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Working Paper Series
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ECONOMIC INCENTIVES FOR SEX-SELECTIVE ABORTION IN INDIA

Daniel Rosenblum

Working Paper No: 2014-13

www.canadiancentreforhealtheconomics.ca

August 22, 2014

Canadian Centre for Health Economics
Centre canadien en économie de la santé
155 College Street
Toronto, Ontario

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Abstract

In order to understand the economic incentives behind sex selection in India, I provide the first estimates of the magnitude of the economic benefits of having a son instead of a daughter. I estimate large gains to per capita income and expenditure, household assets, and a reduction in the probability the household is below the poverty line. The observed pattern of incentives are compared to observed patterns in sex selection. Estimates show that sex selection may provide economic advantages through a reduction in total children born and also from an adult son's labor supply contribution to his parents' household.

JEL Classification: J13, J16, O12

Key words: sex-selective abortion; son preference; South Asia; India

Corresponding Author:

Daniel Rosenblum*
Dalhousie University
Department of Economics
Halifax, NS B3H 3J5
Canada
Phone: (902) 494-8945
Fax: (902) 494-6917
E-mail: Daniel.Rosenblum@dal.ca

*I thank Christopher Udry, Dean Karlan, and Mark Rosenzweig for guidance. This paper benefited from the comments of conference participants at the 2011 Canadian Economic Association Annual Meeting, 2011 Pacific Development Conference, and the 2011 CIRPEÈ Mini-Conference on Development

1 Introduction

Several recent papers estimate the large number of female sex-selective abortions in India. Jha et al. (2006), Jha et al. (2011), and Bhalotra and Cochrane (2010) find consistent estimates of close to 500,000 selective abortions per year in India or about 2 percent of annual pregnancies. Sex selection and excess female mortality are prevalent enough to skew the sex ratio of men to women far above the rates seen in developed countries and is a major concern for policy makers.[1]

Although it is not a new idea that sex selection occurs for economic reasons, this paper is the first to estimate the magnitude of the economic benefits of a son relative to a daughter in India.[2] I use the plausibly exogenous sex outcome of a first-birth in India as a proxy for the effect of sex selection. If parents in India are not selectively aborting their first pregnancies, we can estimate the average difference between economic outcomes of households with a first-born boy and those with a first-born girl. This difference is the estimated average effect of sex selection at the first pregnancy. The goal of this research is to provide estimates of the size of the economic incentives for sex selection as well as determine whether patterns in the relative value of sons can plausibly explain the variation across India in the prevalence of sex-selective abortion.

I estimate that having a first-born son instead of a daughter increases per capita yearly income, per capita monthly expenditures, and household assets, while reducing the probability that the household is below the poverty line. The incentives for sex selection are likely different at higher parities. And, in particular, these incentives likely rise with the number of previously born daughters and fall with the number of previously born sons. Thus, one can think of the estimated economic benefit of a son versus a daughter at the first parity as a lower bound on the economic incentives for sex selection for a household with no previously born sons.

[1] For example, recently the Indian government introduced programs to provide monetary incentives for parents to have daughters and keep their daughters alive. The *Apni Beti Apna Dhan* (Our Daughter, Our Wealth) program in the state of Haryana gives parents cash when a daughter is born plus a long-term savings bond if the daughter survives to age 18 and is unmarried (Sinha and Yoong, 2009).

[2] By sex selection, I mean the continued abortion of female fetuses until a male child is born.

It may not be intuitive that the fact that parents are not sex selecting at the first parity can be used to estimate the incentives for sex selection. If these incentives are strong, parents should be sex selecting even at the first parity, which defeats this paper's empirical strategy. Yet, there is substantial evidence from large Indian datasets that parents do not use sex-selective abortion for their first pregnancies (Bhalotra and Cochrane, 2010; Ebenstein, 2007; Jha et al., 2011; Portner, 2010; Rosenblum, 2013). I provide evidence that even though there are strong incentives for sex selection at the first parity, they do not appear strong enough to cause it to occur until the second or higher order parities. Parents in India generally prefer two or more children (Bhat and Zavier, 2003). In addition, there is sociological evidence that parents do not have a strong preference for sons at the first parity, but they have a strong preference for sons after this first birth (Patel, 2007). As I will show, the economic benefits of sons diminishes with the number of sons and are only detectable for the first son, not the second son. Thus, parents who want two or more children should be willing to have a first-born daughter in anticipation of sex selecting at the second or higher parity. In other words, even if a son provides strong economic benefits at the first parity, since fertility is not assured and sex selection is costly, the optimal strategy to having two children, one of which is male, at the least cost and with the least risk is to let the first child be born regardless of sex and then use sex selection only at the second parity if the first-born is female.

To address the possibility that sex selection (or some other type of selection bias) may be the underlying cause of the empirical finding of sons' economic benefits, I present evidence that parents of first-born sons are not differentially wealthier than parents of first-born daughters when their children are young, before a son could realistically increase household wealth. From a slightly different perspective, when you divide the sample of households with young children by wealth, the sex-ratio of first-born children is no different for the richest compared to the poorest households. In summary, there is substantial evidence that parents are not sex selecting at the first parity, even though there are economic incentives to do so. This can reasonably be explained by parents' optimal fertility decisions, i.e. although a son provides economic benefits at the first parity, since parents have non-economic incentives (desiring more than one child), they should prefer to only resort to selective abortion at higher parities.

There are a number of hypothesized mechanisms for the benefits of sons in India. Shepherd (2008) summarizes several of these, including greater male participation in agriculture or in the labor force in general, lower marriage costs for sons[3], and the cultural convention of financial support in old-age from sons and not daughters. What we call "economics" and what we call "culture" are inter-related here. For example, the cultural conventions of joint households where sons live with their parents even after marriage and daughters move sometimes a great distance to live with their in-laws could be the reason for the strong relative economic value of sons. I take the cultural context as given and examine the incentives within this context. Although the determination of the exact mechanisms which cause sons to be valuable is outside the scope of this paper, I investigate two related mechanisms by comparing incentives for younger and older parents.

The first mechanism is the additional household labor supplied by a son. I find that if older parents have a first-born son, they have more workers in the household and are, thus, significantly better off in terms of household income and wealth compared to parents with a first-born daughter. The second mechanism is the effect of sex selection on household composition. Parents who use sex selection have fewer children, and this is one reason that parents are better off in per capita terms when their son is young. Clark (2000) explains that parents in India follow son-preferring fertility stopping rules, where the birth of a daughter causes parents to increase their fertility in the hopes of having one or more sons. However, sex selection increases the number of household members when parents are older because daughters leave when married and sons add a daughter-in-law and his children, which may decrease the economic benefits of sex selection in per capita terms. I compare different equivalence scales to examine how these composition

[3] In India, it is common for the bride's parents to transfer assets to the groom and his parents at the time of marriage. Rao (1993) and Anderson (2003) show that dowries can be substantial costs to the parents of daughters.

effects change the interpretation of the estimates. Regardless of the equivalence scale, a first-born son always has a positive average effect for some age groups and never has a negative effect.

In addition, I examine heterogeneity in the benefits of sons relative to daughters across regions and demographic groups. I use these estimates to examine whether patterns in economic incentives can explain the observed variation in sex selection across Indian geography and demographic groups. The patterns in incentives match patterns in sex selection, showing that the economic value of sons is a plausible cause of sex selection in India. Last, I focus on economic differences between households with a second-born son compared to a second-born daughter, conditional on the sex of the first-born child. I find that a second-born son provides no economic benefit if the first-born child is male. This finding of diminishing returns to sons helps to explain why parents do not sex select at the first parity and why there is no demographic evidence in India of sex selection occurring conditional on the birth of a previously born son.

2 Background

Many researchers have found bias against girls in South Asia (Visaria, 1969; Basu, 1989; Sen, 1990; Coale, 1991; Klasen, 1994; Hazarika, 2000; Asfaw et al., 2007; Anderson and Ray, 2010). There are fewer attempts to determine or measure the specific economic incentives causing this discrimination. Rosenblum (2013), for example, hypothesizes that the future economic benefits of sons and costs of daughters drive son-preferring fertility stopping rules that exacerbate discrimination against girls. Rosenzweig and Schultz (1982) argue that the relatively high future wages of sons cause parents to invest in sons over daughters in India. They explain part of the excess female mortality in India by these wage differences. Overall, however, the economic causes of son-preference and sex-selective abortion in India have not been deeply explored.

China also has a substantial missing women problem. There has been a debate about the availability of prenatal sex detection and extent of sex selection in China with, for example, Johansson and Nygren (1991) arguing that sex selection is a minor problem and others arguing the opposite (Junhong, 1991). The recent estimates of Anderson and Ray (2010) show that sex-selective abortion is a substantial problem in China and that male-female mortality patterns are similar to those seen in developed countries.

