Development and Gender Inequality

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It would have never been possible without his brilliant leadership!

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Introduction

"Poverty, under nutrition, mortality, low rate of alphabetism,… are problems that concern men and women and different classes. But the systematically inferior position of women inside and outside the household in many society points to the necessity of treating gender as a force on its own in development analysis." (Sen, 1990b)

The four essays collected in this volume aim is to shed some light on specific aspect in which women are discriminated against (employment, education and access to health care) in developing countries and on the impact that gender inequalities have on development.

"A great deal of evidence from around the world indicates that gender inequalities undermine the effectiveness of development policies—in fundamental ways. Yet gender issues are often absent from policy dialogue and policymaking. Does poverty cause larger gender disparities, or does gender inequality lead to poverty? And the evidence suggests that the relationship goes both ways. Reducing poverty will go some way towards reducing harmful gender disparities. But neither gender disparities nor poverty can be eliminated without addressing gender issues directly. Recognizing that poverty and gender inequality are intertwined can help us formulate more effective development strategies." (World Bank, 2001)

This volume is divided in four chapters, which examine different life's spheres in which women could be discriminated against in developing countries.[1] Chapter one is a co-authored chapter with Professor Stephan Klasen, Chapter three and four are co-authored chapters with Professor Stephan Klasen and Abay Asfaw.

The ***first chapter*** investigates the impact of gender bias in education and employment on economic growth in developing countries. There is a sizable literature that analyses the impact of gender inequality in education on economic growth. A number of theoretical and empirical contributions have found a negative link between gender

[1] It is important to mention that previous versions of the articles included in this volume were published as co-authored papers in Journals or as working Papers. I would like to take the opportunity to thank the German Research Council (DFG) and the World Bank for financing my PhD research. A first version of the essay presented in chapter one of this volume was commissioned as background paper for a 2004 World Bank Publication; *Gender and Development in the Middle East and North Africa. Women in the Public Sphere*. The research presented in Chapter two, three and four was conducted as part of a larger research project financed by the DFG on *Gender Bias in mortality in South Asia*.

inequality and economic growth (e.g. Oded Galor and David Weil, 1996; Nils-Petter Lagerlöf, 2003; Dollar and Gatti, 1999; Klasen, 2002). This literature suggests that, largely due to the impact of female education on fertility and the creation of human capital of the next generation, a lower gender gap will spur economic development. The effects on growth found are quite large for the regions where gender inequality is sizable, such as South Asia or the Middle East and North Africa (MENA). In fact, Klasen (2002) estimated that 0.9 percentage points of the 1.8 percentage point annual per capita growth difference between the countries in MENA and those in East Asia and the Pacific can be attributed to higher initial gender inequality in education there as well as a slower closing of the gap vis-à-vis East Asia and the Pacific. This chapter, using cross-country data for ninety-three countries in the period 1960-2000, expands the results of these previous studies on education gaps on growth and extends the analysis to employment gaps using panel data. The results show that the combined 'costs' of education and employment gaps in Middle East and North Africa and South Asia amount respectively to 0.9-1.7 and 0.1-1.6 percentage point differences in growth (depending on the preferred specification) where gender gaps in employment appear to have a larger and increasing effect on economic growth than gender gaps in education.

The ***second chapter*** investigates the microeconomic determinants of child mortality in India using a very large and representative dataset. Studies from demographers, physicians, epidemiologists, and other disciplines have shown that women have inherent biological and behavioural advantages of living longer than men at all ages in the same socio-economic environment (Hart, 1988; UNDP, 1995; Waldron, 1995; World Health Organization, 1998; Gjonca, et al., 1999; Kalben, 2002). This fact is known since 1750 when mortality rates were computed from the first Swedish national census (Kalben, 2002). It has also become clear that an improvement in social, cultural, and economic conditions enhances this biological advantage of women (WHO, 1998). Gjonca, et al. (1999:1-2) show that 'infant and childhood mortality is higher for boys than for girls, and these higher death rates for males continue throughout their entire life span'. However, this biological advantage of women could not be realised in South Asian countries. Various researchers, using different demographic techniques, have shown that between 60 and 100 million women are missing in Asia and North Africa (Sen, 1992; Coale, 1991; Klasen, 1994). While the magnitude varies from one study to another (depending on the data and the standard sex ratio reference level used), the excess mortality of women in South Asia is no longer contentious. It is also only in this part of

the world that the life expectancy of women at birth is lower or equal to men, despite the biological advantage of women as a group to live longer than men. The non-responsiveness of this discrimination to the improvement in the economic status of households (Hill and Upchurch, 1995; Kurz and Johnson-Welch, 1997) also makes the issue of 'excess female mortality' a serious concern in this region. It is generally hypothesised that this higher than expected female mortality in South Asian countries reflects social, cultural, familial, behavioural, and other discriminatory behaviour of households, communities, and sometimes governments against girls and women. Therefore, there is a crucial need to investigate factors and mechanisms that jeopardise the biological advantage of women to live longer than men and consequently produced millions of 'missing women' and unbalanced sex ratio in this part of the world.

In the literature authors investigate immediate determinants of discrimination and the effects on girls' nutrition status and mortality (gender biased allocation of resources, i.e. food, health care). In the past nutritional imbalances were considered as one of the basic reasons for excess female deaths especially among young children. In the literature it is argued that girls receive less food than boys, or food of relatively poor quality. However, recent findings reveal that there is no significant gender discrimination in nutrition among 0-5 year old children (Kurz and Lohnson-Welch, 1977; Das Gupta, 1987; Hazarika, 2000). Mothers' education is another factor that might affect the extent of sex differentials in mortality especially among children. Studies conducted in Bangladesh (Bhuiya, 1991) and India (Bourne and Walker, 1991) reveal that the predicted gender disparities in mortality is very low for female children of literate mothers compared to female children of illiterate mothers. The denial of equal access to health care is also considered as one of the most important factors that may explain the higher than expected women mortality in South Asian countries. Singh, et al. (1962), Aziz (1977), Chen, et al. (1981) and Kurz and Johnson-Belch (1997), report gender discrimination in getting medical care and immunization in Punjab, Bangladesh, Pakistan, and other developing countries. However, most of the studies which have tried to investigate the impact of health on gender bias in mortality focus on young children and on specific types of health care services such as immunization, visiting health care providers, and the like (Chaudhury, 1988; Chen, et al., 1981; Rajeshwari, 1996; Sood and Nagla, 1994; Dasgupta, 1987), while the concept of health care goes far beyond a mere visit of a health care provider. Moreover, most of the studies relied on one time period data and on descriptive statistics, which limit the depth of their analysis. This essay constitutes a first attempt in

this direction. The study shows that not only children have very high mortality rates in India especially if coming from poor household, have illiterate mothers and live in northern states, but the hazard ratio of dying is throughout higher for girls than boys. The estimations show that girls born in northern states, having illiterate mothers have 60% more chances to die in their first five years in India than boys.

The aim of the last two chapters of my dissertation is to fill the gap in the literature and provide a more comprehensive and nationally representative analysis investigating intra-household discrimination in access to health care in India.

More specifically the essay in C***hapter three*** shows that the increased return on investment on women in India in the past decades is reflected in the decline in health care utilization disparities between girls and boys. India experienced a large and significant improvement in health care utilization between girls and boys in the period 1986-1996. The results emphasize that significant improvement were observed in the probability of getting medical help during illness in this period and also that the amount of health care expenditures between boys and girls during the period under observation increased. These promising results have important policy implications and needs to be addressed in a timely manner. Evidence of gender inequality in heath care utilization is still wide spread in India and varies across states; only a sharp and homogenous increase in the return on investment for girls across the country will produce the expected results in the next decades.

The essay in C***hapter four*** argues that intra-household gender-discrimination in receipt of medical attention can be one of the most important factors explaining the unbalanced sex ratio in the country. The 52nd Indian National Sample Survey, which collected detailed verbal autopsies, is used in this analysis to show that girls are 1.7 times less likely to die in hospital than their brothers. The estimated coefficient of different interaction variables also reveal that the probability of infant and young girls with alive female siblings to die in the hospital is extremely low. The estimations confirm that girls are highly discriminated against in access to hospital treatment.

These four essays show that gender inequalities exact high human costs and high costs to development—and because the factors that cause gender inequalities to persist are difficult for individuals alone to change—there is a strong case for public action to promote gender equality.

