High Imbalance Sex Ratio Enhanced Entrepreneurship and Development

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Abstract: *Indian experience is becoming relatively surplus of men in the pre-marital age cohort. The existing literature focuses only on its negative aspects. The provide evidence that imbalance in sex ratio may stimulate economic growth by inducing private sector development. First, growth of private firm, an important engine of economic growth, are likely to emerged where sex ratio imbalances is high. We find that an increase in the sex ratio by 5 basis points, holding other variable constant, would raise the economic growth rate by 6.10 percentage points per annum. Second, household with a female head had more own account of firm and female household industry.*

Keywords: *Economic Growth, Entrepreneurship, Private Firm, Saving Rate, Sex Ratio.*

1. INTRODUCTION

A sex ratio imbalance in the marriage is a common demographic feature in many Asian economies. In such economies, parents voluntarily limit the number of children they wish to have. This, together with a strong preference for sons, and the availability of inexpensive technology to screen the gender of a fetus (most commonly by Ultrasound B) to abort the unwanted pregnancy, leads parents to engage in sex selective abortions in favor of male child.

In 1952, when the family planning policy was first introduced in India, its sex ratio at birth were 1.057 boys per girl, which was basically in line with the natural rate observed in most countries. The Indian sex ratio deteriorated steadily to 1.064 boys per girl in 1990 and 1.072 in 2007 (Provisional Population Data, 2011). As a result, roughly one out of every twelfth young men today has no realistic hope to get married, mathematically speaking. In some state, one out of every seventh men cannot get married. This situation is projected to deteriorate in the next ten years based on the population census data.

The existing literature has identified several negative consequences of a serious sex ratio imbalance. First, the scale of involuntarily single men is frightening. Second, the imbalance may cause crimes. Using data across Chinese provinces, Edlund, Li, Yi, and Zhang (2007) estimate that every one basis point increase in the sex ratio (e.g., from 1.10 to 1.11 boys per girl) raises violent and property crime rates by 3 per cent, and the rise in the sex ratio imbalance may account for up to one-seventh of the overall rise in crime in China. Third, the imbalance may also trigger competitive savings among households, men and households with sons forego current consumption to accumulate wealth in order to improve a young man's standing in the marriage market relative to other men. This increase in the savings rate is inefficient since it does not alter the number of unmarried men in the aggregate.

In this paper, we study a possibly positive effect of the sex ratio imbalance on economic growth. If the family wealth of a man relative to those of other men is a sorting variable for a man's relative standing in the marriage market, then a rise in the sex ratio can inspire men and parents with a male child to find ways to accumulate more wealth. Working harder or longer and becoming more entrepreneurial are ways to achieve this objective. As a result, the economy may grow faster than it would have otherwise. As far as we know, this effect has never been investigated before.

We conduct the empirical analysis using data from censuses of firms, censuses and surveys of population, and household surveys. Several reasons make India a particularly good candidate for this research topic. First, India presents one of the highest sex ratio in the world due to its socio and cultural habits. As a result, there is a better chance to detect this growth effect if one exists. Second, a within-country study has advantages over cross-country studies as the legal system and other institutions can be more plausibly held constant across regions within a country than across countries. As a very large country, there are many sub-national geographic units in India that allow us to have sufficient statistical power when exploring regional variations. Third, while the Indian economy is about one six the size of the United States on a PPP-adjusted basis, the contribution of Indian growth to the incremental world GDP has been the second largest after the China in the world since 2002 (IMF 2009). Therefore, understanding the determinants of Indian growth has intrinsic value for international macroeconomics due to its direct global implications.

2. EXISTING LITERATURE

The hypothesis that a higher sex ratio can be an important driver for entrepreneurial activities in India is related to status goods, economics of family, entrepreneurship, and causes and consequences of sex ratio imbalance. Each of them is too vast to be referenced comprehensively here. Instead, we selectively discuss some of them, with a view to highlight some insight most relevant for our empirical investigation.

Several theoretical papers have pointed out a connection between concerns for status (one's relative position in a society), the savings rate, and the economic growth rate (Cole, Mailath and Postlewaite, 1992; Cornero and Jeanne, 1999; and Hopkins and Kornienko, 2009).