Empirical research on China shows that sons can provide greater economic benefits than daughters. Ding and Zhang (2009) use an instrumental variables approach to help resolve the endogeneity problem between household finances and the number and sex composition of children. They find that in China a son increases investment in household agriculture and business. Ebenstein (2011) uses variation in fines for having extra children in China to identify the value of sons versus daughters. He estimates that a son is worth an extra 1.42 years of income to a household. Qian (2008)'s research uses a similar logic as Rosenzweig and Schultz (1982) and finds that labor income differences between men and women in China can explain some of the mortality differences. Even though parents may prefer sons for economic reasons, there is the potential for negative externalities. Edlund et al. (2013) examine the larger social costs of the high male-female sex ratio in China, finding that an increase in men causes an increase in crime.

Son preference is not restricted to developing countries. For example, Dahl and Moretti (2008) show that fathers in the US are more likely to remain in a marriage if they have a son, while Lundberg and Rose (2002) find that fathers of sons increase their labor supply. Choi et al. (2008) find similar effects in West Germany, where having a son is also correlated with increased paternal labor supply and a lower probability of divorce.

Although I calculate the economic benefits of sex-selective abortion in India, I do not estimate its direct economic cost. Arnold et al. (2002) estimate the cost of sex detection via ultrasound at US$10-$20 per test and Ganatra and Hirve (2002) finds that in rural Maharashtra the cost of an abortion (in private clinics) costs US$10 in the first trimester and US$30 in the second trimester. Although these costs may seem low, they are still significant in a country where much of the population lives in poverty. Households who live in rural areas, farther away from medical services, will incur even larger costs than households who have easier access. Additionally, there are potentially significant negative effects from abortions on the health of the mother, which increase as health providers decline in quality and availability. Part of the opportunity cost of abortion is giving birth, which has its own economic and health costs. These costs could be similar to the direct costs of sex-selective abortion.[4] This paper cannot precisely estimate the specific costs to households of sex-selective abortion, and thus cannot estimate the exact net economic benefit of sex selection. Nonetheless, estimating the benefits will yield important information about parental incentives to use sex-selective abortion.

3 Data Description

I use the detailed economic data from the 2005 India Human Development Survey (IHDS). The data is nationally representative of India and covers 41,554 households in 1504 villages and 970 urban neighborhoods in 33 states and union territories. The IHDS contains data on household spending, income, labor supply, and assets as well as demographic characteristics such as household members' age, education, caste, and religion. Ever-married women between the ages of 15 and 49 are asked additional questions, and in particular are asked to report their full birth history. 31,062 of these women report having one or more children. However, to simplify the analysis, I only use the birth histories of heads of household or their spouse and not, for example, daughters-in-law. Some households are dropped from the analysis if the head of household has no children, birth history was not recorded, the head of household has multiple wives, or the head of household has first-born twins, bringing the sample size down to 24,158 households. Although the IHDS is a cross-section, the detailed economic data makes it more informative than, for example, the multiple waves of the Indian National Family Health Surveys (NFHS) which

[4] The 2007-2008 Indian DLHS 3 has responses from 217,986 women about the cost of their most recent delivery. The sample-weighted mean cost of delivery is about Rs. 2200.

only contain a household wealth index.[5]

One may worry that the missing birth histories create bias because they are of women who used selective abortion. Most of the birth histories dropped from the analysis are daughters-in-law living with the household head. Analyzing them is complicated by the many households with more than one daughter-in-law, making it difficult to match children to their mother and to attribute the effects of the sex of a first-born child. However, to address the possibility of such bias, I perform several tests that show that parents of first-born sons are not initially different, and in particular not wealthier, than parents of first-born daughters.

4 Estimation Strategy

The estimation strategy uses the observation that the sex outcome of a first-birth in India is a random event. As shown in Bhalotra and Cochrane (2010), Ebenstein (2007), Jha et al. (2011), Portner (2010), and Rosenblum (2013), in India first births have a biologically normal sex ratio, i.e. parents do not use sex-selective abortion for their first pregnancies. Given the large amount of evidence that sex selection is not influencing the first birth parity, we can treat a first birth as a natural experiment and ask what would have happened if parents had used sex selection at the first parity. Households with a first-born girl, if they had used sex selection (ignoring any direct costs of selective abortion), would on average look exactly like households with a first-born boy. Thus, the following equation estimates the effect of sex selection at the first parity on the household economy:

$$Y_{ij} = \alpha + \beta FirstBoy_{ij} + \gamma' \mathbf{X}_{ij} + S_j + e_{ij} \tag{1}$$

[5] As in the IHDS, a separate analysis using the NFHS estimates that a first-born boy predicts greater wealth in households (estimates not reported). They also follow the same age pattern as assets in the IHDS: a first-born boy is correlated with more wealth for older households compared to younger households.

where Y_{ij} is the economic variable of interest for household i in state/territory j. $FirstBoy_{ij}$ is a 0/1 variable equal to 1 if parents have a first-born boy and equal to 0 if parents have a first-born girl. $\mathbf{X}_{ij}$ is a vector of household variables, including parents' age at the time of the survey, years of schooling, religion, caste, and whether the household is in a rural or urban part of India. S_j are state/territory fixed effects, and e_{ij} is the error term. Caste and religion are included in the same variable as caste predominantly applies to Hindus, and in the IHDS caste status precludes one from being in another religion. Thus, caste indicates specific subsamples of Hindu households. β is the estimated economic value of a first-born son compared to a first-born daughter, i.e. the estimated economic value in 2005 of using sex-selective abortion to attain a son instead of a daughter at the first parity. Since the data is a cross section, we can only measure the 2005 value of sex selection and not how that value changes over time for a specific household. However, a sub-analysis focusing on different age categories of parents gives an indication of how the economic incentives for sex selection change as parents age.

I estimate the effect of sex-selective abortion on four measures of economic well-being: the (natural) log of per capita yearly income (PCI) in Indian rupees, log of per capita monthly expenditure (PCE) in Indian rupees, as well as a household asset index, and whether the household is below or above the poverty line. There is a strong economic argument for using household expenditure as a measure of long-term household welfare (Deaton, 1997). I include income as well, even though it may represent a more short-term measure of welfare in addition to having potentially more difficult measurement problems. I also use per capita instead of total income or expenditure to help to account for differences in household composition (Datta and Meerman, 1980). Per capita measures ignore potential economies of scale in the household.[6] Because sex selection affects household size directly, I investigate how different household equivalence scales affect the interpretation of the estimates.

The IHDS household asset index is based on the household's ownership of durable

[6] See Deaton (1997) for a discussion of the various problems of calculating per capita equivalents.

items (vehicle, sewing machine, computer, etc.) and the quality of the home (flush toilet, quality of the walls, roof, and floor, electricity, etc.). The index ranges from 0 to 30 with 30 indicating the highest level of assets. The asset measure can be thought of as a measure of household wealth. As argued by Filmer and Pritchett (2001), an asset index can also be interpreted as a long-term measure of household welfare. Last, I estimate the effect of sex selection on poverty status. The poverty line is determined by the Indian Planning Commission's official per capita expenditure poverty lines for 2005, which varies by location.

5 Exogeniety of the Sex of First-Born Children

If parents of first-born boys in the IHDS were systematically different than households with a first-born girl in unobservable ways prior to having their first child, it would be a threat to the empirical strategy. The population weighted ratio of male to female first-births in the IHDS is 1.09 with a 95% confidence interval of 1.05-1.13. 1.09 is larger than the 1.03-1.07 range considered biologically normal (Chahnazarian, 1988). However, even with more than 24,000 observations, the sample size is too small to reject the hypothesis that the sex ratio at birth is normal.[7] The larger data sets used in previous studies find that the sex ratio at birth for first-borns is biologically normal in India (Bhalotra and Cochrane, 2010; Ebenstein, 2007; Jha et al., 2011; Portner, 2010; Rosenblum, 2013). However, I provide additional evidence to ensure that there is no bias from sex selection at the first parity in the IHDS.

One test to detect such a bias is to estimate whether first-born boy and first-born

[7] The reason that a large sample size is needed to accurately estimate proportions can be seen from the formula to calculate 95% confidence intervals:

$$p \pm 1.96\sqrt{\frac{p(1-p)}{n}}$$

where p is the estimated proportion and n is the number of observations. Assuming the estimated proportion was exactly 1.05 males per female (or 51.2% male births), one would need more than 40,000 observations to get a 95% confidence interval within the 1.03-1.07 range. If the estimated proportion was exactly 1.06 males per female, one would need more than 170,000 observations to get a 95% confidence interval within the 1.05-1.07 range. The closer the actual estimated proportion is to 1.07, the more observations are needed to distinguish the estimated proportion from being above 1.07.

girl households are systematically different in characteristics that should be exogenous to the sex of their first-born child. Table 1 presents population-weighted means for IHDS household variables separated into male and female first-birth households. These variables include parents' age and education, religion, caste, and whether they live in a rural or urban area. There are almost no statistically significant differences between first-born boy and first-born girl households.[8] This table shows that if there is bias in the dataset, it is likely small.