Chapter 1.The Impact of Gender Inequality in Education and Employment on Economic Growth in Developing Countries: Updates and Extensions[2]

Abstract

Using cross-country and panel regressions, we investigate to what extent gender gaps in education and employment reduce economic growth. Using most recent data and investigating a long time period (1960-2000), we update the results of previous studies on education gaps on growth and extend the analysis to employment gaps using panel data. The combined 'costs' of education and employment gaps in Middle East and North Africa and South Asia amount respectively to 0.9-1.7 and 0.1-1.6 percentage point differences in growth compared to East Asia. Gender gaps in employment appear to have an increasing effect on economic growth differences between regions, with the Middle East and North Africa and South Asia suffering from slower growth in female employment

1.1. Introduction

There are many reasons to be concerned about existing gender inequalities in important well-being related dimensions such as education, health, employment, or pay. From a welfare as well as an equity perspective, such gender inequalities are problematic as they lower well-being and are a form of injustice in most conceptions of equity of justice.[3] While such a view would argue for reducing gender inequalities in these dimensions of well-being on intrinsic grounds, recently a literature has developed that has investigated the instrumental effects of gender inequality on other important development outcomes with a particular focus on economic growth. Without denying the importance of reducing gender inequality on intrinsic grounds, this paper is a contribution to that latter literature.

[2] A previous version of this paper co-authored with Stephan Klasen was published in the Feminist Economics in 2009.

[3] See Klasen and Wink (2003) and Klasen (2002, 2007) for a discussion of these issues.

A significant focus of that literature has been to examine the impact of gender inequality in education on economic growth. A number of theoretical contributions have suggested a negative link between gender inequality and economic growth (e.g. Oded Galor and David Weil 1996; Nils-Petter Lagerlöf 2003). This literature shows that, largely due to the impact of female education on fertility and the creation of human capital of the next generation, a lower gender gap will spur economic development. The next section will briefly summarize the main findings from that literature.

In parallel, an empirical literature has also examined these effects. While some earlier studies had suggested that gender inequality in education might actually increase economic growth (Robert Barro and Jong-Wha Lee 1994; Barro and Xavier Sala-I-Martin 1995), more recent work has shown that the opposite appears to be the case (Anne Hill and Elizabeth King 1995; David Dollar and Roberta Gatti 1999; Kristin Forbes 2000; Stephen Knowles, Paula Lorgelly and Dorian Owen 2002; Stephan Klasen 2002; Steven Yamarik and Sucharita Ghosh 2003; Dina Abu-Ghaida and Klasen 2004). These studies not only differed from previous analyses in their findings of the impact of gender inequality on economic growth, but also were able to explain why earlier studies had found the opposite effect and why more careful econometric techniques yielded the new finding that gender inequality in education reduces economic growth.[4]

These macro studies are also consistent with findings using micro data showing that girls have a higher marginal return to education, and even more so, if the impact of female education on fertility and education of the next generation is included (Hill and King 1995; World Bank 2001; King, Klasen, and Maria Porter 2008).

The effects found are quite large for the regions where gender inequality is sizable, such as South Asia or the Middle East and North Africa (MENA). In fact, Klasen (2002) estimated that 0.9 percentage points of the 1.8 percentage point annual per capita growth difference between the countries in MENA and those in East Asia and the Pacific can be

[4] Among the problems in the findings by Barro and co-authors identified by these studies were the absence of regional dummy variables, particularly for Latin America and East Asia. In the former, low initial gender gaps were accompanied by low growth, while in the latter relatively high initial gender gaps were accompanied by high subsequent growth. In the absence of regional dummy variables, a causal link is made between these associations. It is quite likely, however, that the growth experiences of these regions were also influenced by other region-specific factors that are largely unrelated to gender gaps. The fact that these regional dummies are (at least jointly) significant and that then the negative effect of female education reverses itself once regional (or country fixed) effects are considered supports this view. Further problems with these studies are the use of initial period education variables, the high collinearity between male and female education, and the endogeneity of these variables. For a discussion of these issues, see Dollar and Gatti (1999), Lorgelly and Owen (1999), Forbes (2000) and Klasen (2002),

attributed to higher initial gender inequality in education there as well as a slower closing of the gap vis-à-vis East Asia and the Pacific.[5]

While these results are instructive, they are based on information on education and economic performance until 1990. Recently, new data on education achievement and economic performance have become available that now stretch to 2000 so that one purpose of the paper is to update the findings of the impact of gender inequality on economic growth. We will do this by using an updated and extended data set and the same econometric specification that was used in Klasen (2002). For some regions (including the MENA region), an update is particularly germane as the gender gaps in education have been closing more rapidly recently so that one would expect smaller but still remarkable costs for the existing gender gap in education.

A subject that has not been investigated in great detail is the impact of gender inequality in *employment* and *pay* on economic growth. The relatively small theoretical literature on the subject yields conflicting results (e.g. Robert Blecker and Stephanie Seguino 2002; Berta Esteve-Volart 2004; Tiago de Cavalcanti and Jose Tavares 2007). While there is some empirical literature suggesting that high *earnings* gaps, combined with high female labour force participation rates, helped spur export-oriented economic growth in some Asian countries (e.g. Stephanie Seguino 2000a, b; Matthias Busse and Christian Spielmann 2006), there has not been a thorough empirical investigation of the role of gender gaps in *employment* on economic growth and the few studies existing have to be treated with caution due to problems of endogeneity, unobserved heterogeneity and poor data quality and availability.

These issues can best be treated in a panel framework, where one considers the impact of initial female labour force participation on subsequent economic growth, and thus can at least partly address issues of endogeneity and unobserved heterogeneneity. With forty years of data, such an analysis is now possible and therefore a second aim of the paper is to investigate the impact of gender gaps in labour force participation on economic growth in such a panel framework.

[5] The reported figures in Klasen (2002) are actually slightly different, as Israel, Sudan, and Turkey were all included in the Middle East Region. For this report, they were allocated to other regions (Israel to OECD, Turkey to Eastern Europe, Central Asia and Sudan to Sub Saharan Africa) and therefore the analysis in Klasen (2002) was redone to reflect this. The figures reported above are based on that analysis.

1.2. Gender Inequality and Economic Performance: Theory and Evidence

There have been a number of theoretical and empirical studies finding that gender inequality in education and employment reduce economic growth.[6] The main arguments from the literature, which are discussed in detail in Klasen (1999, 2002, 2006) are briefly summarized below.

Regarding gender inequality in education, the theoretical literature suggests as a first argument that such gender inequality reduces the average amount of human capital in a society and thus harms economic performance. It does so as by artificially restricting the pool of talent from which to draw for education and thereby excluding highly qualified girls (and taking less qualified boys instead, e.g. Dollar and Gatti, 1999). Moreover, if there are declining marginal returns to education, restricting the education of girls to lower levels while taking the education of boys to higher levels means that the marginal return to educating girls is higher than that of boys and thus would boost overall economic performance (World Bank 2001; Knowles et al. 2002).

A second argument relates to externalities of female education. Promoting female education is known to reduce fertility levels, reduce child mortality levels, and promote the education of the next generation. Each factor in turn has a positive impact on economic growth. Thus gender gaps in education reduce the benefits to society of high female education (e.g. Galor and Weil 1996; Lagerlöf 1999; World Bank 2001; King, Klasen, and Porter 2008).

A third argument relates to international competitiveness. Many East Asian countries have been able to be competitive on world markets through the use of female-intensive export-oriented manufacturing industries, a strategy that is now finding followers in South Asia and individual countries across the developing world (Klasen, 2006). In order for such competitive export industries to emerge and grow, women need to be educated and there must no barrier to their employment in such sectors. Gender inequality in education and employment would reduce the ability of countries to capitalize on these opportunities (Seguino 2000a, b; World Bank 2001; Busse and Spielmann 2006).[7]

[6] See, for example, Abu-Ghaida and Klasen (2004), Klasen (2006), Jennifer Stotsky (2006) and Mark Blackden et al (2007), for a review.

[7] There is also some empirical support for the claim by Seguino (2000a, b) that higher gender wage gaps were a further pre-condition of these export-oriented strategies. There is a related debate as to whether growth has reduced these gender wage gaps, which appears to be the case in many, but not all countries. For

Regarding gender gaps in employment, there are a number of closely related arguments. First, there is a similar argument that it imposes a distortion on the economy as do gender gaps in education. It artificially reduces the pool of talent from which employers can draw upon, thereby reducing the average ability of the workforce (e.g. Esteve-Volart 2004). Such distortions would not only affect dependent employed, but similar arguments could be made for self-employed in agricultural and non-agricultural sectors where unequal access to critical inputs, technologies, and resources would reduce the average productivity of these ventures thereby reducing economic growth (see Mark Blackden et al 2007). As self-employment (including in agriculture) is included in our empirical assessment, these arguments might have some empirical relevance in accounting for the results.

A second also closely related argument suggests that gender inequality in employment can reduce economic growth via demographic effects. A model by Cavalcanti and Tavares (2007) suggest that gender inequality in employment would be associated with higher fertility levels which in turn reduce economic growth.

Thirdly, the results by Blecker and Seguino (2002) imply that gender gaps in employment access would also reduce economic growth as it would deprive countries to use (relatively cheap) female labour as a competitive advantage in an export-oriented growth strategy.