When wealth defines one's status in the marriage market, a greater concern for status may lead to an increase in the growth rate. In principle, concerns for status could also produce the opposite effect on savings and growth. In particular, if status is enhanced by conspicuous consumption, then a greater concern for status can translate into a reduction in savings (Frank, 1985 and 2005).

It is interesting to note that, while many papers on the topic of status use competition in the marriage market to illustrate the idea, the sex ratio is always assumed to be balanced. In other words, no explicit comparative statistics are derived in terms of a rise in sex ratio imbalance.

Paper follows the Du and Wei (2011b) model that explores the effect of a higher sex ratio on entrepreneurial activities. As it is the only model that explicitly studies such a topic, we review it with some details. Du and Wei derive the following key proposition: As the sex ratio rises, as long as it is beyond a (low) threshold, more men choose to become entrepreneurs. Here is the intuition. By the structure of the model, successful entrepreneurs can always succeed in getting married, but failed entrepreneurs do not. When the sex ratio exceeds a threshold, an increase in the sex ratio raises the probability that a male worker will not get married, while it does not alter the expected utility of being an entrepreneur (to a first-order approximation). If the utility from a marriage is sufficiently large, more men would respond to a higher sex ratio by becoming entrepreneurs.

In terms of the empirical literature, Angrist (2002) examined variations in the sex ratio across immigrant groups in the United States. He documented that a higher male/female sex ratio has a large positive effect on the female marriage rate, and a large negative effect on female labor market participation. Interestingly, he found that "higher sex ratios also appear to have raised male earnings and the incomes of parents with young children." These results are consistent with what we report in this paper. It is important to note that Angrist (2002) did not directly study the effects of sex ratio imbalance on entrepreneurial activities and economic growth, which are the central focus of this paper.

There is an extensive literature in demography that documents the phenomenon of unbalanced sex ratios in Asia (for example, Gu and Roy, 1995; Guilmoto, 2007; and Li, 2007). In an influential paper, Oster (2005) proposes that the prevalence of Hepatitis B is a significant cause of the sex ratio imbalance in Asia.

This discussion has clear implications for the empirical work in this paper. First, it is interesting to find out if entrepreneurial activities are indeed linked to local sex ratios. Second, given the hypothesized mechanisms, it is informative to check whether and how households with a son and those with a daughter respond differently to a rise in the sex ratio. Third, given the possibility that a

higher sex ratio could also raise crime rates and have other consequences that are potentially negative for economic growth, it is important to check the general equilibrium effect, whether the economy-wide entrepreneurial activities and work effort increase on net, as reflected in a higher overall growth rate, in response to a rise in the sex ratio.

3. STATISTICAL EVIDENCE

We start by providing some basic facts about Indian growth. We then use data from the recent censuses of manufacturing firms (2005) to investigate whether local sex ratio imbalance is a predictor of the extent of local entrepreneurial activities. To zoom in on possibly distinct responses by families with a son versus those with a daughter, we turn to household-level evidence. Finally, to capture the general equilibrium effect of a rise in the sex ratio, we conduct a panel growth regression across Indian states over 2005 and 2011.