If, as shown in Bhalotra and Cochrane (2010), wealthier households are more likely to use sex selection, and parents use sex selection at the first parity, then it would not be surprising if I find that a first-born boy predicts better economic outcomes. For parents of older children, it is impossible to disentangle this selection bias from the true increase in wealth generated by a son. However, ultrasound only started to become prevalent in the 1990s and, hence, older parents were much less likely to have access to sex-detection technology than younger parents. For parents of young children, if the sex of a first-born is truly exogenous, then sons should have no effect on wealth, which takes time to accumulate.

I test for the existence of this selection bias in young households in two ways. First, focusing on households where the first-born is aged five or under, I examine whether there are significant differences in the sex ratio of first borns for wealthy versus poor households. Because of the limited sample size, I only test the difference between households above the median household asset index and those below. The survey-weighted proportion of young wealthier households with a first-born son is 0.520 (standard error: 0.018), while it is 0.528 (standard error: 0.020) for households with low assets. Hence, there is no detectable difference in the probability of giving birth to a first-born son based on initial

[8] The one exception is self-identified Muslim households, where first-born boy households are 13 percent Muslim and first-born girl households are 11 percent Muslim. One possibility is that Muslim households are using sex-selective abortion for first-pregnancies. However, since Muslim households are poorer on average compared to non-Muslim households, it is unlikely that this would introduce much bias into the estimates. All of the estimates in the paper are robust to dropping Muslim households from the sample. Given the large number of variables, it is also likely that this exception represents a false positive.

Table 1: Descriptive Statistics by First-Birth Outcome

Independent Variables	First-Born Boy (1)	First-Born Girl (2)	Difference (3)
Mother's Age (years)	35.02	35.02	0.01
	(0.11)	(0.12)	(0.14)
Father's Age (years)	40.41	40.23	0.18
	(0.15)	(0.12)	(0.16)
Mother's Education (years)	3.72	3.67	0.05
	(0.08)	(0.08)	(0.09)
Father's Education (years)	5.99	5.95	0.03
	(0.09)	(0.09)	(0.09)
Urban (0/1)	0.31	0.31	0.00
	(0.01)	(0.01)	(0.03)
Muslim (0/1)	0.13	0.11	0.01**
	(0.01)	(0.01)	(0.01)
Christian (0/1)	0.01	0.02	-0.00
	(0.00)	(0.00)	(0.00)
Sikh, Jain (0/1)	0.01	0.01	0.00
	(0.01)	(0.01)	(0.00)
Brahmin (0/1)	0.05	0.05	-0.00
	(0.00)	(0.00)	(0.00)
High Caste (0/1)	0.15	0.15	-0.00
	(0.01)	(0.01)	(0.01)
Scheduled Caste (0/1)	0.23	0.23	0.00
	(0.01)	(0.01)	(0.01)
Scheduled Tribe (0/1)	0.07	0.08	-0.00
	(0.01)	(0.01)	(0.01)
Other Backward Classes (OBC) (0/1)	0.35	0.36	-0.00
	(0.01)	(0.01)	(0.01)
Dependent Variables	**First-Born Boy** (4)	**First-Born Girl** (5)	**Difference** (6)
Annual Per Capita Income (Rs.)	9955	9411	544**
	(221)	(236)	(229)
Monthly Per Capita Expenditure (Rs.)	852	832	20*
	(12)	(12)	(11)
Below Poverty Line (0/1)	0.21	0.22	-0.01
	(0.01)	(0.01)	(0.01)
Household Asset Index	11.24	11.09	0.16
	(0.13)	(0.13)	(0.11)
Observations	12636	11522	

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

Notes: No households with first-born twins. Sampling weights used. Standard errors in parentheses. Rounding of estimates causes some of the differences to be 0.01 greater or lesser than the subtraction of Column (2) from Column (1) would indicate.

wealth.

Second, I estimate the effect of a first-born son on household assets and poverty status using Equation 1, again only for parents of children aged five years or younger. As shown in Table 2, I find no statistically significant difference between the two types of young parents, providing additional evidence that households who have a first-born boy are not initially wealthier than households with a first-born girl.

Table 2: OLS: Correlation of a first-born son with household assets and poverty status, first-born age 5 or younger

	Asset Index		**Below Poverty Line**	
First-Born Boy	0.050	0.108	-0.005	0.003
	(0.208)	(0.114)	(0.012)	(0.014)
Controls	no	yes	no	yes
Observations	2431	2400	2431	2400
R^2	0.000	0.664	0.000	0.196

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

Notes: Robust standard errors clustered by state in parentheses, no first-parity or second-parity twin households. Controls: parents' age and education, caste/religion, urban/rural, and state.

Although it is unlikely that sex selection occurs at the first parity, an additional problem with the estimation strategy, as indicated in Rosenblum (2013) and Milazzo (2014), is that there is the potential for recall and survival bias in the data that causes first-born girl households to appear to be better off than they really are. Recall bias occurs when parents do not accurately report their birth history. In particular, parents may fail to report daughters who died when very young. Survival bias happens because mothers of first-born girls have more children on average than mothers of first-born sons. Since death during childbirth is not uncommon in India, this difference in number of children means that mothers of first-born girls are more likely to die than mothers of first-born boys and, therefore, are not available to be surveyed. In either case, the worst-off mothers of first-born girls are those not being surveyed or wrongly reporting their first-born child is a son. Thus, β may be an underestimate of the true economic benefits of having a first-born son instead of a first-born daughter. Household demographic variables are included in the estimations to reduce this bias. However, there is little change to the coefficients if demographic controls are omitted. This provides further evidence that there is little bias in the estimates and that the sex of a first-born can reasonably be treated as exogenous.

6 Average Economic Gains from Sex Selection

On average, households with a first-born boy have better economic outcomes compared to first-born girl households. Table 1 Columns (4) and (5) show the mean dependent variables of interest with the sample separated by the sex of the first-born child. The average household in the IHDS is very poor, with per capita income of Rs. 9,700 annually,[9] per capita monthly expenditures of Rs. 840,[10] and 22 percent of households living below the poverty line. These number indicate the intense poverty of many of the households in the survey as well as the potential for large increases in household welfare from small increases in income or wealth.

The full estimation results indicate a strong positive effect on the household economy of having a son instead of a daughter. Columns (1) and (2) in Tables 3-6 show estimates of the average economic benefit across India of a household using sex selection. As seen in Column (2), where controls are added to reduce bias, a first-born son increases annual per capita household income on average by 6.9 percent across India, increases monthly household per capita expenditure by 2.1 percent, increases the household asset index by 0.2, and decreases the probability that a household is in poverty by 0.7 percentage points. The estimates for income, expenditure, and assets are statistically significant at the one percent level. The estimates for below poverty line status are significant at the ten percent level. These findings show that there are substantial economic gains from sex selection.

[9] $620 in 2005 USD using World Bank PPP
[10] $54 in 2005 USD using World Bank PPP