A fourth argument relates to the importance of female employment and earnings for their bargaining power within families. There is a sizable literature that demonstrates that female employment and earnings increase their bargaining power in the home (e.g. Amartya Sen 1990; Thomas Duncan 1997; Lawrence Haddad, John Hoddinott, and Harold Alderman 1997; World Bank 2001; Stephan Klasen and Claudia Wink 2003; King, Klasen, and Porter 2008). This not only benefits the women concerned, but their greater bargaining power can have a range of growth-enhancing effects. These could include higher savings as women and men differ in their savings behaviour (e.g. Stephanie Seguino and Maria Sagrario Floro 2003), more productive investments and use and repayment of credit (see Janet Stosky 2006), and higher investments in the health and education of their children, thus promoting human capital of the next generation and therefore economic growth (e.g. Thomas 1997; World Bank 2001).

a discussion, see Seguino (2000a, b), Klasen (2002), Busse and Spielmann (2006) and Stotsky, (2006), among others.

A fifth argument relates to governance. There is a growing but still rather speculative and suggestive literature that has collated evidence that workers, on average, appear to be less prone to corruption and nepotism than men (World Bank 2001; Anand Swamy, Omar Azfar, Stephen Knack and Young Lee 2001). If these findings prove to be robust, greater female employment might be beneficial for economic performance in this sense as well.[8]

There is a related theoretical literature that examines the impact of gender discrimination in pay on economic performance. Here the theoretical literature is quite divided. On the one hand, studies by Galor and Weil (1996) and Calvalcanti and Tavares (2007) suggest that large gender pay gaps will reduce economic growth. Such gender pay gaps reduce female employment, increase fertility, and lower economic growth through these participation and demographic effects. In contrast, Blecker and Seguino (2002) highlight a different mechanism, leading to contrasting results. They suggest that high gender pay gaps and associated low female wages increase the competitiveness of export-oriented industrializing economies and thus boost the growth performance of these countries. The most important difference of this study, in contrast to the models considered above, is that it is focusing more on short-term demand-induced growth effects, while the other models are long-term growth models where growth is driven by supply constraints. Clearly both effects can be relevant, depending on the time horizon considered, an issue that is also discussed briefly below.

It is important to point out that it is theoretically not easy to separate the effects between gender gaps in education, employment, and pay. In fact, in most of the models considered above, gender gaps in one dimension tend to lead to gender gaps in other dimensions, with the causality running in both directions.[9] For example, gender gaps in education might automatically lead to gender gaps in employment, particularly in the formal sector, where employers will prefer educated workers and thus will not consider applications of uneducated women. Conversely, if there are large barriers to female employment or gender gaps in pay, rational parents (and girls) might decide that education of girls is not as lucrative which might therefore lead to lower demands for female

[8] See a related discussion in King, Klasen, and Porter (2008) about the growth and welfare effects of women as policy-makers. The 'causes' of these differences in behavior may well be related to different socialization of girls and boys, a subject that leads beyond the scope of this paper.

[9] The one exception is again the short-term model of Blecker and Seguino where large gender gaps in pay, combined with small gender gaps in education and employment, deliver the growth-enhancing effects.

education and resulting gender gaps in education.[10] Thus gender gaps in education and employment are closely related to each other.[11]

They are not measuring the same thing, however, and thus are important to investigate separately. For one, it might be the case that the two issues are largely driven by institutional factors that govern education and employment access and do not therefore greatly depend on each other. For example, one might think of an education policy that strives to achieve universal education and thus reduces gender gaps, while there continue to be significant barriers to employment for females in the labour market. This might be particularly relevant to the situation in the Middle East and North Africa but most recently also for South Asia. Moreover, the externalities of female education and female employment are not all the same. For example, female education is likely to lead to lower fertility and child mortality of the off-spring, while the effect of female employment on these items is likely to be much smaller and more indirect (working mainly through greater female bargaining power; and there may be also be opposite effects including that the absence of women in the home might in some cases negatively impact on the quality of child care). Conversely, the governance externality applies solely to female employment, not to female education.

On the empirical evidence, there is a considerable literature now documenting that gender gaps in education reduce economic growth. King and Hill (1993) as well as Knowles et al. (2002) use a Solow-growth framework and find that gender gaps in education significantly reduce the level of GDP. Dollar and Gatti (1999), Forbes (2000), Yamarik and Ghosh (2003), Appiah and McMahon (2002) and Klasen (2002) investigate the impact of gender gaps on economic growth and all find that gender gaps in education have a negative impact on subsequent economic growth. They also find that the earlier results by Barro and Lee (1994) that female education might negatively impact economic growth do not stand up to closer econometric scrutiny.

There are much fewer empirical studies on the impact of gender gaps in employment and pay on economic growth, largely related to data and econometric issues discussed above. Klasen (1999) found that increases in female employment were associated with higher growth in a cross-country context. It included growth in female employment as a variable explaining economic growth and found a positive effect. This

[10] On these issues, see discussions in King and Hill (1993), Alderman et al. (1995, 1996), and World Bank (2001)

[11] Also, it is not obvious which factor is the prime cause of gender gaps that one should then include in a reduced form estimation.

might have accounted for another 0.3 percentage points in the growth difference between the MENA region and East Asia and the Pacific (EAP). But these findings have to be treated with caution as they may suffer from reverse causality. In particular, it might be the case that high growth draws women into the labor force (rather than increasing female participation promoting economic growth). There are no easy ways to correct for this econometrically as there are unlikely to be valid instruments that can be used. Also, there are questions about the international comparability of data on labor force participation rates. To the extent that the problems of comparability affect levels of labor force participation, but not trends over time, these problems might be avoided in a fixed effects panel setting as the one we are undertaking here.

At the sub-national level, Berta Esteve-Volart has found significant negative effects of gender gaps in employment and managerial positions on economic growth of India's states using panel data and controlling for endogeneity using instrumental variables (Esteve-Volart, 2004).

There are some papers by Seguino (2000a, b) that support the contention that the combination of low gender gaps in education and employment with large gender gaps in pay (and resulting low female wages) were a contributing factor to the growth experience of export-oriented middle income countries. Supporting this empirical claim is a paper by Busse and Spielman (2006) which finds for a sample of 23 developing countries that a combination of low gender gaps in education and employment and large gender gaps in pay helped promote exports. Unfortunately, there are no comprehensive, standardized and comparable data on gender pay gaps across many countries so that these analyses have been based on relatively small and rather specific samples of countries.

Also empirically, there are some questions about separation of the effects of gender gaps in education and employment. In regressions that only consider the effect of gender gaps in education, they might implicitly also measure the impact of gender gaps in employment, particularly if the two are highly correlated. Such high correlation might also make it difficult to separately identify the effects when both are included in a regression (due to the multicollinearity problem).[12] Also, it will be difficult to assess

[12] It turns out that in our total sample, gender gaps in education and employment are not very closely correlated so that it should be possibly to separately identify the effects. This overall low correlation is largely driven by a negative correlation between gender gaps in education and employment in Sub Saharan Africa and, to a lesser extent, South Asia, while in the other regions, the correlation is positive and usually large and significant. This negative correlation in Sub Saharan Africa is related to high female employment in agriculture despite low levels of female education; in this case, low education is not a barrier to high

which of the two is the causal driver of the other, given the close and plausible theoretical and empirical linkage.

In sum, there is considerable theoretical support for the notion that gender gaps in education and employment are likely to reduce economic performance (while the literature on the effect of gender pas in pay is more divided). The empirical results also point to negative effects of gender gaps in education, but there is little reliable cross-country evidence on gender gaps in employment. In the following section we will discuss gender gaps in education and employment by developing region before estimating the impact of these gaps on economic performance there.

1.3. Education, Employment, and Economic Performance

In this section we will present data on growth, education, and employment of the different world regions with particular focus on the Middle East and North Africa Region (MENA),[13] Sub Saharan Africa, and South Asia, the areas with particularly high gender gaps in education and/or employment. The data sources and definitions are shown in Table 1.1.

As shown in Figure 1.1, the fastest-growing region in the past forty years according to our data set has been the region of East Asia and the Pacific. The real per capita annual growth rate between 1960 and 2000 in this region was 4.05%. On the contrary, the region that registered least growth is the Sub-Saharan Africa region (0.57%). Latin American and Caribbean countries (LAC) did not experience high growth rates either: they grew 1.53% annually. Middle East and OECD countries' growth rates are in-between at 2.24% and 2.66% annual growth per capita, respectively. To better analyze the pattern of the per capita growth rate we will decompose it in decades for the past forty years (1960s-1970s-1980s and 1990s) and consider the different world's regions growth rates in the different decades.

female employment as is the case elsewhere (in the formal sector in Africa, see Klasen 2006; Blackden et al. 2007)

[13] See Annexes for the list of countries per region for which we have data availability.