3.1. Basic Information

Table3.1. *Basic Socio-economic Information*

	Mean	Std. Error of Mean	Std. Deviation
Sex ration in 2011	1196.70	40.97683	242.4222
Sex Ratio2001	1093.68	15.09339	89.29372
Child Sex Ratio Age Group 0-6 in 2011	1407.42	59.94773	354.6556
Child Sex Ratio Age Group 0-6 in 2001	1288.68	48.80407	288.7288
Male Literacy Ratio in 2011	78.65	1.372707	8.121043
Female Literacy Ratio in 2011	85.27	1.069378	6.326527
Total Literacy Ratio in 2011	71.47	1.772847	10.4883
Male Literacy Ratio in 2001	69.56	1.820538	10.77045
Female ale Literacy Ratio in 2001	76.55	1.56645	8.28886
Total Literacy Ratio in 2001	57.53	2.41871	12.79862
Decadal State Population Growth in 2011	19.03	1.863041	11.0219
Decadal State Population Growth n 2001	25.28	2.100956	12.42942
State Labour Force Participation in 2010	357.00	11.83938	61.51923
State Labour Force Participation of Female In 2010	169.26	18.687	97.1005
Share of Labour Force (Aged 15-59) in Total Population in 2010	504.63	14.51035	75.39799
Share of Female Labour Force (Aged 15-59) in Total Population In 2010	239.56	26.33773	136.8549
Average Growth Rate of Firm in 1990-98	2.2479	0.16938	0.82979
Average Growth Rate of Firm in 1998-05	2.9739	0.39572	2.09395
No. of Employment in Lakh in 2005	1195.09	248.7426	1471.581
No. of Own Account Firm in State in 2005	3.84	0.755944	3.854574
Employment Generated By Own Employment Firm As Percentage of Total in 2005	3.84	0.77591	3.956379
Share of State Gross Domestic Product in Total GDP in 2011	3.11	0.636908	3.3702
Share of State Gross Domestic Product in Total GDP in 2005	3.12	0.622599	3.521953
State Domestic Growth Rate in 2011	14.51	0.917134	4.853017
State Domestic Growth Rate in 2005	8.12	0.884115	5.001307
State Credit Deposit Ratio in 2010	54.21	4.683915	23.88337
State Credit Deposit Ratio in 2005	47.02	4.389812	22.38374
State Per Capita Income in 2011	51170.25	4639.08	24547.7
State Per Capita Income in 2005	33897.94	3348.727	18943.26
Male Household Industry in States in 2001	214543.23	55286.67	327080.3
Female Household Industry in states in 2001	134202.03	35250.68	208545.8
State Household Size in 2011	5.29	0.103125	0.610097
Total Households With Male Head in 2001	4890042.91	1031435	6102052
Total Households With Female Head in 2001	571081.66	116571.2	689644.8

Since our first piece of evidence has to do with variation in regional economic activity. We use most recent censuses of firms in 1998 and 2005 and population census 2001 and 2011 with various reports of National sample Survey organization. During the period 1990-98, the growth of enterprises was 2.36 (Economic Census, 1998) and in period of 1998-2005, the growth of enterprises was 4.69

(Economic Census 2005), while the same period the growth rate of workers was 1.71 and 2.78 respectively.

The growth of the private sector is a major part of the over all growth story. The private sector is registered as private firm. In fact, most firms were registered as private firm in 95 per cent in 2005 and 94 per cent in 1998 (Economic Census 2005 & 1998).

Average mean state per capita income in 2011 was 51170 and in 2005 was33897 while in 2011, average mean state domestic growth was 14.51 per cent and it was 8.12 per cent in 2005. More interesting average mean share of state gross domestic product in National GDP was nearly same in both years. It may be possible that at state level share of state gross domestic product in national GDP varies.

Table also elaborate two recently population census data of 2001 and 2011. The mean sex ratio of 2001 was 1094 and 2011 was 1197. In this paper, we define sex ratio between the number of males and the number of females, expressed in number of males per 1000 females. Data shows an average in 2011 one out of every five could not get married. Sex ratios between age cohorts 0-6 are worse. In 2001, sex ratio was 1289 and in 2011 it increases to 1407. This means between age cohort 0-6 every forth boy could not get married. Average decadal growth rate decreases from 25.28 in 2001 to 19.03 in 2011.

3.2. Connection between Female Household Head and the Private Sector Growth

We now examine whether there is any connection between the female household head and private sector growth. In figure 3-A, we plot the households with female head and number of own account firms across all states. There is strong positive relationship between the number of firm and households with female. That is, regions with more female headed households has more number of own private firms.

First, we try to understand what factors affect the private sector development. Many factors could affect the growth of the firms. The female headed household industry, state per capita income, state domestic growth rate, own account firm, and share of state gross domestic product in national product could all matter. We also interested in investing whether the female household industry and state per capita income also play a role. We use following regression equation for measurement of the relationship:

Table3.2. *OLS Estimate for Female Household Head and Private Sector Growth*

	Mean	Standard Deviation	β	t-value	Sig. level	95 per cent Confidence Interval for B	
						Lower Bound	Upper Bound
(Constant)	806038.5652	743269.7173		2.746673	0.013266	88970.48	667893.4
Female Household Industry In 2001	196136.2609	234760.953	0.478428	4.710532	0.000174	0.839156	2.190316
State Per Capita Income In 2005	29490.26087	15158.03248	-0.28799	-3.37352	0.003384	-22.916	-5.32708
State Domestic Growth Rate In 2005	7.617391304	3.487652528	0.098519	1.177446	0.254352	-16467.1	58458.53
No. of Own Account firm	4.2696	3.89492	0.912	10.201	0.000	138583.128	209559.901
Share Of State GDP In Total GDP In 2005	3.83	3.743114891	0.508896	4.896781	0.000116	57696.17	144406.7
R=0.957883845, R Square=0.91754146, Adjusted R Square=0.89921734, R Square Change=0.109846, Durbin-Watson= 1.806							

Predictors: (Constant), female household industry in 2001, state per capita income in 2005, state domestic growth rate in 2005, share of state GDP in total GDP in 2005.

Dependent Variable: total households with female head in 2001.

Number of Own Account Firm$_{2005}$ = β Households with Female Head$_{2001}$ + X$_k$ Ѓ + e$_K$ (1)
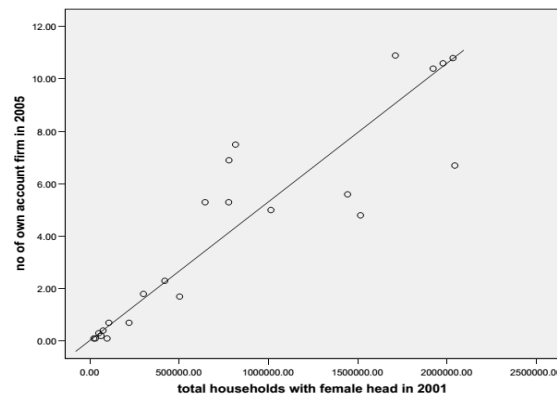
Fig3-A. *Scator Plot of female household and No. of own Account firm*

The result is reported in table 3.3. The coefficient of number of owns account firm is 0.912 and statistically significant at 1 per cent level. Other variable such as female household industry, state per capita income and state gross domestic product share in national gross domestic product are also statistically significant. Value of adjusted R square is 0.89921734. The adjusted R square gives us some idea of how well our model generalizes and ideally we would like its value to be the same, or very close to, the value of R square. The difference for the model is small (in fact the difference between the values is 0.91754146-0.89921734 = 0.01832412, about 18 per cent). This means 89 per cent interpretation is done by the variable.

We also test that higher sex ratio leads to more established of private firm. For this, we use following regression equation-

$$\text{No. of Firm}_{2005} = \beta \text{ Sex Ratio}_{2001} + X_k \acute{\Gamma} + e_K \tag{2}$$

The coefficient of number of firm is 0.912 and statistically significant at 10 per cent level. Number of own account firm is also significant at 10 per cent level. Other variable that is significant is state per capita income at 5 per cent level and coefficient is 0.556701.

Table3.3. *OLS Estimate for Sex Ratio and Private Sector Growth*

	Mean	Std. Deviation	β	t-Value	Sig. level
(Constant)	1083.71	92.2493		9.60609	4.7906E-08
No. of Own Account Firm in 2005	4.431818	3.906208	0.679332	1.905059	0.0749071
Growth Rate of Per Capita Net Domestic Product in 2001	0.777727	6.61562	-0.07888	-0.35599	0.72649775
State Per Capita Income in 2005	29774.36	15451.94	0.556701	2.488183	0.02424348
Growth Rate of Firm in 1998	2.34	0.696659	0.201237	0.943874	0.35926966
No. of Firm in 2005	1609	1529.98	0.64363	1.9135	0.07374819
R=0.626939, R Square=0.393053, Adjusted R Square= 0.203382, R Square Change= 0.138896 Durbin-Watson= 2.408298					

Predictors: *(Constant), no. of own account firm in 2005, growth rate of per capita net domestic product in 2001, state per capita income in 2005, growth rate of firm in 1998, no. of firm in 2005.*

Dependent Variable: *sex ratio in 2001.*

Other factors growth rate of per capita net domestic production and growth rate of firm are not statistically significant. In other words, more private firms were established in the all states with higher sex ratio. Thus, we conclude that development of the private sector is correlated with higher sex ratio and female headed family. In other words higher sex ratio and female headed family leads to higher development.