Table 3: OLS: Effect of a First-Born Boy on Per Capita Income.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
First-Born Boy (FB)	0.071***	0.069***	0.044***	0.038**	0.042**	-0.011	0.042***	-0.006
	(0.014)	(0.013)	(0.015)	(0.017)	(0.018)	(0.048)	(0.011)	(0.047)
FB*(30 $\leq$Mother Age $<$ 35)			0.074***	0.068***	0.068***	0.068***		0.070***
			(0.022)	(0.023)	(0.023)	(0.023)		(0.022)
FB*(35 $\leq$Mother Age $<$ 40)			0.040	0.037	0.037	0.038		0.043
			(0.031)	(0.031)	(0.031)	(0.031)		(0.031)
FB*(40 $\leq$ Mother Age $<$ 45)			0.011	0.012	0.013	0.014		0.021
			(0.029)	(0.030)	(0.029)	(0.030)		(0.028)
FB*(Mother Age $\geq$ 45)			-0.008	-0.008	-0.008	-0.007		0.003
			(0.033)	(0.032)	(0.033)	(0.033)		(0.032)
FB*Primary Ed.				-0.012	-0.010	-0.012		-0.018
				(0.031)	(0.032)	(0.031)		(0.028)
FB*Below 10 Yrs Ed.				0.028	0.032	0.033		0.027
				(0.022)	(0.023)	(0.025)		(0.023)
FB*Above 10 Yrs Ed.				0.006	0.015	0.020		0.021
				(0.034)	(0.039)	(0.037)		(0.035)
FB*Urban					-0.020	-0.021		-0.012
					(0.022)	(0.021)		(0.022)
FB*High Caste						0.043		0.013
						(0.049)		(0.048)
FB*OBC						0.070		0.047
						(0.052)		(0.053)
FB*Scheduled Caste						0.049		0.028
						(0.051)		(0.051)
FB*Scheduled Tribe						0.016		-0.001
						(0.047)		(0.050)
FB*Muslim						0.068		0.048
						(0.049)		(0.049)
FB*Sikh/Jain						0.018		0.026
						(0.072)		(0.072)
FB*Christian						0.107		0.109
						(0.090)		(0.082)
FB*North							0.015	-0.010
							(0.035)	(0.034)
FB*West							0.086***	0.087**
							(0.025)	(0.033)
FB*East							0.048*	0.010
							(0.024)	(0.029)
FB*Center							0.038	-0.001
							(0.028)	(0.033)
FB*Northeast							-0.097**	-0.046
							(0.043)	(0.031)
Controls	no	yes	yes	yes	yes	yes	no	yes
R-Squared	0.001	0.383	0.385	0.386	0.387	0.387	0.055	0.368
Observations	23829	22322	22322	22322	22322	22322	23681	22181

(* p<0.1, ** p<0.05, *** p<0.01)

Notes: Robust standard errors, clustered by state, are reported in parentheses. Controls are parents' age and education, caste/religion, urban/rural, and state. The omitted mother age category is under 30. Education interactions are for mother's education and the omitted category is below primary education. The omitted caste/religion is Brahmin. The omitted region is the South. State dummy variables are not included in the regional estimates in Columns (7) and (8).

Table 4: OLS: Effect of a First-Born Boy on Per Capita Expenditure.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
First-Born Boy (FB)	0.021**	0.021***	0.017	-0.000	0.004	0.014	-0.005	-0.010
	(0.010)	(0.007)	(0.011)	(0.013)	(0.015)	(0.043)	(0.006)	(0.044)
FB*(30 $\leq$Mother Age $<$ 35)			0.034**	0.030**	0.029**	0.029**		0.031**
			(0.013)	(0.013)	(0.013)	(0.013)		(0.012)
FB*(35 $\leq$Mother Age $<$ 40)			0.004	0.004	0.004	0.004		0.009
			(0.020)	(0.020)	(0.020)	(0.019)		(0.022)
FB*(40 $\leq$ Mother Age $<$ 45)			-0.017	-0.015	-0.015	-0.015		-0.008
			(0.024)	(0.024)	(0.024)	(0.025)		(0.022)
FB*(Mother Age $\geq$ 45)			-0.010	-0.008	-0.008	-0.008		0.003
			(0.027)	(0.028)	(0.028)	(0.027)		(0.026)
FB*Primary Ed.				0.037*	0.039**	0.038**		0.050**
				(0.018)	(0.018)	(0.018)		(0.021)
FB*Below 10 Yrs Ed.				0.024	0.029*	0.028		0.033*
				(0.016)	(0.016)	(0.017)		(0.017)
FB*Above 10 Yrs Ed.				0.053**	0.063***	0.062**		0.075***
				(0.020)	(0.020)	(0.023)		(0.022)
FB*Urban					-0.020	-0.021		-0.021
					(0.018)	(0.018)		(0.018)
FB*High Caste						-0.008		-0.013
						(0.039)		(0.038)
FB*OBC						-0.003		0.001
						(0.035)		(0.035)
FB*Scheduled Caste						-0.018		-0.018
						(0.037)		(0.038)
FB*Scheduled Tribe						-0.016		0.017
						(0.042)		(0.041)
FB*Muslim						-0.004		-0.002
						(0.042)		(0.040)
FB*Sikh/Jain						-0.035		-0.061
						(0.056)		(0.055)
FB*Christian						-0.029		-0.036
						(0.050)		(0.053)
FB*North							0.051***	0.041**
							(0.017)	(0.018)
FB*West							0.051***	0.037*
							(0.017)	(0.018)
FB*East							0.044*	0.011
							(0.024)	(0.019)
FB*Center							0.026***	0.012
							(0.007)	(0.013)
FB*Northeast							-0.078**	-0.088***
							(0.032)	(0.025)
Controls	no	yes	yes	yes	yes	yes	no	yes
R-Squared	0.000	0.451	0.453	0.451	0.451	0.451	0.090	0.416
Observations	24139	22596	22596	22596	22596	22596	23990	22454

(* p<0.1, ** p<0.05, *** p<0.01)

Notes: Robust standard errors, clustered by state, are reported in parentheses. Controls are parents' age and education, caste/religion, urban/rural, and state. The omitted mother age category is under 30. Education interactions are for mother's education and the omitted category is below primary education. The omitted caste/religion is Brahmin. The omitted region is the South. State dummy variables are not included in the regional estimates in Columns (7) and (8).

Table 5: OLS: Effect of a First-Born Boy on Household Assets.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
First-Born Boy (FB)	0.169*	0.197***	0.019	0.069	0.094	-0.026	0.049	0.010
	(0.092)	(0.042)	(0.076)	(0.083)	(0.088)	(0.253)	(0.120)	(0.247)
FB*(30 $\leq$Mother Age $<$ 35)			0.189	0.150	0.149	0.157		0.155
			(0.117)	(0.112)	(0.112)	(0.111)		(0.114)
FB*(35 $\leq$Mother Age $<$ 40)			0.068	0.052	0.053	0.063		0.067
			(0.094)	(0.093)	(0.093)	(0.096)		(0.099)
FB*(40 $\leq$ Mother Age $<$ 45)			0.427**	0.409**	0.411**	0.421**		0.400**
			(0.159)	(0.156)	(0.155)	(0.154)		(0.165)
FB*(Mother Age $\geq$ 45)			0.332**	0.321**	0.324**	0.336**		0.335*
			(0.138)	(0.136)	(0.136)	(0.144)		(0.164)
FB*Primary Ed.				0.018	0.026	0.024		0.080
				(0.208)	(0.210)	(0.208)		(0.217)
FB*Below 10 Yrs Ed.				-0.044	-0.019	0.000		0.030
				(0.124)	(0.132)	(0.132)		(0.122)
FB*Above 10 Yrs Ed.				-0.102	-0.051	-0.018		0.025
				(0.141)	(0.142)	(0.159)		(0.153)
FB*Urban					-0.108	-0.124		-0.090
					(0.140)	(0.139)		(0.140)
FB*High Caste						-0.052		-0.165
						(0.181)		(0.175)
FB*OBC						0.081		0.042
						(0.249)		(0.233)
FB*Scheduled Caste						0.033		-0.068
						(0.249)		(0.250)
FB*Scheduled Tribe						0.166		0.106
						(0.285)		(0.299)
FB*Muslim						0.443		0.396
						(0.304)		(0.298)
FB*Sikh/Jain						0.124		-0.092
						(0.392)		(0.388)
FB*Christian						0.889*		0.873*
						(0.460)		(0.432)
FB*North							0.262	0.056
							(0.211)	(0.127)
FB*West							0.328**	0.212*
							(0.120)	(0.110)
FB*East							0.197	-0.084
							(0.274)	(0.167)
FB*Center							0.212	-0.010
							(0.127)	(0.103)
FB*Northeast							-0.556*	-0.305
							(0.296)	(0.216)
Controls	no	yes	yes	yes	yes	yes	no	yes
R-Squared	0.000	0.656	0.656	0.652	0.652	0.652	0.107	0.629
Observations	24158	22612	22612	22612	22612	22612	24009	22470

(* p<0.1, ** p<0.05, *** p<0.01)

Notes: Robust standard errors, clustered by state, are reported in parentheses. Controls are parents' age and education, caste/religion, urban/rural, and state. The omitted mother age category is under 30. Education interactions are for mother's education and the omitted category is below primary education. The omitted caste/religion is Brahmin. The omitted region is the South. State dummy variables are not included in the regional estimates in Columns (7) and (8).