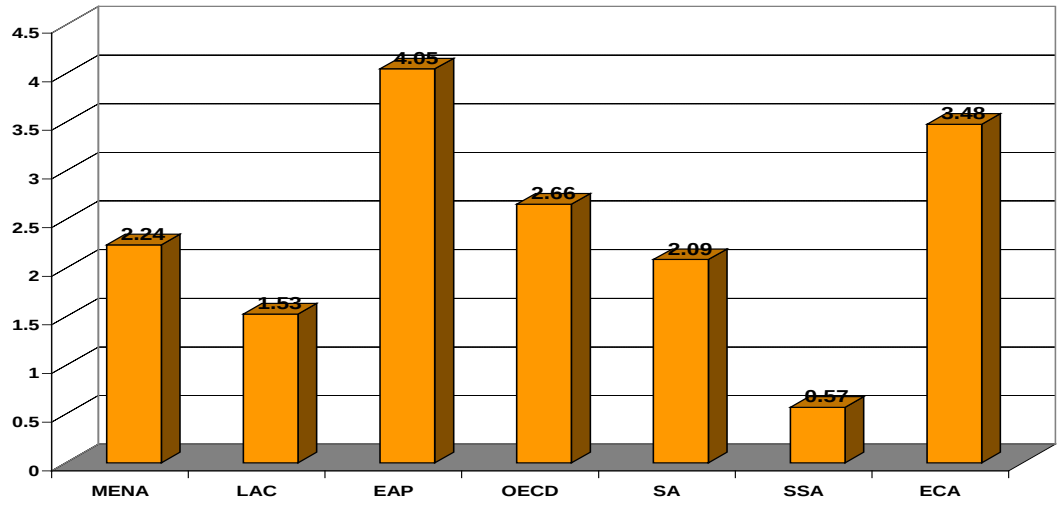
Table 1.1 Variables names, definition and data source

Variable	Definition	Data source
G	Per capita annual compound growth rate in Purchasing power parity (PPP)	Penn World Table (6.1)
INV	Average investment rates	Penn World Table (6.1)
POPGRO	Population growth rate	Penn World Table (6.1)
OPEN	Average of exports plus imports as a share of GDP	World Development Indicators (WDI, 2002)
LFG	Labor Force growth rate	WDI, 2002
FERT	Level of fertility	WDI, 2003
M5	Under five mortality rate	WDI, 2004
Life	Life expectancy measured in years	WDI, 2005
ED	Number of year of schooling for the male population(15+ and 25+)	Barro and Lee (2000)
AED	Number of year of schooling for the population	Barro and Lee (2000)
GED	Absolute growth in male years of schooling	Barro and Lee (2000)
GAED	Absolute growth in total years of schooling	Barro and Lee (2000)
RED	Female-Male ratio of schooling	Barro and Lee (2000)
RGED	Female-male ratio of the growth in the years of schooling	Barro and Lee (2000)
MACT	Male economic activity rate (15-64)	ILO Laborsta (2003)
FACT	Female economic activity rate (15-64)	ILO Laborsta (2003)
RACT	Female-Male Ratio of Activity Rates (15-64)	ILO Laborsta (2003)
TACT	Total economic activity rate (15-64)	ILO Laborsta (2003)
FLFT	Female share of the total labor force (15-64)	ILO Laborsta (2003)

Notes:

Note that the sample of countries included is restricted due to data availability, see Annex for detailed listing. Figures refer to unweighted averages and not all countries in each region are included due to data availability. World region: SA (South Asia), SSA (Sub-Saharan Africa), ECA (Eastern Europe), EAP (East Asia and Pacific), LAC (Latin America and Caribbean, MENA (Middle East and North Africa), OECD (Industrialized countries members of OECD).

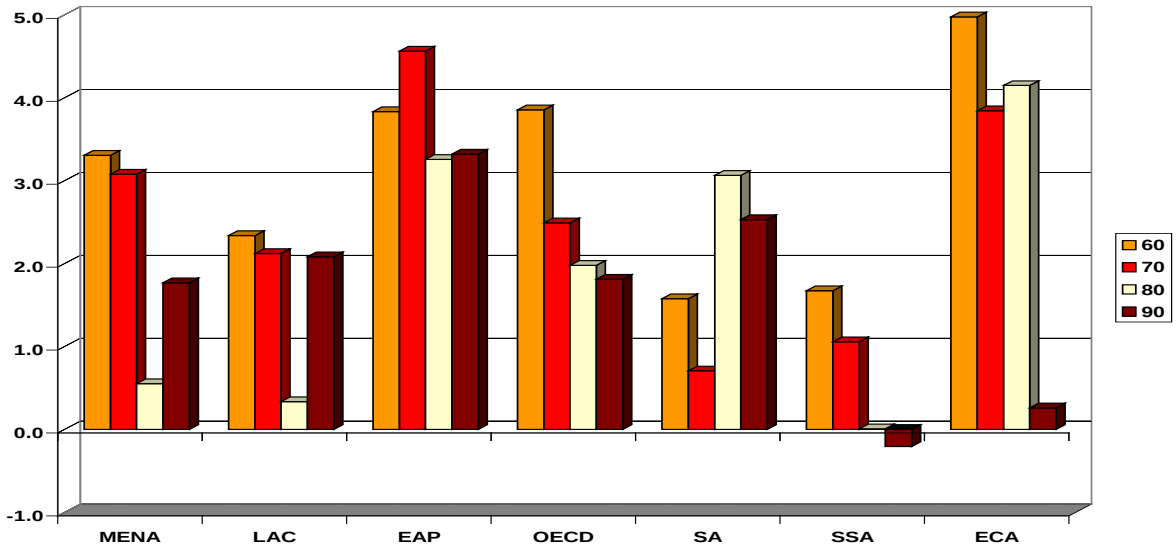
Figure 1.1 Real Regional per capita annual growth rate 1960-2000



Source: Penn World Table 6.1.

Considering the growth rate per decade in Figure 1.2 allows us to take into account the growth rates of Eastern Europe (ECA), because after 1990 the data available for this region increases significantly. During the nineties those countries were in transition and their rate of per capita growth was very low (0.26%). But also in Sub-Saharan Africa, the annual per capita growth rate decreased in the last 4 decades and actually shows negative growth in the 1990s (-0.21).

Figure 1.2 Real Regional per capita annual growth rate per decade



Source: Penn World Table 6.1.

In other world regions the per capita growth rate was generally higher in the 1960s and 1970s and then it decreased in the 1980s and 1990s with the exception of the South Asia region (SA) where the annual growth rate grew quickly in 1980s and was maintained almost at the same level in the 1990s. This result was largely driven by India and Sri Lanka. But their neighbors (EAP countries) still remain the countries that experience largely higher annual per capita growth rate in each decade. The region of Middle East and North Africa (MENA) together with Latin America seems to be successfully recovering from very low growth in the 1980s. One should point out that the data for the Middle East and North Africa included in the analysis do not consider many of the oil-exporting Arab states including Saudi Arabia, Kuwait, UAE, Oman, and Libya for which no income data over time.[14] Nevertheless, the growth experience there is to a considerable extent influenced by the direct and indirect impact of oil prices on oil-producing (and neighboring) countries.[15]

Non-economic indicators of well-being show a similar pattern, although some differences emerge (Appendix Table 1.9). The three indicators shown, under five mortality, fertility, and life expectancy all show larger improvements than the income measures. But the pace of improvements is similar to the growth indicator, with East Asia and Pacific showing the fastest improvements on most indicators, while Sub Saharan Africa showing the slowest. Here the MENA region compares very favorably with rapid improvements in life expectancy and under five mortality, and large reductions in fertility, particularly in the past 20 years while in South Asia the improvement was generally smaller.

Turning to the indicators of concern here, gender inequality in education and employment, in the appendix Tables 1.10 and 1.11 show the development in the regions between 1960 and 2000 by decade. The tables show that in all the regions, the education level of the adult population has increased considerably since 1960. Male and female adults have between 1.8 and 4.4 more years of education in 2000 than in 1960, with Sub Saharan Africa showing the slowest progress and East Asia and the MENA region the fastest. Regarding gender inequality, the data show considerable gender inequality in education in 1960 in most regions. The worst affected were South Asia, Sub Saharan Africa, and the MENA region, where female adults had about half or less the education

[14] Also note that following the World Bank country classification system, Turkey is considered to belong to the Eastern Europe and Central Asia and Israel to OECD.
[15] Iran is the only major oil producer included in the sample, but Egypt, Algeria, and Yemen also depend, directly or indirectly (via migration and remittances) on oil-production.

level than their male peers. In all regions, this gap has been reduced, but the gap remains sizable in some. In South Asia, female adults still only have about 60% of the educational achievement of males, and the gap has closed quite slowly in Sub Saharan Africa. The gaps have been closing faster in East Asia and Pacific and also in the MENA region where female adults (15 and older) now have about 73% of the education of males.

