supply in Ethiopia, perhaps because the persistence of traditional family structures in the face of rising national female employment facilitates maternal employment. This finding has implications for other LDCs as well.

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For the past half century, developed countries have experienced rising female labor force participation rates along with fertility declines. Substantial research has been undertaken to estimate the relationship between fertility and labor supply with appropriate consideration of the endogeneity of fertility. The bulk of this research, focusing on developed countries, has established a negative relationship between female labor supply and fertility. This paper offers evidence on the link between female labor supply and fertility for Ethiopia, a least developed nation.

With a population of about 83 million, Ethiopia is currently Africa's second most populous country after Nigeria. In 2000, Ethiopia's population was growing at approximately 2.4% per year, a rate that would double the population in 28 years (DHS, 2005). [Footnote: Most African countries had a population growth rate that was in the same range as Ethiopia. For example, Nigeria had a population growth rate of 2.67% in 2000.] Ethiopia's total fertility rate (TFR) has declined from its peak of 7.7 children per woman in 1990 to 5.9 children per woman in 2000 (Central Statistical Authority of Ethiopia (CSA), 2000). [F: The total fertility rate (TFR) is the average number of children that would be born alive to a woman during her lifetime if she were to pass through her childbearing years conforming to the age-specific fertility rates by age of a given year.] Evidence from the data suggests that this decline in fertility has been much faster among the urban than the rural population as is typical for developing countries.

In least developed countries (such as Ethiopia), extended family networks and unpaid household production on the part of young children facilitate maternal paid employment. In fact, maternal employment is on the rise while traditional family structures (i.e., extended families residing in single households and child work) remain

the norm. There is much evidence that many children in least developed countries perform substantive work (see ILO 2002, for example.). K. Basu and R. Ray (2002) point out that the work performed by children takes place within the household and mostly revolves around household chores or work on the family farm. If indeed the mother has help in the house, be it from children or other family members, she is not forced to leave the workforce when she has an additional child. As a result, in the case of least developed countries, the relationship between fertility and labor supply of married women might not be inverse. To our knowledge, there is no empirical evidence of this relationship in Ethiopia nor any other developing country.

The main contribution of this study is our investigation of the effect of fertility on the labor supply of married women in a least developed country using a unique survey data set from the Demographic Health Survey (DHS) of Ethiopia. The other contribution of this study is the use of a new instrumental variable (IV), namely the husband's desire for children, to account for the endogeneity of fertility. In the next section we briefly describe the literature linking fertility and maternal labor supply. Then, we describe our data and empirical methodology and in the final section we discuss our results.

I. Fertility and Labor Supply: Theory and Evidence

The economic theory of fertility, first formalized in the 1960s, treats children as a type of good and views fertility as the response to the individual's demand for children relative to other goods. [F: See, most importantly, G. Becker (1960).] The underlying utility maximization framework in this theory is the assumption that individuals maximize utility by making best choices concerning adult goods, leisure, and child

services. Constraints in this model include budget and time constraints as well as a child services production function in which child services are produced with both parental time and child good inputs. Solving the first order conditions from this model yields demand equations for adult goods, leisure time, and child services (hereafter referred to as fertility), all determined jointly.

Empirical research of the consequences of childbearing on maternal labor supply is complicated by the endogeneity of fertility in female labor supply decisions. Several studies have used instrumental variable estimation (IVE) as a solution to this problem; however, this approach relies on the availability of an exogenous instrument to explain fertility that does not also explain labor supply. Rosenzweig and Wolpin (1980b) relied on unplanned births as an instrument while Rosenzweig and Schultz (1980a) relied on the availability and cost of contraceptives. Most relevant for our research is the paper by Angrist and Evans (1998) that relies on sibling sex composition as an instrumental variable (IV) for fertility in the United States. This IV exploits the widely observed phenomenon of parental preferences for a mixed sibling sex composition in the U.S. Following Angrist and Evans (1998), many studies have used sibling sex composition to instrument for fertility. Mauren and Moschion (2006) use the same IV for France while Cruces and Galiani (2003) use it for Argentina and Mexico. Cruces and Galiani (2003) investigate the extent to which the causal link identified in Angrist and Evans for the U.S. can be generalized to the context of developing countries, where fertility is higher, female education levels are much lower and childcare facilities are fewer relative to the U.S.

On the other hand, Chun and Oh (2002) argue that while U.S. households prefer balancing the sex composition of their children; Korean families prefer sons.

Consequently, 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 instrument which posits that fertility reflects, at least in part, cultural norms.