4. GENERAL EQUILIBRIUM EFFECT: SEX RATIOS AND PER CAPITA GDP

So far, we have discussed evidence on how a higher sex ratio stimulates the private sector growth. Figure 1, 2 and 3 we plot state per capita income and sex ratio, the state domestic growth rate and sex ratios, and share of state GDP in national GDP across all states. There is a strong positive relationship between the sex ratio and state per capita income, state domestic growth rate and share of state GDP in national GDP across all states.

Table4.1. *Sex Ratios and State per Capita Income*

	2011		2001	
	β	t-value	β	t-value
(Constant)		4.36344		-1.54781
Sex Ratio	1.22041*	3.34622	1.871404**	2.036772
Child Sex Ratio Age Group 0-6	1.719218*	4.713265	-1.3871	-1.59846
Male Education	0.56055	1.442491	-0.35589	-0.89614
Female Education	-1.11317*	-3.01434	0.072709	0.175467
State Population Growth	-0.37332*	-2.0905	-0.55707**	-2.68649
Share of Female Labour Force (Aged 15-59) In Total Population	-0.04003	-0.28445	0.169735	0.93627
R	0.869351		0.716855	
R Square	0.755772		0.513882	
Adjusted R Square	0.664186		0.331587	

Note: *And ** Denotes Statistically Significant At 5 Per Cent and 10 Per Cent Levels Respectively. Predictors: (Constant), Sex Ratio , Child Sex Ratio Age Group 0-6 , Male Literacy, Female Literacy, State Population Growth, Share of Female Labour Force (Aged 15-59) in Total Population.*

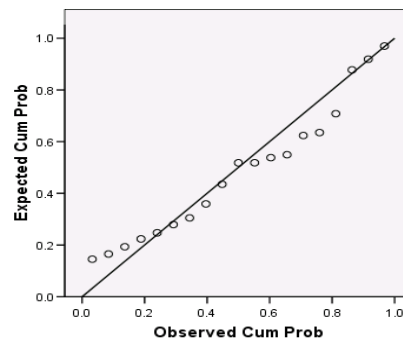**Dependent Variable:** *State per Capita Income.*

Fig2. *Normal probability curve between sex ratios and Growth in Own Account Firm In 2005*

To capture the general equilibrium effect, we now examine the overall relationship between sex ratios and state per capita income for the period 2001 and 2011. Dependent variable is the state per capita income and the independent variable are sex ratio, child sex ration between age group 0-6, male education, female education, state population growth rate, and share of female labour force (aged 15-59) in total population.
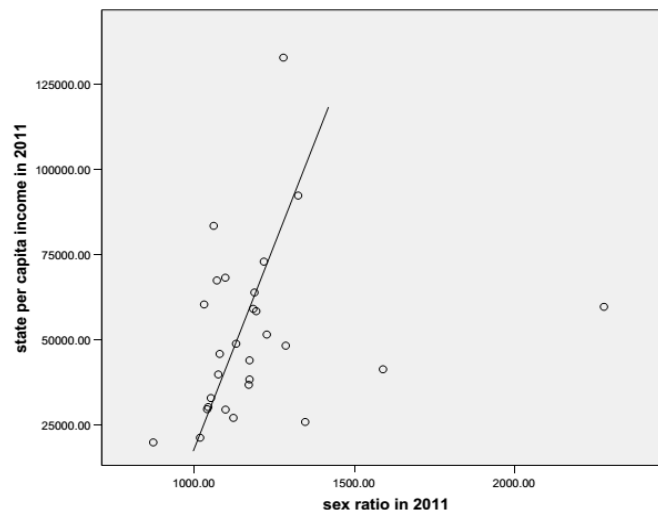