Appendix Table 1.11 examines data on labor force participation rates by gender, the female share of the labor force, and the rates of formal sector employment. The data show that inequality in labor force participation is also considerable, although the gaps have been narrowing. From these data a consistent pattern emerges. In particular, East Asia and the Pacific as well as Latin America show rapidly declining gender gaps in labor force participation and formal sector employment; Sub Saharan Africa show declines in female labor force participation and employment, but from a high level;[16] and the MENA region has the lowest female labor force participation rate and formal sector participation of women throughout the period. As in other regions, in MENA the gaps in employment have also narrowed in recent decades, but by less than most other regions.[17] In South Asia the gender gap in employment in the past four decades was only marginally reduced.

From our theoretical discussion, we would expect that excluding women from the pool of talent is particularly damaging formal sector employment which may depend predominantly on having the best talent. Thus using the gender gap in formal sector employment might be most appropriate. On the other hand, these data are available from the ILO for a much smaller pool of countries and it appears that measurement error and international comparability is particularly problematic using these data. Therefore for the empirical analysis that follows, we will use the gender gaps in total employment only.

Even if formal sector employment data are not readily available and comparable, one might still want to use overall employment rather than labor force participation data as the presumed theoretical effects are related to employment rather than participation. The difference between the two is, of course, unemployment rates. While we do not have reliable employment data at the national level, the KILM data of the ILO (ILO, 2007) suggest that, first, unemployment rates are below 10% in all regions except the MENA

[16] Sub Saharan Africa's high female labor participation rate is largely confined to the agricultural sector which still employs the majority of workers in most Sub Saharan African countries. The international comparability of labor force participation data in own-account agriculture is particularly problematic. In formal sector employment, female employment rates are much lower and the gender gap is significant; but these data are, as discussed, missing for many countries and show consistency and comparability problems.

[17] The combination of rapidly shrinking gender gaps in education yet large and persistent gender gaps in employment in the MENA region constitutes a major puzzle. See World Bank (2004) for a careful discussion.

region (where they are believed to hover around 12-14%), and that, second, the differences in male and female unemployment rates are quite low (usually less than 1 percentage point) so that labor force participation data appear to be reasonable proxies for employment levels by sex.[18]

In general, however, the quality and comparability also of the ILO labor force data is open to question. These constitute estimates based sometimes on very patchy primary data. The comparability problems are likely to be larger in level differences across countries than in trends over time. Despite these problems, we are forced to rely on the available ILO labor force data as the only available cross-country panel data for our analysis. Inherent measurement error in all the labor force estimates leads to the well-known downward bias of coefficients in regression analyses. Thus any effect that we find is likely to understate the true extent of the effect. Unfortunately, it is very difficult to econometrically control for measurement error. We know little about its structure, nor are there good instruments to address it. We hope that our panel analyses will at least partly reduce this problem to the extent that measurement error and comparability problems are lower across time than they are across space and can therefore be partly controlled for by using country-specific effects.

1.4. Data and Estimation procedure

Since the early 1990s a good deal of empirical growth research using cross-country data was inspired by new growth theories and the availability of better data. In our estimation strategy, we make use of cross-country and panel growth regressions as have been pioneered by Barro (1991) and used in a large literature since. Our particular estimation strategy for the cross-section analysis follows Klasen (2002); in the panel analysis we will extend the analysis. As our focus is on long-run economic growth, the most basic specification will use purely cross-country data where the period 1960-2000 will be treated as a single observation for each country. In order to partly control for possible endogeneity issues and unobserved heterogeneity, we will also consider panel regressions that treat each decade as one observation. Those panel regressions will also

[18] Unemployment rates for females in Latin America and in the Middle East and North Africa are several points higher than for males. Thus in these regions, the gender gap in employment is actually slightly larger than in labor force participation. But as this gender gap in unemployment rates is rather stable over time, it would be absorbed by the country-specific effects in our panel estimation. We also tried to use sectoral employment data that is available for some countries since the 1980s to adjust our labor force participation data to focus on non-agricultural employment. But there were so many data gaps and measurement error and comparability was so severe that these data turned out to be unusable.

allow us to properly study the impact of gender inequalities in employment on economic growth.

We include a number of regressors that were found to effect economic growth in the literature, including population growth, labor force growth, openness (exports plus imports as a share of GDP), the investment rate, human capital, and regional dummy variables to capture region-specific effects, which are invariably not captured in such cross-country regressions and can include common geographic, institutional, policy, trade, or conflict experiences within regions.[19]

In order to avoid some of the methodological problems of earlier studies on gender inequality and economic growth, we do not include in our equations male and female education level separately. Instead, we generate four different education variables, one for the initial level of education in 1960, one for the gender gap in the level of education in the 1960, one for the growth in the level of education in the period 1960-2000 and one for the growth rate of the female-male education level ratio for the period 1960-2000. For the level of education, we could use the average education, the male or the female education level. Each would make different assumptions about the possibilities to affect the gender gap. Using the male educational level as a proxy for average education provides an upper-bound estimate of the effect of gender inequality in education on growth as it implicitly assumes that one could improve the gender gap in education by sending more girls to school without having to take out boys (as the male education levels is held constant this way).[20] In the alternative specification, when we use average education and the gender gap in average education in our equations we assume that any increase in female education means an equal sized reduction in male education and thus constitutes a lower-bound estimate of the effect of gender inequality on economic growth.

It may well be the case that gender inequality in education has a direct impact on economic growth; but gender inequality may also affect economic growth through effects it has on investment rates, population growth, and labor force growth (see previous discussion). The interest is in capturing both the direct and indirect effects of gender inequality on economic growth. Following Klasen (2002) we will estimate a set of

[19] We have also undertaken some further robustness checks using more variables used in standard growth regression analysis. The results are available on request. While the use of regional dummy variables is invariably a measure of our ignorance, in many cross-country regressions they turn out to be significant pointing to region-specific left-out variables that are hard to capture in standard cross-country regressions.
[20] Knowles et al. (2002) suggest that this is the most suitable specification for analyzbing gender gaps in education. This specification was also used in Klasen (2002).

regressions to capture these two effects. Using the variables defined in Table 1.1 the equations estimated in the cross-country analysis are the following:[21]

$$g = \alpha + \beta_1 INV + \beta_2 POPGRO + \beta_3 LFG + \beta_4 ED60 + \beta_5 GED + \beta_6 RED60 + \beta_7 RGED + \beta_8 X + \epsilon \quad (1.1)$$

$$INV = \alpha + \beta_9 POPGRO + \beta_{10} LFG + \beta_{11} ED60 + \beta_{12} GED + \beta_{13} RED60 + \beta_{14} RGED + \beta_{15} X + \epsilon \quad (1.2)$$

$$POPGRO = \alpha + \beta_{16} OPEN + \beta_{17} ED60 + \beta_{18} GED + \beta_{19} RED60 + \beta_{20} RGED + \beta_{21} X + \epsilon \quad (1.3)$$

$$LFG = \alpha + \beta_{22} OPEN + \beta_{23} ED60 + \beta_{24} GED + \beta_{25} RED60 + \beta_{26} RGED + \beta_{27} X + \epsilon \quad (1.4)$$

$$g = \alpha + \beta_{28} OPEN + \beta_{29} ED + \beta_{30} GED + \beta_{31} RED60 + \beta_{32} RGED + \beta_{33} X + \epsilon \quad (1.5)$$

$$g = \alpha + \beta_{34} INV + \beta_{35} POPGRO + \beta_{36} LFG + \beta_{37} AED60 + \beta_{38} GAED + \beta_{39} RED60 + \beta_{40} RGED + \beta_{41} X + \epsilon \quad (1.6)$$

$$g = \alpha + \beta_{42} AED + \beta_{43} GAED + \beta_{44} RED60 + \beta_{45} RGED + \beta_{46} X + \epsilon \quad (1.7)$$

The first equation measures the direct impact of education and the gender bias in education on economic growth, as it controls for investment, population and labor force growth. In all regressions we do control for regional variation.[22]

The data used in this paper come from different data sources. Table 1.1 provides information on data sources and a description of the computation of the main variables of interest.

Education and gender bias in education could, however, influence population growth, investment and labor force growth in the future. Therefore there is a need to consider the indirect impact of education and gender inequalities on economic growth via these variables (equation 2-4). The total effect of gender inequality in education on growth is

[21] Note: equation 3 and 4 contain an additional explanatory variable with respect to Klasen (2002); openness.
[22] We use dummy variables for all regions, where the region left out is East Asia and Pacific.

determined by the path analysis, in which we simply sum the direct effect and indirect effects of gender inequalities in education on growth (see Klasen, 2002).

The fifth equation is the so called "reduced form" regression. In this equation, investment, population and labor force growth variables are omitted. We expect the coefficients on education of this regression to measure the total effect of gender bias in education directly. The results should then be comparable to the sum of direct and indirect effects calculated using the path analysis.