Table 6: OLS: Effect of a First-Born Boy on Poverty Status.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
First-Born Boy (FB)	-0.008*	-0.007*	-0.000	-0.001	-0.001	0.016	-0.000	0.020
	(0.004)	(0.004)	(0.010)	(0.013)	(0.013)	(0.028)	(0.003)	(0.025)
FB*(30 ≤Mother Age < 35)			-0.028**	-0.027**	-0.027**	-0.026**		-0.027**
			(0.013)	(0.013)	(0.013)	(0.012)		(0.013)
FB*(35 ≤Mother Age < 40)			-0.004	-0.004	-0.004	-0.004		-0.005
			(0.013)	(0.013)	(0.013)	(0.013)		(0.014)
FB*(40 ≤ Mother Age < 45)			0.011	0.011	0.011	0.012		0.009
			(0.014)	(0.014)	(0.014)	(0.015)		(0.013)
FB*(Mother Age ≥ 45)			-0.018	-0.018	-0.018	-0.017		-0.021
			(0.014)	(0.014)	(0.014)	(0.015)		(0.013)
FB*Primary Ed.				-0.013	-0.013	-0.012		-0.011
				(0.022)	(0.022)	(0.022)		(0.024)
FB*Below 10 Yrs Ed.				0.007	0.006	0.008		0.008
				(0.008)	(0.007)	(0.009)		(0.009)
FB*Above 10 Yrs Ed.				-0.003	-0.003	-0.003		-0.003
				(0.010)	(0.013)	(0.013)		(0.013)
FB*Urban					0.002	-0.000		0.000
					(0.016)	(0.016)		(0.017)
FB*High Caste						-0.019		-0.013
						(0.020)		(0.019)
FB*OBC						-0.037*		-0.037**
						(0.018)		(0.017)
FB*Scheduled Caste						-0.007		-0.005
						(0.021)		(0.022)
FB*Scheduled Tribe						-0.011		-0.023
						(0.028)		(0.027)
FB*Muslim						0.003		0.004
						(0.026)		(0.025)
FB*Sikh/Jain						0.021		0.046***
						(0.016)		(0.014)
FB*Christian						0.002		0.008
						(0.037)		(0.038)
FB*North							-0.017**	-0.023***
							(0.007)	(0.007)
FB*West							-0.018	-0.012
							(0.012)	(0.007)
FB*East							-0.029***	-0.015**
							(0.009)	(0.005)
FB*Center							0.016**	0.022***
							(0.006)	(0.004)
FB*Northeast							0.036***	0.040***
							(0.012)	(0.011)
Controls	no	yes	yes	yes	yes	yes	no	yes
R-Squared	0.000	0.201	0.202	0.202	0.202	0.202	0.055	0.155
Observations	24158	22612	22612	22612	22612	22612	24009	22470

(* p<0.1, ** p<0.05, *** p<0.01)

Notes: Robust standard errors, clustered by state, are reported in parentheses. Controls are parents' age and education, caste/religion, urban/rural, and state. The omitted mother age category is under 30. Education interactions are for mother's education and the omitted category is below primary education. The omitted caste/religion is Brahmin. The omitted region is the South. State dummy variables are not included in the regional estimates in Columns (7) and (8).

7 Household Size, Economies of Scale, and Household Labor Supply

If household economies of scale are important, then household demographic changes may cause per capita measures to overestimate the effect of a first-born son on the household economy when children are young and underestimate the effect when children are old. The reason is that parents who have a first-born son have fewer children on average,[11] which may be the reason that per capita income and expenditure are larger for these households. In India joint households are prevalent, and it is common for sons to live with their parents after marriage, while daughters live with their in-laws after marriage. Hence, older parents of sons gain household members, while parents of daughters lose household members, possibly causing per capita income and expenditure to fall for older parents of first-born sons.[12]

Wealthier households may wait longer to have a child than poor households. Thus, the relative age of a child to his parents may be endogenous to economic outcomes. However, the mother's age is exogenous to household economic outcomes. Therefore, I use age of the mother rather than age of the first-born to investigate changes to demographic structure. The sample is stratified by the mother's age (under 30, between 30 and 35, between 35 and 40, between 35 and 40, and above 45) to test the effect of a male first-born on household composition.

To give a better sense of the demographic make-up of the household for each mother age category, the mean age of first-born children is shown in Table 7 Column (1). This also helps to show how the mother age categories indicate the marital status of children. Less than one percent of sons are married below the age of 13. Four percent are married between the ages of 13 and 20. 34 percent are married between the ages of 21 and 25.

[11] As in Rosenblum (2013) a first-born son predicts fewer total children born (about 2/5 of a child fewer in the IHDS data for mothers aged 35 and older).

[12] For example, a household with one son will start out with three family members (mother, father, son) and then increase to four with the addition of the son's wife and then continue to increase as the son has children. By contrast, two parents with four daughters will start off with six household members, but then shrink to two as all the daughters get married and join different households.

Only the marital status of current household members are observed in the IHDS. Thus, a daughter's marriage status is generally not observed because they usually leave the household after marriage. For example, less than one percent of daughters living in their parents' household are married under the age of 20, and only six percent are married between the ages of 21 and 25.

Table 7 shows the effect of a first-born son on the number of children (aged 0-14) in Column (2), number of adolescents and young adults (15-21) in Column (3), number of mature adults (21+) in Column (4), number of workers in the household in Column (5), and total household members in Column (6). A first-born son reduces the total number of household members when parents are young and raises it when parents are old. This effect on the household demographic composition is due to a reduction in the number of children for younger mothers and an increase in the number of adults (and workers) for older mothers.

Column (3) in Tables 3-6 includes interaction terms between having a first-born boy and the mother age categories. They show that younger households (mothers aged 30-35) with a first-born boy are less likely to be in poverty, while older households (mothers aged 35-40 or above 40) have significantly greater assets. It is the younger households that appear to gain the most from a son in per capita income or expenditure. In order to better understand the changes in incentives as households age, I stratify the sample by mother's age categories and compare the effect of sex selection on the log of per capita income and per capita expenditure, the log of total income and total expenditure, and the log of income/$\sqrt{N}$ and expenditure/$\sqrt{N}$, where N is the total number of household members. These represent both extremes of equivalence scales (no economies of scale versus full economies of scale) and the in-between measure that is used as an equivalence scale in most industrialized countries. The estimates of β for the five mother age categories and three equivalence scales are shown in Figure 1 and Figure 2. See Appendix A for a more thorough discussion of equivalence scales and their corresponding estimates.

The figures show how per capita measures can underestimate the economic gains from

Table 7: OLS: Effect of a first-born son on household size and household labor by mother's age

	Mean Age	**Coefficient on First-Born Boy**				
	First-Born	**Children**	**Teens**	**Adults**	**Workers**	**Total**
	(1)	(2)	(3)	(4)	(5)	(6)
Mother Age < 30	6.382	-0.103***	0.006	-0.007	0.005	-0.104***
	(0.058)	(0.018)	(0.010)	(0.025)	(0.023)	(0.032)
Observations	5762	5628	5628	5628	5628	5628
$30 \leq$ Mother Age < 35	12.154	-0.261***	0.002	0.002	-0.008	-0.256***
	(0.074)	(0.041)	(0.012)	(0.021)	(0.031)	(0.048)
Observations	4923	4705	4705	4705	4705	4705
$35 \leq$ Mother Age < 40	16.622	-0.284***	0.112***	0.037**	0.105***	-0.135***
	(0.077)	(0.049)	(0.033)	(0.016)	(0.029)	(0.043)
Observations	5677	5273	5273	5273	5273	5273
$40 \leq$ Mother Age < 45	20.927	-0.213***	0.041	0.280***	0.235***	0.108
	(0.107)	(0.055)	(0.036)	(0.031)	(0.031)	(0.077)
Observations	4489	4091	4091	4091	4091	4091
Mother Age ≥ 45	25.029	0.031	-0.113**	0.388***	0.237***	0.304***
	(0.119)	(0.043)	(0.052)	(0.046)	(0.064)	(0.089)
Observations	3293	2915	2915	2915	2915	2915

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

Notes: Standard errors in parentheses for mean age of first-born children. Robust standard errors clustered by state in parentheses for all regression estimates. All regressions include the following independent variables: parents' age and education, caste/religion, urban/rural and state. Column (1) presents the mean age of first-born children within each mother age category. Columns (2)-(6) show the estimated effect of having a first-born son the total number of children, teens, adults, workers, or total household members. "Total" is the number of children plus teens plus adults. "Workers" are the number of household members that have worked at least 240 hours per year.