Fig4.1. *Relationship between State per Capita Income and Sex Ratios*

The growth regression for both years is reported in table 4.1. The coefficient of the sex ratio is positive and significant: on average, per capita income growth is faster in states/periods with higher sex ratio for the year 2011. The coefficients on the first two control variables are consistent with the standard growth regressions. The coefficient of child sex ratio between age group 0-6 is positive and statistically significant. The mean is higher investment in children yields high returns. In other words, investment in children promotes higher per capita income and economic growth. The coefficient on the female education and state population growth is negative and statistically significant. The possible reason for this is to middle class women in the society are less incentives to find a job or becoming an entrepreneur because they want to maintain both cultural habits, modern and traditional. Coefficient of population growth rate is negative consistent with the Malthusian idea. In 2001, coefficient of sex ratio is significant and positive but coefficient of child sex ratio between age group 0-6 is negative and statistically insignificant.
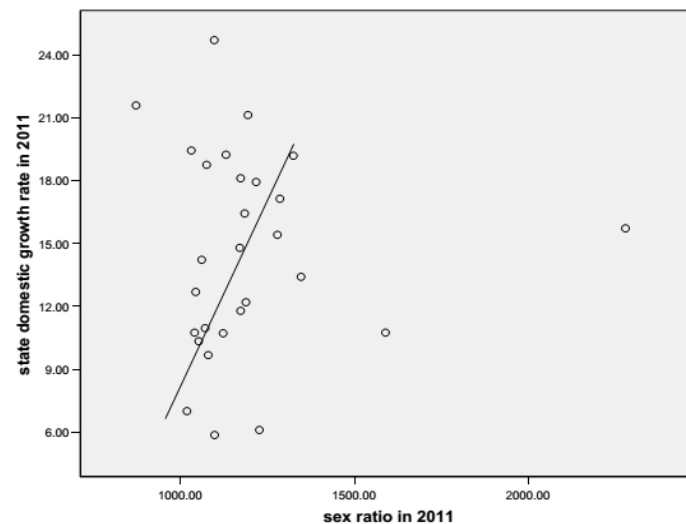

Fig4.2. *Relationship between State Domestic Growth Rate and Sex Ratio*

Both two coefficients on the sex ratio variable are positive and statistically significant. To understand the economic significance of the estimates, we take coefficient value for 2011 in column 2. An increase in the sex ratio by 5 basis points, holding other variable constant, would raise the growth rate by 6.10 percentage points per annum (=1.22041x 0.05x 100). This accounts for about 42 per cent (=6.10/ 14.15) of the actual mean increase in the annual growth rate during this year. This means that the effect of the sex ratio is economically significant. Note that both because the sex ratio for the pre-marital age cohort is projected to be higher over the next decade, and because the "natural" growth rate expected from the convergence force in the Solow model will decline, the relative importance of the sex ratio effect on economic growth is likely to rise in the medium term.
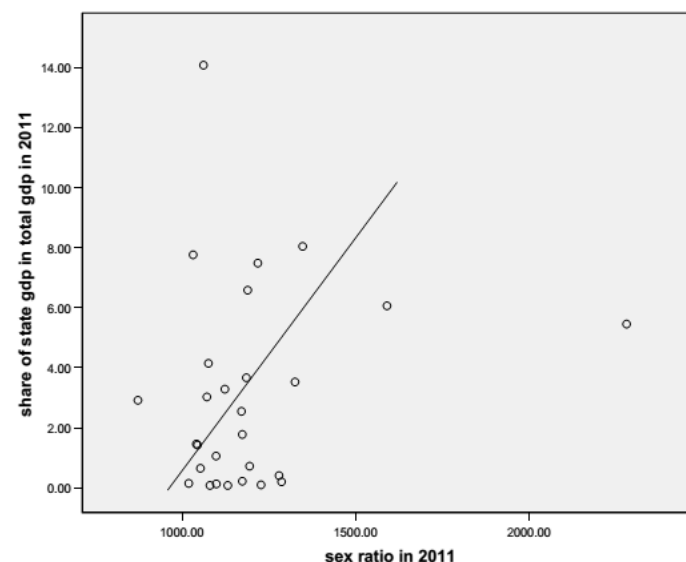

Fig4.3. *Relationship between Share of State GDP in Total GDP and Sex Ratio*

5. CONCLUDING REMARKS

Robert M. Solow, the Nobel Prize winner for his pioneering work on the theory of economic growth, once said that Galbraith's disdain for ordinary consumer goods "reminds one of the Duchesses who, upon acquiring a full appreciation of sex, asked the Duke if it were not perhaps too good for the common people". Of Milton Friedman, Solow wrote, "Everything reminds Milton of the MONEY SUPPLY. Well, everything reminds me of sex, but I keep it out of the paper."[1] Well, Solow might have missed something economically significant by not linking sex with economic growth. This paper proposes that an unbalanced sex ratio may be one of the significant drivers for economic growth.