Equations 6-7 consider the total number of years of schooling as a measure for the average human capital generating a lower bound estimate of these effects.

The model is then re-estimated using panel data where dependent and explanatory variables refer to the following decades; 1960-69, 1970-79, 1980-89, 1990-2000. Using panel data would allow us to control for endogeneity of the education and employment variables by using initial values of each decade, and address unobserved heterogeneity and/or measurement error using country-specific effects.[23] This way we feel we are able to generate more robust estimates, particularly regarding the employment variables where endogeneity and measurement error are likely to be particularly problematic.

We will use several variables to investigate the impact of gender inequalities in employment on growth across the world. In a first specification we will add to our equation female share of the labor force. This specification holds the total labor force fixed and just adjusts the female share of labor force assuming that higher female employment could only come about through increased total employment. While this might be the best specification, it does not allow for possible influences of male labor force participation on economic growth, which might bias the results.[24] We use a similar technique to that employed in the cross-country growth regression model for the education variables with employment. We generate upper and lower bound estimates. We use male activity rates together with female-male ratio as upper bound estimates (the assumption is that the female-male ratio could be increased without reducing male activity rates, basically more jobs in total) and the total activity rate together with the female-male ratio as lower bound (the assumption is that any additional female job would lead to fewer male jobs). As with

[23] In the panel we use the total years of schooling of the population over 25. We do so because in the panel analysis we only have a ten-year window in which human capital (and gender differences) can have an effect and thus we want to focus our attention on the human capital of the labor force (rather than also including the 15-24 year old, only some of whom are in the labor force). In robustness checks, we also include the years of education of adults 15 or older to particularly capture the effects of young educated women who make up a significant share of female employment in many developing countries.

[24] On the other hand, empirically male labor force participation rates do not differ much across space and over time so that the growth effects observed are probably due to increased female employment.

the education estimates, we believe that the true effects are closer to the former than the latter specification. It turns out that the best panel specification is to use fixed effects to control for unobserved heterogeneity[25].

Compared to Klasen (2002), the country sample is smaller due firstly to changes in data availability from Penn World Tables, secondly to the elimination of apparently inconsistent data for education in two countries and thirdly to the lack of data for many transition countries before 1990.[26]

In addition to the dependent and explanatory variables of our cross-country model we do report child mortality (under 5 years of life) in 1960 (M560) and in 2000 (M500), the fertility rate (FERT) and the gross domestic product per capita (GDP) in 1960 and in 2000 for each region. This includes a number of variables typically used in cross-country growth models. We already commented above on trends and regional differences in GDP growth, education, labor force, and non-income indicators of well-being by decade.

One point of note is the variable RGED which measures the female-male ratio of growth in education in the period 1960-2000. This variable clearly reflects the different progress made in reducing the gender gap in education in a region. While the ratio is far above 1 in East Asia and the Pacific, suggesting that females expanded their education faster than males, the reverse is the case especially in South Asia (0.77) but also in MENA region (0.87). The figures for SSA shows that female expanded their education about as fast as men. Table 1.2 also includes data on other regressors including the investment rate, population growth, labor force growth. Here well-known differences emerge. The region of East Asia and the Pacific is notable for its high investment rates, its high level of openness, and its moderate population growth. The reverse is the case for Sub Saharan Africa. The MENA region shows very high levels of population growth, but also sizable investment rates and levels of openness. While South Asia shows relatively high rates of population growth and low level of openness and investment.[27]

[25] We have run the regressions for random effect but specification tests (Hausman tests) suggested that the fixed effect specification is superior.

[26] The previous version of the Penn Table (5.6) provided data for the following additional countries: Djibouti, Malta, Oman, Puerto Rico, Saudi, Somalia, Surinam, Iraq, Liberia, Myanmar, Reunion, Sudan, Swaziland, and Yugoslavia. For the last 9 countries Barro-Lee data on education were available. In addition to that the data for Eastern Europe countries were not limited to the 1990s. Penn 6.1 provides data for the entire sample set only for two Eastern Europe countries (Romania and Cyprus). Barro-Lee education data are suspicious for Austria and Bolivia, as they suggest stagnating or declining educational attainment despite substantial increases in enrolments. Hence we dropped these two countries from our analysis.

[27] It is quite difficult to adequately measure trade openness and the variable we use, export plus imports as a share of GDP, are not free from problems as these ratios are systematically lower in larger economies despite

Table 1.2 Descriptive statistic for Cross-Section Analysis

	TOTAL	MENA	LAC	EAP	OECD	SA	SSA	ECA
G	1.78	2.24	1.53	4.05	2.66	2.09	0.57	3.48
INV	15.48	13.18	13.96	20.53	23.92	11.21	10.45	17.31
OPEN	72.98	71.41	79.37	87.82	57.26	38.6	74.76	81.91
M560	166.65	233.75	135.5	139.56	37.45	228	273.08	80.78
M500	64.35	45.13	32	31.77	6.62	80.65	147.42	16.38
POPGRO	1.89	2.75	1.79	2.01	0.73	2.2	2.5	0.91
FERT60	5.31	7.12	6.12	5.69	2.88	6.3	6.49	3.24
FERT00	3.15	3.32	2.7	2.27	1.67	3.45	5.09	1.47
GDP60	3377	1971	3299	1813	8473	930	1478	2233
GDP00	8693	4462	6897	12033	23153	2186	2375	7910
LFG	2.02	2.95	2.35	2.69	0.86	2.33	2.46	1
RED60	0.7	0.39	0.91	0.59	0.93	0.29	0.47	0.73
RGED	1.03	0.87	1.09	1.24	1.02	0.77	0.97	1.05
EDF60	3.41	0.65	3.26	2.74	6.56	0.89	1.19	5.24
GEDF	0.07	0.11	0.07	0.1	0.07	0.06	0.05	0.09

Source: WDI 2002,Penn World Table 6.1, Barro & Lee (2000). All refers to variables means.

1.5. Results

Table 1.3 shows the basic set of regressions using the methods of Klasen (2002) but with the new data that now stretch from 1960-2000. We start by considering the basic regression in column 1. Before turning to the education variables, we briefly comment on the other regressors. Compared to Klasen (2002), we observe a considerably better fit of the regression results, which might partially be due to the slightly smaller (and more homogeneous) sample. Also, all the direct and reduced form regressions pass the omitted variable test.[28] The substantive results confirm many of the findings from the empirical growth literature. First, we see a strong conditional convergence effect, there is a sizable positive impact of investment on economic growth, a large negative impact of population growth, while we also observe a large positive impact of labour force growth. These findings confirm that the timing of the demographic transition can have a powerful impact on economic growth (David Bloom and Jeffrey Williamson 1998). The size of the effect is considerably larger now than it was in Klasen (2002). When population growth is falling due to lower fertility, but labour force growth is still high due to past high fertility, countries are receiving a 'demographic gift' of a low dependency burden (Bloom and

identical trade policies; other proxies have different problems. For a discussion, see Jeffrey Frankel and David Roemer (1999) and Dani Rodrik and FranciscoRodriguez (2000)

[28] The population growth regression does not pass the Reset test, suggesting that omitted variables and/or non-linearities in these regressions might be a problem. This does not affect out main (including the size of the direct, indirect and total effects) results and could only have a possible (and likely minor) influence on the relative importance of these two indirect effects.

Williamson 1998) that allows higher savings, a higher ratio of workers to population, and higher investment demand. Given that fertility in the MENA and South Asia region is falling rapidly, one would expect the region to enter this phase of the 'demographic gift' in coming decades. To what extent they will be able to capitalize on this opportunity will depend largely on the ability to generate employment for the large numbers of young people entering the labour force in coming decades.

Of the regional dummy variables, only those for Sub Saharan Africa and Latin America have a (marginally) significant negative coefficient. The size of the coefficients are much smaller than in Klasen (2002), suggesting that the model is better able to explain the growth differences between regions than was possible in Klasen (2002).

Turning to the education variables, the initial male education and the growth of male education have the expected positive signs, although only the education growth variable is significant. The initial female-male ratio of education has the expected positive sign but it is not significant (differently from Klasen, 2002 where it was marginally significant). In contrast, the female-male ratio of growth in adult years of schooling is significant and larger in magnitude than found in Klasen (2002). As these coefficients express the direct effect of gender inequality on economic growth, it appears that the direct effect of *initial* gender inequality on economic growth is relatively small while the impact of the gender inequality in the *growth* of education has a sizable direct impact on growth.[29]

Columns 2-4 estimate the indirect impact of gender inequality in education on economic growth through the effects they have on investment, population growth, and labour force growth. The investment regression shows that the initial female male ratio of education has a significant positive effect on growth, while the impact of gender inequality in the growth of education is also positive but not significant. In the population growth and labour force growth regressions, the impact of gender inequality in education is in the right direction, though not significant.[30]

[29] But here, endogeneity might be a problem which will be partially addressed in the panel regressions.