According to a study conducted by the World Health Organization (WHO), "women's decision-making abilities in general remain constrained and subjugated to the political, socio-economic, and cultural dominance of men." [F: An Assessment of Reproductive Health Needs in Ethiopia conducted by WHO (1999).] According to Cruces and Galiani, a desirable fertility instrument is one drawn from institutional structures or cultural norms. Our instrument, the husband's desire for children, reflects cultural norms, thus is credible as a factor relevant to fertility that is exogenous to labor supply decisions. Additionally, its reflection of cultural norms is consistent with much previous research that relies on cultural preferences regarding children's sex.

II. Our Data and Empirical Methodology

A. Data and Descriptive Statistics

Our data are drawn from the Ethiopian Demographic and Health Survey (DHS) of 2000 conducted by the Central Statistical Authority (CSA) of Ethiopia and provided by ORC macro. This cross-sectional survey covers both urban and rural areas and addresses topics such as household characteristics, health, paid and unpaid work, and education, among many other topics. This survey interviewed both women and men in selected households, thereby permitting the unique opportunity to incorporate information in our study regarding spousal fertility attitudes. Our sample is comprised of 954 married women of childbearing age (i.e., aged 15-39).

The key variable of interest for our study is the husband's desire for children. In the DHS, the wives were asked if their husbands want more children than they want, and if the husbands do want more children, then our fertility instrument takes the value of one. Otherwise, its value is zero. This instrument reflects the husband's desires as well as cultural norms, both exogenous to the mother's employment choice.

Other variables from this dataset that we utilize in our estimation are the woman's age group (15-19, 20-24, 25-29, 30-34, 35-39), number of children, a household wealth index, the number of children under 5 years old, the number of adult household members (other than the parents), the level of education of the husband, the level of education of the wife, urban/rural residence, religion, and if the mother worked for pay. Household wealth is proxied by the quintiles of the household wealth index that is constructed by DHS by incorporating information concerning household possessions (such as a television set, radio, telephone, house and cattle), and household facilities (such as access to electricity, source of drinking water, type of toilet facility and main material of floors), means of transport, and the number of rooms used for sleeping. It is designed to measure economic status of households. We include in our estimation two dummy variables constructed from this wealth index indicating medium or high wealth. [F: Specifically, the HIGH wealth dummy variable takes the value of one for individuals from households in the highest wealth quintile while the MEDIUM wealth dummy variable takes the value of one for individuals from households in the third and fourth wealth quintiles.]

Most notable in the descriptive statistics is the extremely low level of female education [F: The descriptive statistics are available upon request]. In our data, on average, married women in Ethiopia report 1.1 years of education, with about 74%

reporting no formal education at all. This could be because most of the women in our sample (about 72%) live in rural areas. The descriptive statistics also show that the average number of living children in the sample is about 3.75 as opposed to the average number of children ever born which are about 4.5. The average number of persons in the household is about 6.4 including the husband and wife. Regarding the paid labor force, 65% of the married women in our sample work for pay (cash or in kind). [F: Approximately one-third of these working women receive payment in kind in lieu of wages.]

The region of residence and level of education play an important role in the fertility rates of married women in Ethiopia. Specifically, married women living in urban areas or having high levels of formal education tend to have much lower fertility rates than their rural or poorly educated counterparts. (See 1999 WHO report.) [F: Ethiopia is subdivided into 9 ethnically based regions and 2 autonomous regions (administrations) which are Addis Ababa and Dire Dawa]. A priori, we expect the education level of the woman, the education level of her husband, and household wealth index to be negatively related with fertility, since education and wealth are generally negatively related with the number of children the couple are likely to have.

It is also important to control for urban/rural residence since there is a large variation in fertility rates among urban and rural women. We include the age of the woman at first marriage in our analysis (in the first stage fertility equation) because, in many societies, age at first marriage marks the point in a woman's life when childbearing becomes socially acceptable. Early age at first marriage could imply early age at childbearing and a higher level of fertility for the society (DHS, 2000). The variables

household members and children under 5 years old are needed to construct a variable to account for household members (including older children) that can help the mother with childcare.

II. B. Our Empirical Methodology

We begin our empirical work with a baseline estimation of the effect of fertility on female employment. This estimation employs a probit model using a directly observed but likely endogenous measure of fertility (the number of children). Next, following Chun and Oh (2000), we employ a two-stage regression where the first stage employs OLS to explain fertility and the second stage utilizes a probit model of employment. In the first stage, OLS is used to predict the number of children as a function of our fertility instrument (i.e., the husband's desire for children), as well as a list of control variables. Specifically, this exogenous measure of fertility preferences used to instrument fertility equals one if the husband's desire for children is greater than the number of children the wife desires and 0 otherwise.