A strong sex ratio imbalance is present in China, Vietnam, Korea, India, Taiwan, Singapore and several other economies due to a combination of a parental preference for sons, easy availability of technology to screen the sex of a fetus, and a limit on the number of children that a couple either desires to have or is allowed to have. As men face a diminishing prospect of finding a wife, parents of a son or the son himself are more eager to do something to improve his standing in the marriage market relative to other men in the same cohort. Since wealth is a significant determinant of one's relative standing, parents with a son and men respond to a rise in the sex ratio by engaging in more entrepreneurial activities, supplying more labor, and becoming more willing to take unpleasant or dangerous jobs, all in pursuit of a higher expected pay.

We find strong supportive evidence across states and households in India. Using the data from two economic censuses in 1998 and 2005, we find that sex ratio is a significant predictor of which states are more likely to have more private firms. The economic impact is also significant: An increase in the sex ratio by 5 basis points, holding other variable constant, would raise the growth rate by 6.10 percentage points per annum. We also find that families with a female household head had more own account of firm and female household industry.

Accumulating more wealth is not the only way for men or households with a son to compete in the marriage market. Parents may also invest more in the education of their sons, and push them to work harder in school. There may also be a spillover from a boy's education to a girl's education. Such mechanisms have not been empirically investigated. In addition, as noted earlier, several other economies also have a strong sex ratio imbalance. Some of them are also known to have a high rate of economic growth. We leave a rigorous investigation of these topics to future research.

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Appendix-A

Table3-A. *Correlation Matrix Female Household Head and Own Account Firm*

		Total Households With Female Head In 2001	Female Household Industry In 2001	State Per Capita Income In 2005	State Domestic Growth Rate In 2005	Share Of State GDP In Total GDP In 2005
Pearson Correlation	Total Households With Female Head In 2001	1				
	Female Household Industry In 2001	0.88569	1			
	State Per Capita Income In 2005	-0.1903	-0.1414	1		
	State Domestic Growth Rate In 2005	0.29088	0.23946	0.4797	1	
	Share Of State GDP In Total GDP In 2005	0.80632	0.67392	0.2319	0.4243	1
Sig. (1-tailed)	Total Households With Female Head In 2001	.				
	Female Household Industry In 2001	9.7E-09	.			
	State Per Capita Income In 2005	0.19218	0.25998	.		
	State Domestic Growth Rate In 2005	0.08906	0.13556	0.0103	.	
	Share Of State GDP In Total GDP In 2005	1.7E-06	0.00021	0.1435	0.0218	.

Table3-B. *Correlation matrix between sex ratios and Growth in Own Account Firm in 2005*

		Sex Ratio In 2001	No of Own Account Firm in 2005	Growth Rate of Per Capita Net Domestic Product in 2001	State Per Capita Income in 2005	Growth Rate Of Firm in 1998	No Of Firm In 2005
Pearson Correlation	Sex Ratio In 2001	1					
	No of Own Account Firm in 2005	0.050837	1				
	Growth Rate of Per Capita Net Domestic Product in 2001	-0.31915	-0.16851	1			
	State Per Capita Income in 2005	0.427849	-0.23922	-0.22611	1		
	Growth Rate Of Firm in 1998	0.08418	-0.0266	-0.23917	-0.10961	1	
	No if Firm in 2005	-0.12153	0.781918	-0.07491	-0.05885	0.088306	1
Sig. (1-Tailed)	Sex Ratio In 2001	.					
	No of Own Account Firm in 2005	0.411117	.				
	Growth Rate of Per Capita Net Domestic Product in 2001	0.073843	0.226741	.			
	State Per Capita Income in 2005	0.023497	0.141814	0.155808	.		
	Growth Rate Of Firm in 1998	0.354777	0.453234	0.141866	0.313639	.	
	No if Firm in 2005	0.295033	8.61E-06	0.370207	0.397373	0.34798	.