[30] While there is a large and conclusive literature that shows that female education reduces fertility (e.g. see Schultz 1997; Klasen, 1999; and World Bank 2001 for a survey), the link between female education and population growth rates is less strong as population growth is also affected by the age structure of the population. In a population with a large share of women in child-bearing age, even a low total fertility rate for each of them can generate considerable population growth compared to a population where the share of women is lower. Therefore it is not surprising that the link here is weaker than if one used the total fertility rate as the dependent variable. When we include labor force growth in the population equation to proxy for the effect of the age structure, the effects of the initial female-male ratio of schooling and the ratio of the growth become significant, as expected.

Table 1.3 Gender Inequality in Education and Economic Growth

Dependent variable	Growth (1)	INV (2)	POPGRO (3)	LFG (4)	Growth (5)	Growth (6) +	Growth (7) +
LOGGDP60	-2.27***	-3.51	-0.18	-0.21	-2.47***	-2.29***	-2.52***
	0.5	3.1	0.34	0.36	0.63	0.52	0.65
POPGRO	-2.80***	0.91				-2.79***	
	0.53	2.25				0.53	
LFG	2.33***	0.04				2.32***	
	0.47	2.1				0.47	
OPEN	-0.001	0.041**	-0.003	-0.002	0.005*	-0.0005	0.006*
	0.003	0.02	0.002	0.002	0.004	0.003	0.004
INV	0.06***					0.06***	
	0.02					0.02	
RED60	0.68	5.84**	-0.4	-0.17	1.75**	0.76	1.72**
	0.85	3.08	0.32	0.33	0.89	0.89	0.91
ED60	0.01	0.92**	-0.02	0.01	0.16**	0	0.13*
	0.07	0.44	0.05	0.06	0.09	0.08	0.1
GED	10.42***	35.42	-1.01	0.85	17.33***	10.59***	18.31***
	4.35	28.95	1.94	2.14	4.46	4.78	4.86
RGED	0.70***	2.07	0.001	0.05	0.95***	0.47**	0.62**
	0.29	2.19	0.25	0.25	0.37	0.25	0.34
SA	-0.07	-3.58	-0.17	-0.46**	-0.90*	-0.02	-0.85*
	0.59	3.07	0.24	0.24	0.64	0.61	0.65
SSA	-0.83*	-6.92***	0.40**	-0.06	-2.49***	-0.81*	-2.47***
	0.57	2.76	0.22	0.22	0.7	0.58	0.71
ECA	-0.1	3.57	-0.91**	-1.32***	-0.46	-0.1	-0.46
	0.63	2.8	0.41	0.54	0.87	0.63	0.88
LAC	-0.87*	-4.87**	0.08	-0.17	-1.79***	-0.87*	-1.81***
	0.56	2.73	0.28	0.27	0.74	0.56	0.74
MENA	-0.17	-3.77	0.72**	0.48	-1.26**	-0.12	-1.24**
	0.53	3.77	0.42	0.41	0.66	0.52	0.65
OECD	0.47	4.81*	-1.07***	-1.64***	-0.12	0.55	0.01
	0.6	3.04	0.37	0.38	0.83	0.6	0.82
CONSTANT	7.35***	13.65	3.26***	3.39***	7.16***	7.65***	7.73***
	1.84	11.8	1.06	1.11	2.1	1.85	2.14
ADJ R2	0.76	0.66	0.64	0.62	0.63	0.76	0.64
OV Test	passed	passed	Failed	Passed	passed	passed	Passed
OBS	93	93	93	93	93	93	93

Source: Authors computation

Heteroscedasticity-adjusted standard-errors reported under the coefficients. *** Refers to 99%; ** to 95%; and * to 90% significance level using a one-tail test. +: regression with total education instead of male education only. OV test refers to the Ramsey Reset test for omitted variables. Regions (SA, SSA, ECA, LAC, MENA and OECD) are dummies, missing dummy is East Asia and Pacific.

Column 5 shows the reduced form regression, which omits the investment, population growth, and labour force growth variables and thus gives a direct estimate of

the total effect of gender inequality in education on economic growth. The coefficients on both the initial ratio as well as the ratio of educational growth are considerably larger than in column 1 and now both are highly significant. This suggests that gender inequality in education, both initial as well as gaps in educational growth, have a significant negative impact on growth. A comparison between column 1 and 5 shows that the initial gender gap in education has mainly an indirect impact on economic growth (it appears from column 2 to be via investment) while the female-male ratio of educational growth has mainly a direct impact.

Regressions 6 and 7 use average education and thus estimate a lower bound effect of the impact of gender inequality on economic growth. The effects are generally predictably smaller and somewhat less significant.

In Table 1.4 we calculate to what extent gender bias in education can explain growth differences between the various regions of the world. We do this for the upper and lower bound estimates. Fortunately, the difference between these two estimates is fairly small.

We also note that the sum of direct and indirect effect (regression 1-4) gives very similar results as the direct estimate from the reduced form (regression 5). As expected, the regions with the largest gender gaps in education, South Asia, Sub Saharan Africa and MENA suffer the largest losses in terms of economic growth. But there are big differences here. In contrast to Klasen (2002) where both South Asia and the MENA region were suffering similar losses of about 0.9 percentage points in annual per capita growth per year, the losses are now slightly larger for South Asia, around 1 percentage point, and very much smaller for the MENA region, at about 0.7 percentage points per year. The difference for the diverging performance lies in the faster expansion of female schooling in the MENA region which has contributed to closing the gender gap in education, while progress in South Asia was much more modest.

When examining the pathways through which gender inequality in MENA, South Asia and Sub-Saharan Africa leads to lower growth, there is a sizable direct effect which amounts to about 60% of the total difference. This direct effect refers mainly to the lowering of the quality of human capital as a result of gender inequalities in education. But this is actually somewhat smaller than found in Klasen (2002) where for MENA about 75% of the total effect was accounted for by the direct effect. The indirect effect via investment has become somewhat smaller while via demographic more important. Clearly all pathways investigated contribute to the resulting growth difference, and the magnitudes

have shifted toward a greater importance of the demographic pathway which suggests that higher female education lowers population growth which in turn helps improve economic growth.

Table 1.4 Gender inequality and growth differences between Regions

	Difference SSA-EAP	Difference SA-EAP	Difference MENA-EAP	Difference SSA-EAP	Difference SA-EAP	Difference MENA-EAP
Total annual growth difference	**3.48**	**1.96**	**1.74**	**3.48**	**1.96**	**1.74**
Accounted for by:	**Upper bound estimate**			**Lower bound estimate**		
Direct effect of gender inequality in education (1)	0.26[31]	0.52	0.38	0.22	0.45	0.33
Of which:						
Initial ratio (RED60)	0.08	0.2	0.14	0.09	0.23	0.15
Ratio of educational growth (RGED)	0.18	0.31	0.24	0.13	0.22	0.17
Indirect effects:						
via investment	0.08	0.17	0.12	0.07	0.14	0.07
via population growth (3)	0.14	0.33	0.22	0.1	0.26	0.17
via labor force growth (4)	-0.02	-0.06	-0.04	-0.01	-0.04	-0.02
Total Indirect Effect	**0.22**	**0.34**	**0.3**	**0.16**	**0.36**	**0.22**
Of which:						
Initial ratio (RED60)	0.13	0.32	0.22	0.12	0.29	0.14
Ratio of educational growth (RGED)	0.07	0.12	0.09	0.04	0.07	0.04
Total Direct and Indirect effect	**0.46**	**0.95**	**0.69**	**0.38**	**0.81**	**0.55**
Total effect using Reduced form (5)	**0.47**	**0.97**	**0.7**	**0.38**	**0.81**	**0.41**
Of which: RED60	0.22	0.52	0.36	0.21	0.52	0.24
Of which: RGED	0.25	0.45	0.35	0.17	0.29	0.16

Source: Authors computation

Table 1.5 shows the result of panel regressions using fixed effects, which was found to be the preferred specification based on the Hausman test. Also here, the empirical findings in those regressions are consistent with the empirical and theoretical literature: we find conditional convergence, a positive effect on growth of the working age population, and a negative effect of population growth, though both are significant in only

[31] Sums do not add up precisely due to rounding

some specifications.[32] Investment rates significantly promote growth and openness has a small positive, but rarely significant impact.