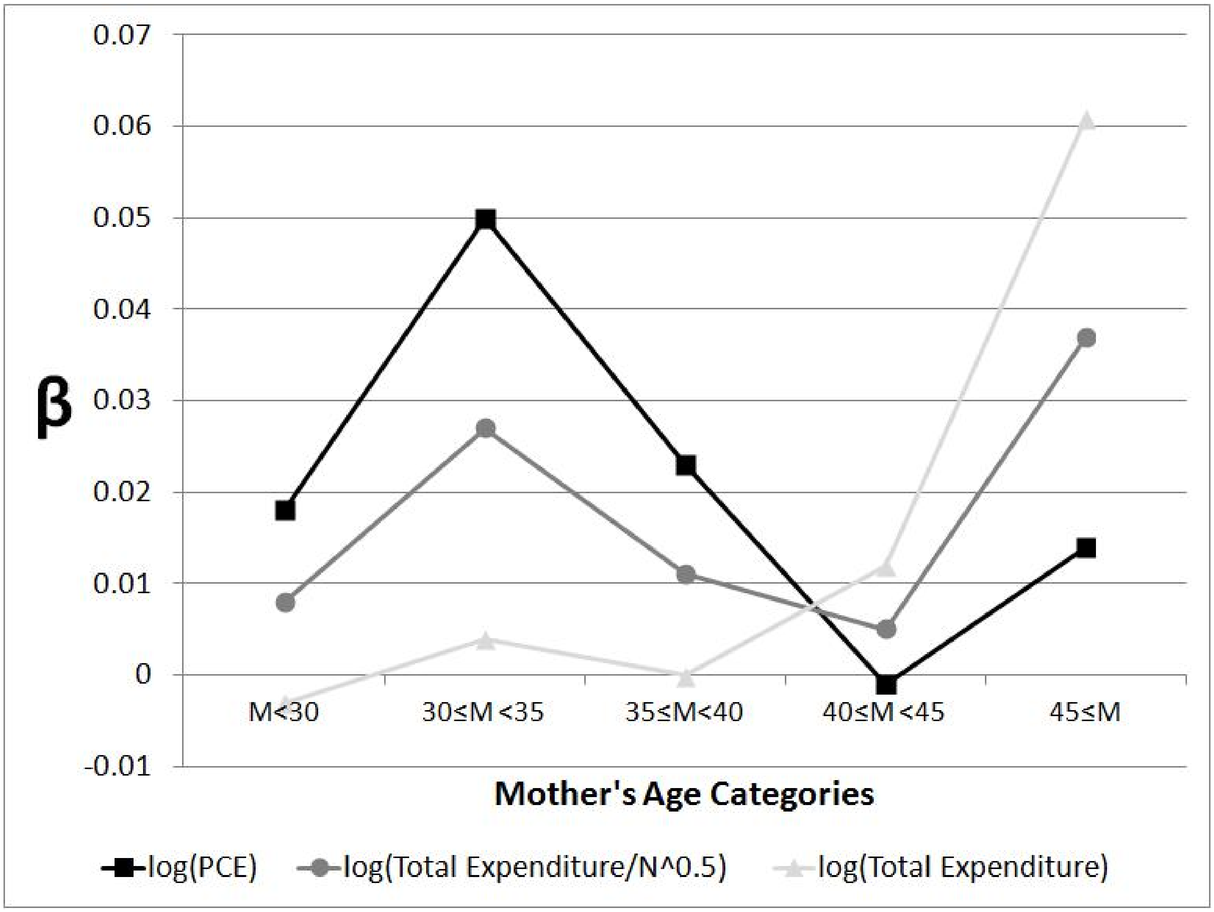

Figure 1: Estimated household expenditure benefits of sex-selective abortion for three levels of household economies of scales: per capita expenditure (PCE), total expenditure/$\sqrt{N}$ (where N is the total number of household members), and total expenditure. The sample is stratified by mother age categories. See Appendix A for estimation tables.

sex selection for older parents and overestimate them for younger parents. For per capita measures of economic well-being, the benefits accrue largely when mothers are in the 30 to 40 age range, when households with a first-born boy have fewer household members. For total income or expenditure measures, the largest benefits accrue when the mother is 45 or older, when households that used sex selection would be larger. These graphs illustrate that regardless of the economies of scale, there are large economic benefits from sex selection at some age categories.

These estimates provide insights into the two proposed mechanisms for the economic benefits of sons. As indicated in Table 7, Column (5), in the long-run, because of the

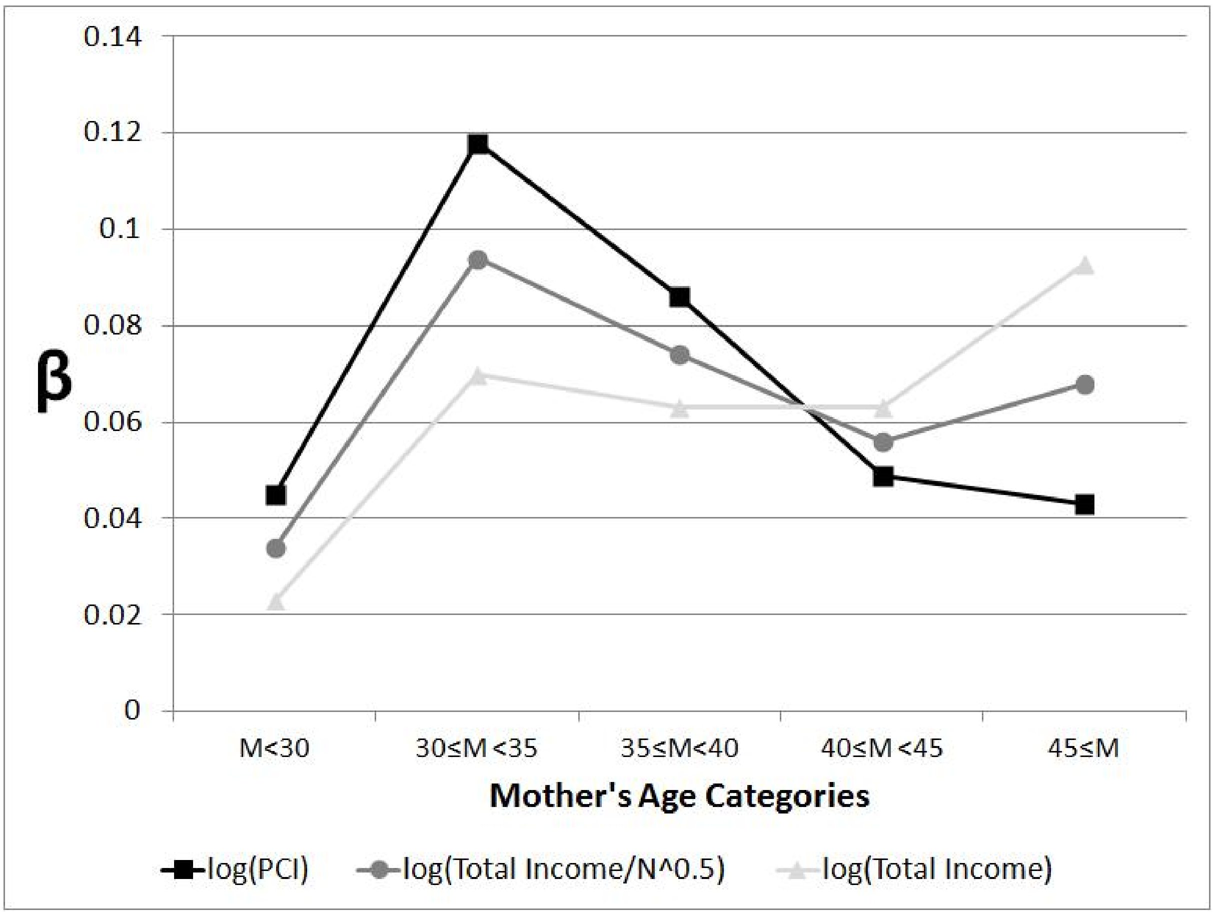

Figure 2: Estimated household income benefits of sex-selective abortion for three levels of household economies of scales: per capita income (PCI), total income/$\sqrt{N}$ (where N is the total number of household members), and total income. The sample is stratified by mother age categories. See Appendix A for estimation tables.

joint household structure in India, having a son instead of a daughter increases the number of workers in the household when parents are older. Indeed, these households are significantly better off in terms of total, if not per capita, income and expenditure. Table 9 in Appendix A shows that older mothers with a first-born son live in households with significantly higher assets and a lower probability of being below the poverty line.[13] These findings show that old-age support is a significant economic reason to have a son in India.

The short-run mechanism for the economic value of sons is that they reduce desired fertility, increasing expenditure and income per person. This is enough to push some households above the poverty line. The two mechanisms are interrelated in that parents' desire for support in old age may cause them to have many daughters to attain a son. Sex selection would improve the household economy in the short run by limiting the number of daughters in the household while parents attempt to have a son. Having fewer children may free up parents' labor, which would increase total and per capita income. Or as in the US and West Germany, fathers of sons may increase their labor supply simply because they have a son (Lundberg and Rose, 2002; Choi et al., 2008).