In the second stage, the generated fertility measure from the first regression and the control variables listed previously are used to estimate the effect of fertility on the employment of married women in Ethiopia. Here, employment is defined as a dummy variable equaling the value of 1 of the mother works for pay (i.e., paid in cash or kind). Using this two-step methodology, we estimate the effect of fertility on married women's labor supply in Ethiopia. Note that identification is achieved by including the fertility instrument in the fertility equation but not in the employment probit equation. Additionally, the wife's age at first marriage explains fertility but not employment while

the number of adult household members (excluding the parents) explains employment but not fertility.

III. Results and Discussion

As a frame of reference, we begin our estimation with a direct, observed measure of fertility, namely the total number of children. The results show that the total number of children does not significantly affect the labor supply of married women in Ethiopia. [F: The results are available upon request] This could be because of the presence of the household members including older children that help the mother inside the home. If indeed the mother has help in the house, be it from older children or other family members, she is not forced to leave the workforce when she has an additional child.

However, these estimates could be biased as our econometric model needs to accommodate the endogeneity of fertility. Therefore our next set of estimations use an instrumental variable (IV) as a solution to this problem. Specifically, our instrumental variable equals one if the husband's desire for children is greater than the number of children the wife desires, and the IV equals zero otherwise. Our instrument for fertility is statistically significant at the 5% level in the first stage regression. The magnitude of the coefficient suggests that if the husband wants more children, then the number of children increases by 19 percentage points. This positive impact of the husband's desire for children on fertility is expected due to the cultural dominance of men, particularly in the rural areas.   Other factors statistically important to the family's fertility choice are maternal age, age at first marriage, and wealth. [F: Results from this first stage estimation are available upon request from the authors.]

The second stage employment probit regression results that utilize the predicted number of children from the first regression and a set of control variables are shown below.

Second Stage Probit Results, Dependent Variable: Worked for Pay

Variables	Marginal Effect	Standard Error
Predicted number of children	0.0042	0.0116
Husband's education level	0.0225	0.0203
Rural Residence	0.1427**	0.0386
Education level	-0. 0151*	0.0083
Household members	-0.0040	0.0089
Age Cohort		
Age Cohort 25_29 =1	0.0439	0.0407
Age Cohort 30_34 =1	0.0308	0.0489
Age Cohort 35_39 =1	0.0110	0.0530
Religion		
Christian	-0.5222*	0.2863
Muslim	0.1584	0.1291
Animist and others	-0.4388*	0.2879
Wealth Index		
Medium	-0.5585**	0.1253
High	-0.6635**	0.1323
Pseudo R2 = 0.0423	Sample size = 954	

*Significant at the 5% level, * Significant at the 10% level

The second stage probit regression results show that fertility (instrumented by the father's desire for children) does not significantly affect the labor supply of married women in Ethiopia. There are two possible explanations for this result that contradicts the previously established result of the inverseness of fertility and labor supply. First, fertility might be an insignificant determinant of the labor supply of married women in Ethiopia because of the large household size in Ethiopia, including older children. These extra household members might assist the mother's paid employment by performing unpaid labor in the home. If indeed the mother has help in the home, she may have less of a need to withdraw from paid labor force participation upon childbirth. Because the

family members alleviate child rearing responsibilities, there is less pressure for the mother to leave her paying job and take care of the newborn.

Another explanation for the insignificance of fertility in paid labor force decisions is the high levels of unemployment and underemployment. Data show that female unemployment in Ethiopia was 12% in 1999; underemployment was much higher and has become a serious problem in the country, especially in urban areas (Demeke, Guta, and Ferede, 2005). Demeke, Guta and Ferede (2005) note that if the underemployed were included in the unemployed category, then the unemployment rate would increase substantially. This might mean that when the wife's fertility is affected because of her husband's desire for children she does not want to leave her job due to the difficulty she might face later when searching for another job. Therefore the women who have had the opportunity to gain paid employment prior to bearing children are unlikely to withdraw temporarily from the workforce upon childbirth.

The table also shows the marginal effects of other factors important to female employment. For example, women living in rural areas are more likely to engage in paid work while education and wealth are both related negatively to employment. Interestingly, the mother's age is not an important employment determinant. Also, the presence of other adult household members is not a significant direct determinant of paid labor force participation, but according to our explanation for our fertility estimate, may be important indirectly as a determinant of fertility. Finally, women belonging to the Christian faith are less likely to work for pay.

Despite numerous empirical studies establishing the inverse relationship between fertility and labor supply in developed or developing countries, prior to this paper there

was no comparable evidence for least developed countries. We provide that evidence using Ethiopia as a case study and in fact reject this inverseness. We conclude that the combination of a trend towards increased female labor force participation with persistent traditional family structures may explain this finding. At a minimum, more research is needed to determine if any clear relationship exists between fertility and maternal labor supply in LDCs.

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