8 Heterogeneous Effects of Sex-Selective Abortion

Different types of households likely benefit in different ways from having sons, if they benefit at all. Columns (4) to (8) in Tables 3-6 include interaction terms between having a first-born son and observable household characteristics and location in order to understand the heterogeneous effects of sex-selective abortion on the household economy. This section has two goals. First, it provides policy makers information on which population groups have the strongest incentives to use sex selection. Second, it informs us about whether economic incentives can explain observations from prior research about who is

[13] Analysis of the components of household income and labor show that a first-born son predicts more sons working in the household, rather than daughter-in-laws or other types of household members. A first-born son also predicts having more household income from non-parent sources.

using sex-selective abortion in India.

In particular, this section examines the following observations: 1. Selective abortion happens more often among those with more years of education (Jha et al., 2006; Portner, 2010). 2. There are substantial regional differences in the extent of sex selection. However, regional differences in the number of selective abortions disappear when demographic differences are controlled for (Bhalotra and Cochrane, 2010). 3. Selective abortion does not occur for a given birth parity if there were any previously born sons (Jha et al., 2006; Portner, 2010; Bhalotra and Cochrane, 2010). I also include the heterogeneous incentives for sex-selective abortion for urban versus rural households and for the various caste and religious groups of India.

8.1 Mother's Education

The findings in this section are somewhat consistent with the observed positive correlation between years of education and the use of sex selection. I estimate Equation 1 with interactions between having a first-born son and the mother education groups used in Jha et al. (2006) (no education, less than primary, primary below grade 10, and grade 10 or higher). These estimates are presented in Column (4) in Tables 3-6.[14] The estimates using these cutoffs do not exactly fit the pattern of the more educated using sex selection. Per capita expenditure gains appear largest for the most educated, but the pattern is not monotonic, with mothers with primary education also having large relative gains. There is no detectable additional benefit from a son based on the mother's education for assets, income, or poverty status.

The broader cutoffs used by Portner (2010) (above and below grade 8) fit the pattern of sex-selection, with more education associated with higher per capita expenditures (a 3 percent increase, statistically significant at the five percent level). However, in general

[14]The estimates are similar if the father's education level is used. If the sample only includes mothers (or fathers) with post-secondary education, there is no statistically significant economic benefit of having a first-born son. This finding is in accord with Almond et al. (2009) who find that sex selection occurs amongst Asian immigrants to Canada, even though they likely have small economic incentives to do so.

there are large economic gains to having a son, even for the less educated. Thus, the findings do not entirely explain why, for example, Portner (2010) finds that less educated parents do not use sex-selective abortion. Perhaps it is a matter of access to sex-detection technology. If this is the case, then the estimates would predict a future rise in sex selection amongst those with less education as sex-detection becomes cheaper and more widespread.

8.2 Regional Differences

In India there are large differences in the male-female sex ratio across regions. In particular the richer North[15] has a higher sex ratio than the poorer South. That the North is richer and has more discrimination against girls may be because the North has larger economic gains from a son compared to the South. To test whether there is large variation in the value of a son versus a daughter across India, the sample is split into six subgroups: North, Central, West, East, South, and Northeast.[16] If economic incentives are causing selective abortion, then the gains from a boy should be larger in the areas with a high male-female sex ratio at birth. The following estimation equation is used for the regional estimates:

$$Y_{ik} = \alpha + \beta FirstBoy_{ik} + \theta_k FirstBoy_{ik} * R_k + \psi_k R_k + \gamma' \mathbf{X}_{ik} + e_{ik} \tag{2}$$

where the economic outcome for household i in region k depends on the sex outcome of the first-birth, region fixed effects (R_k), region interacted with the sex outcome of the first-birth, and a vector of household characteristics. The omitted region is the South.

[15] 2005/6 state per capita GDP averaged across northern India (Delhi, Haryana, Himachal Pradesh, Rajasthan, Punjab, and Uttarakhand) is Rs. 40,000 compared to per capita GDP over all of India of Rs. 30,000 and Rs. 32,000 in southern India (Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu).

[16] North: Jammu and Kashmir, Himachal Pradesh, Punjab, Chandigarh, Uttaranchal, Haryana, Delhi, Rajasthan. Center: Uttar Pradesh and Madhya Pradesh. West: Gujarat, Maharashtra, and Goa. East: Bihar, Jharkand, Chhattisgar, Orissa, and West Bengal. South: Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu. Northeast: Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya and Assam.

Equation 2 is estimated with and without $\mathbf{X}_{ik}$, the vector of demographic variables. Without these controls, the estimates show which states have the largest incentives for sex selection on average. These are the relevant estimates for policy makers who want to target the places in India with the largest incentives for sex selection. With the demographic control variables, the estimates show whether the average incentives for sex selection in a region can be explained by the particular demographic make-up of a region. That is, we can test whether the region itself or characteristics of those who live in the region explain the economic incentives for sex selection.

The estimates are presented in Columns (7) and (8) in Tables 3-6. In Column (7), without demographic controls, the North, East, Center, and West generally show greater gains from a son compared to the South, while the Northeast shows lower gains than the South. Stronger regional incentives have a positive correlation with the regional number of sex-selective abortions. Using the estimated number of sex-selective abortions in Jha et al. (2006), one can rank these regions by the number of sex-selective abortions per pregnancy.[17] The North has the most sex-selective abortions, followed by the West, East, Center, South, and then the Northeast with the smallest sex selection problem.

In general, the coefficients show higher gains from a first-born son for regions with more sex selection. The Center has statistically smaller incentives from the East and West for PCI and from the North and East for poverty status. Only the Northeast and South's estimated incentives are consistently less than the other regions at a statistically significant level. Although we cannot precisely determine the pattern in incentives at the regional level, without demographic controls, there appear to be stronger incentives for sex selection for the regions with high levels of sex-selection (the North, West, and East) compared to those with little sex selection (the South and Northeast).

If household demographic controls are added to the regional estimates, as shown in Column (8), the estimated differences across regions are reduced and less statistically

[17]Since Jha et al. (2006) does not include all states, I rank using the following states: North: Himachal Pradesh, Punjab, Haryana, Delhi, Rajasthan. Center: Uttar Pradesh and Madhya Pradesh. West: Gujarat and Maharashtra. East: Bihar, Orissa, and West Bengal. South: Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu. Northeast: Assam.

significant. These estimates support the finding of Bhalotra and Cochrane (2010) that the number of sex-selective abortions are similar across regions when household demographic variables are controlled for. Thus, it is not necessarily the regions themselves that create the incentives for sex selection, rather it could be the particular demographic groups with strong economic incentives that happen to be more prevalent in these regions.

8.3 Other Heterogeneous Effects: Urban/Rural and Caste/Religion

Portner (2010) shows that sex selection has spread to both urban and rural areas of India. In accord with these findings, there is little difference in economic incentives for sex selection between urban and rural parts of India (Column (5) Tables 3-6). In addition, estimates including interactions with caste and religion in Column (6), do not appear to have an effect on incentives. There is a large positive effect of a first-born son on assets for Christian households and a lower likelihood of being in poverty for Other Backwards Classes. However, there are no consistent benefits of sex selection across economic variables for any particular subgroups. This lack of evidence may simply be due to the small sample size of any single caste or religion.

8.4 Diminishing Returns to Sons

Although fertility decisions can be influenced by economic outcomes, most parents in India eventually have two or more children.[18] As indicated by Jha et al. (2006), Portner (2010), and Bhalotra and Cochrane (2010), sex-selective abortion is only likely to occur among second pregnancies if the first child is a daughter.[19] Assuming that the sex of the second-born child is unaffected by the household economy conditional on having a first-born son, we can test whether having an additional son has any effect on the household economy. Table 8 shows the OLS estimates for the value of this second son. There

[18] In the IHDS 94 percent of mothers aged 35 and older have two or more children.

[19] In the IHDS the male-female sex ratio at birth for second-borns conditional on having a first-born male (1.02) is lower than the sex ratio conditional on having a first-born female (1.08). Due to the sample size of the IHDS, they are not statistically different.

are no statistically significant economic benefits from having a second son, indicating diminishing returns to sons.

Table 8: OLS: Effect of sex selection at the second parity on the household economy

Conditional on First-Born Son	**log(PCI)**	**log(PCE)**	**Asset Index**	**Below Poverty Line**
Second-Born Boy	0.020	0.005	-0.001	0.000
	(0.018)	(0.014)	(0.100)	(0.008)
Observations	10229	10340	10349	10349
R^2	0.375	0.450	0.651	0.199
Conditional on First-Born Daughter				
Second-Born Boy	0.069***	0.045***	0.175**	-0.023***
	(0.021)	(0.013)	(0.074)	(0.008)
Observations	9389	9516	9521	9521
R^2	0.371	0.443	0.650	0.211

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

Notes: Robust standard errors clustered by state in parentheses, no first-parity or second-parity twin households. Coefficients not shown for the following independent variables: parents' age and education, caste/religion, urban/rural, and state.

The estimates for the effect of a second-born son conditional on a household having a first-born daughter are also presented in Table 8. The economic incentives for sex selection are similar to those found in Tables 3-6. With the presence of sex selection for this group, it is difficult to make anything conclusive of these effects, since they could be coming from a selected sample of richer households using sex-selective abortion. However, if this bias is small, the estimates indicate that there are strong economic incentives for sex selection at the second parity, conditional on a first-born daughter. These results suggest that having two boys, or a boy and girl (in any order), have similar effects on the household economy. Thus, if parents desire at least two children, and there are only strong economic incentives for having one son, there is no reason to use sex selection at the first parity. Hence, these findings help to explain the observation that parents do not use sex-selective abortion in India if they already have one son.

9 Conclusion

These estimates paint a multihued picture of the economic gains from sex-selective abortion. Sex selection improves the household economy in several different ways depending on the type and age of the household. Some households gain income, while others gain assets. Some types of households are pushed out of poverty, but others are unaffected. That almost all of the statistically significant results show positive gains from sons indicates the general robustness of the finding that a son is a large economic gain for a household. In addition, the incentives for sex selection coincide with observed patterns of sex selection in India. Thus, these economic incentives provide a plausible explanation for the prevalence of sex-selective abortion in India. Furthermore, policy makers can use these findings to inform policies that aim to reduce the economic incentives for sex selection.

This paper explores two of the possible mechanisms that create the economic incentives for sex selection. In the short-run, sex selection reduces the number of children in the household increasing the amount of resources available per person. The increase in household labor supply provided by an adult son is a likely mechanism for the economic benefits of sex selection in the long-run. There are no doubt other possible mechanisms that may explain the economic incentives such as the common practice of dowry.

For policy makers, this paper suggests that eliminating the use of sex-selective abortion may be an expensive and difficult task. However, any marginal increase in the benefit of a daughter relative to a son may decrease the use of sex-selective abortion and increase equality of the sexes in India. The estimates show that there are strong economic incentives for sex selection even in groups that have not recently been using sex-selective abortion. This should serve as a warning to policy makers that as access to sex detection and abortion improves, there may be substantial increases in sex-selective abortion.

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APPENDIX

A Economies of Scale

Sex selection affects the number of people, the total economic output, and the consumption pattern of a household. In addition, having a younger son matters in a different way than having an older son. In particular, younger parents have fewer assets and less immediate income and wealth gains from sons. However, the birth of a son could cause an immediate increase in household spending because parents have stronger incentives to invest in a son than a daughter and also because parents do not have to save for a dowry, retirement, or the costs of extra children they expect to have if following a son-preferring fertility stopping rule.

The sample is split by mother's age in Table 9. The estimates indicate that per capita expenditure gains occur when parents are younger. Per capita income rises the most for mothers between 30 and 40. The largest asset gains and reductions in poverty are for older households. These results make particular sense in the context of dowries. Parents with sons can spend more early in life, since they will gain a large asset in the form of a dowry payment when their son marries. Parents with a daughter, on the other hand, must reduce spending and save for their daughter's marriage when they are young. The results are also consistent with the labor supply findings: fathers work more if they have a son and sons bring extra income to the household when they grow up. Per capita income and expenditure gains fall as parents age and after the son marries since the new daughter-in-law and children in the joint household dilute per capita economic gains from sons.

In order to determine whether the estimated economic benefits of sex-selective abortion are being mechanically driven by changes in household size, I investigate the effects of selective abortion on the household economy for a range of economies of scale. Following along the lines of Lanjouw and Ravallion (1995) I examine the effect of sex selection

Table 9: OLS: Effect of a first-born son, stratified by mother's age

	log(PCI)	**log(PCE)**	**Asset Index**	**Below Poverty Line**
Mother Aged < 30	0.045***	0.018*	0.027	-0.000
	(0.014)	(0.010)	(0.074)	(0.010)
Observations	5563	5625	5628	5628
30 ≤Mother Aged < 35	0.118***	0.050***	0.197**	-0.025**
	(0.018)	(0.012)	(0.081)	(0.012)
Observations	4652	4704	4705	4705
35 ≤Mother Aged < 40	0.086***	0.023	0.101	-0.005
	(0.032)	(0.016)	(0.109)	(0.010)
Observations	5198	5270	5273	5273
40 ≤ Mother Aged < 45	0.049**	-0.001	0.418***	0.010
	(0.024)	(0.018)	(0.133)	(0.008)
Observations	4038	4086	4091	4091
Mother Aged ≥ 45	0.044	0.013	0.351***	-0.020**
	(0.031)	(0.024)	(0.128)	(0.009)
Observations	2871	2906	2915	2915

Significance levels : $*$: 10% $**$: 5% $***$: 1%

Notes: Robust standard errors clustered by state in parentheses. Coefficients not shown for the following independent variables parents' age and education, caste/religion, and state.

on the log of per capita income and expenditure for different size elasticities. For a household of size N, and total expenditure X, the economic welfare of a household is calculated as X/N^{θ}, where θ is the size elasticity and $0 \leq \theta \leq 1$. When $\theta = 0$ welfare is total household expenditure and when $\theta = 1$ it is per capita expenditure. Since there is no agreed upon standard equivalence scale, I tested whether the advantages from sons are robust to a range of θ's. Estimating the regressions for income and expenditure and using $\theta = 0.1, 0.2, ..., 0.9, 1$, the coefficient on First-Born Boy remains positive and significant, only losing its statistical significance for $\theta = 1$ for expenditure. Table 10 reports the coefficients for $\theta = 0$ and $\theta = 0.5$. Only at the extreme of large economies of scale, does average household expenditure not increase at a statistically significant level. These tests indicate that the benefits from sons are largely robust to choice of θ.

Following up on the above discussion of the effects of household size on the economic welfare implications of a son versus a daughter, Table 10 further stratifies the population by the mother's age and reports the coefficient on First-Born Boy. As expected, the gains from a son is larger for older households and smaller for younger households. Also, as noted above, a low value of θ (the more household economies of scale matter) indicates lower benefits for sons when the household is young (since these households are smaller) and a larger benefit for sons when the household is older (since these households are larger). For example when mothers are under the age of 30, a first-born son increases total household income by about 2.3%, but with $\theta = 0.5$, scaled household income rises by 3.4 percent.

When mothers are older the opposite holds. When mothers are over the age of 45, a first-born son increases total household income by 9.3 percent, but with $\theta = 0.5$, scaled household income rises by only 6.8 percent. In either case, sons generally have a strong positive effect on the household economy. In Table 9 above (with per capita measures), as households age, PCI and PCE fall. In Table 10 there appears to be an increasing trend in the income and expenditure gains from sons as households age. And whereas in Table 9 the log of per capita expenditure does not improve for mothers above age 35, in Table 10 total expenditures are significantly higher for households where the mother is 45 or older. Thus, as noted, not accounting for equivalence scales in the per capita analysis of economic outcomes may be overestimating the value of sons early in life and underestimating them later in life.

Table 10: OLS: Effect of a first-born son on log income and expenditure, with economies of scale, stratified by mother's age

	Coefficient on First-Born Boy			
	expend./$N^{0.5}$	**expend.**	**income/$N^{0.5}$**	**income**
All Households	0.016**	0.010*	0.064***	0.058***
	(0.006)	(0.006)	(0.012)	(0.011)
Observations	22596	22596	22322	22322
Mother Aged < 30	0.008	-0.003	0.034**	0.023*
	(0.010)	(0.010)	(0.013)	(0.013)
Observations	5625	5625	5563	5563
$30 \leq$Mother Aged < 35	0.027**	0.003	0.094***	0.070***
	(0.011)	(0.011)	(0.017)	(0.017)
Observations	4704	4704	4652	4652
$35 \leq$Mother Aged < 40	0.011	0.000	0.074**	0.063*
	(0.015)	(0.014)	(0.031)	(0.031)
Observations	5270	5270	5198	5198
$40 \leq$ Mother Aged < 45	0.005	0.012	0.056**	0.063**
	(0.017)	(0.019)	(0.023)	(0.024)
Observations	4086	4086	4038	4038
Mother Aged ≥ 45	0.037*	0.061***	0.068**	0.093***
	(0.020)	(0.020)	(0.030)	(0.031)
Observations	2911	2911	2871	2871

Significance levels : $*$: 10% $**$: 5% $***$: 1%

Notes: Robust standard errors clustered by state in parentheses. Coefficients not shown for the following independent variables parents' age and education, caste/religion, and state.