The specification in regression 8 only examines the impact of gender gaps in education on economic growth. In contrast to the panel results in Klasen (2002) and the cross-section results shown here, the positive effect of a high female-male years of schooling ratio among the adult population (the female-male ratio of education of adults 25 or older) is relatively small and not statistically significant. Further investigations show that this is not driven by a slightly different composition of sample, but by the addition of the 1990s. If the 1990s are dropped, a higher females-male ratio of years of schooling has a large and significant effect (not shown here). In fact, it is due to the two regions Latin America and Sub Saharan Africa in the 1990s. If we exclude these regions for that time period, regression 9 shows that then the positive effect of higher gender equality in education is again sizable and significant.[33] It appears that the moderate to poor growth performance in these two regions despite falling gender gaps in education is important enough to reduce the overall effect of educational gender gaps to insignificance. It seems plausible to assume that the poor growth performance particularly of Sub Saharan Africa was not related to the reduced gender gaps in education, but many other factors that have been analyzed in the literature (e.g. Paul Collier and Jan Willem Gunning 1999; World Bank 2006). Conversely, regression 9 suggests that in all other regions, the impact of gender gaps in education on growth remains as strong in the 1990s as before (in fact, slightly stronger).

In regression 10, we replace the education variable with the education of adults 15 or older. This is to also capture the effects of high employment rates of educated women in the young age groups of 15-24 which might have a particularly large impact on growth. It turns out that in this specification the effect of gender gaps in education on growth are only significant if we limit the analysis to OECD, East Asian, and South Asian countries. But there the effect is very large and highly significant. This appears plausible as these are the regions where young educated women have been particularly active in the labor market.

[32] This may be related to the fact that the impact of population growth and labor force growth materializes with some delay and may therefore not be well-captured in the 10 year periods considered.
[33] It is even larger if we consider the reduced form estimate, i.e. if we leave out the investment rate, labor force growth, and population growth. In both cases, they are larger than identical panel regressions in Klasen (2002).

In regressions 11 to 16, we consider the full sample again and include various employment variables.[34] We consider two different explanatory variables for the labor force participation: the female share of the total labor force (FLFT) and the ratio of female to male economic activity rates (RACT=FACT/MACT). In regression 11 the female share of the labor force (FLFT) has a positive, large significant coefficient on economic growth, i.e. countries where the (initial) female share increased from decade to decade were able to achieve higher rates of subsequent economic growth. The effect of gender-gaps in education (ORED 25+) in this specification is considerable but not significant. If we exclude Sub Saharan Africa and Latin America in the 1990s, the effect becomes much larger and highly significant.[35] In regression 12, we use the other education variable (YRED 15+) which shows a large impact of education gaps on growth, and a smaller and no longer significant impact of female shares of the labor force, again reduced to OECD, East Asia, and South Asia.

In regression 13 we use the male economic active rate (MACT) and the ratio of the female to male economic active rates (RACT) as an alternative way to capture the gender gap in employment. This female-male ratio is highly significant and positive, while the male economic active rate has a non-significant negative sign. If we add the education gap in regression 14 the coefficient on the gender gap in employment is still positive and significant but smaller, while the coefficient on the male activity rate is now positive but still insignificant. The coefficient on educational gaps is not significant. In the reduced sample (excluding Sub Saharan Africa and Latin America for the 1990s), it becomes significant also in this specification while the impact of employment gaps becomes slightly smaller but remains significant (see regression 15). Lastly, we limit our sample to OECD countries, East Asia, and South Asia and use the alternative education variable and find that then education gaps have a very large impact on growth while employment gaps have a smaller (and only marginally significant) impact on growth.

Since the coefficient on the male activity rate is small and insignificant, altering the male activity rate when one increases the female activity rate would not have a significant impact on growth. Thus, in contrast to the education regressions in Table 1.3 it is not

[34] We also analysed the sample where we dropped Sub Saharan Africa and Latin America in the 1990s and report on the results where appropriate.
[35] The regression is not shown but available on request.

necessary to calculate an upper and lower bound regression as the male activity rate seems to be immaterial for growth.[36]

On the whole, these results suggest that gender gaps in employment have a negative impact on economic growth. For the MENA and South Asia region, where female labor force participation is still very low, this could have a significant impact on economic growth. The results also give some interesting insights into the relative importance of education and employment gaps in different time periods. In the full sample of countries, educational gender gaps are not so important, while employment gaps have a particularly large impact on economic performance. This is largely due to the experience of the 1990s where gender gaps in employment appear to be more consequential than those in education. Once Sub-Saharan Africa and Latin America in the 1990s are excluded, however, education and employment gaps have a similar impact on economic growth. If we change to an education variable that particularly includes young people, the results suggest indeed that education gaps are more important than employment gaps, at least in the OECD, East Asia, and South Asia. This suggests that pervious studies that only examined gender gaps in education were partly implicitly capturing the effects of gender gaps in employment and it is indeed useful to consider the two jointly as we have done here. It also suggests, however, that it is not easy to clearly answer the question as to the relative important of the two which appears to be quite sensitive to the sample, time period, and education variable used. This will become more apparent below.

Once again, we simulate the impact of gender inequality in education and employment based on these panel regressions. In Table 1.6 we show to what extent the difference in economic growth between East Asia and the Pacific and the MENA can be accounted for by differences in gender inequality in education and employment. Estimates based on regression 9 already show that gender gaps in education can account for a sizable portion of growth differences, but this difference in declining, due to a shrinking difference in gender gaps in education between the two regions.

Once gender gaps in employment are included, the share of growth differences explained by these combined gaps increases significantly; in fact, in the 1960s, 1970s and 1990s, the gaps can account for all of the growth differences or even more than that in

[36] This is confirmed by regressions (not shown here) where we replaced the male activity rate with the total activity rate and now find that the impact of the gender gap is larger while the impact of the total activity rate is now negative. These regressions are available on request.

some specifications suggesting that the MENA region would have grown faster than East Asia in the absence of the gaps. The growth costs, compared to East Asia, of gender gaps in employment, are increasing over time as the gender gaps in employment are shrinking much faster in East Asia than in MENA.

Table 1.5 Gender inequality and Economic growth

	8	9	10	11	12	13	14	15	16
LOGGDP	-5.54***	-7.82***	-10.37***	-6.08***	-10.81***	-6.99***	-6.14***	-8.48***	-11.09***
	1.42	1.33	1.31	1.43	1.32	1.28	1.48	1.41	1.28
POPGRO	-0.57*	-0.44	-0.22	-0.47	-0.23	-0.47*	-0.59*	-0.45	-0.2
	0.42	0.35	0.4	0.4	0.39	0.37	0.42	0.37	0.39
LFG	0.31	0.46*	0.32	0.38	0.34	0.48*	0.45*	0.54**	0.29
	0.27	0.31	0.4	0.31	0.4	0.3	0.31	0.31	0.37
FLFT				7.86**	4.17				
				3.49	3.36				
OPEN	0.002	0.005	0.006	0	0.006	0.001	0.001	0.003	0.007
	0.004	0.005	0.008	0.005	0.007	0.005	0.004	0.005	0.007
INV	0.09***	0.10***	0.13***	0.10***	0.14***	0.12***	0.10***	0.10***	0.14***
	0.03	0.03	0.02	0.03	0.02	0.03	0.03	0.03	0.02
OED25+	0	0.08		0			0	0.05	
	0.16	0.17		0.16			0.16	0.16	
ORED25+	0.43	2.30**		1.01			1.14	3.09**	
	1.45	1.28		1.43			1.51	1.41	
YED15+			0.31**		0.31***				0.29***
			0.13		0.12				0.12
YRED15+			3.33**		3.66**				4.42***
			1.65		1.7				1.76
RACT						5.41***	3.72**	2.97**	1.93*
						1.48	1.51	1.37	1.49
MACT						-0.7	3.85	-0.91	-6.6
						6.69	6.9	7.03	5.73
1960S	0.12	-0.65	-1.32***	0.59	-0.97*	0.61	0.4	-0.21	-0.49
	0.57	0.59	0.51	0.61	0.59	0.58	0.7	0.76	0.74
1970S	0.04	-0.52	-1.04***	0.37	-0.80**	0.3	0.28	-0.18	-0.47
	0.38	0.41	0.38	0.41	0.44	0.37	0.46	0.51	0.54
1980S	-0.60 **	-1.07***	-0.62***	-0.44*	-0.52**	-0.31	-0.46	-0.86***	-0.33
	0.26	0.29	0.25	0.27	0.26	0.26	0.29	0.33	0.3
Constant	20.20***	26.79***	34.93***	18.53***	34.58***	21.45***	16.04**	27.53***	40.98***
	4.87	4.78	4.73	4.89	4.55	7.8	8.03	7.51	6.32
R2	0.32	0.43	0.6	0.34	0.61	0.36	0.34	0.44	0.62
OBS	341	296	143	341	307	441	341	296	143

Source: Authors computation.

Note: Heteroscedasticity-adjusted standard errors reported under the coefficient. *** Refers to 99%; ** to 95%; and * to 90% significance level using a one-tail test. In regressions 9 and 15, the sample excludes Sub Saharan Africa and Latin America for the 1990s. In regressions 10, 12, and 16, only OECD, East Asian and South Asian countries are included.

In most specifications, the gender gaps in employment explain a larger share of the growth differences with East Asia, suggesting that MENA is particularly held back by its low female labor force participation rates, a subject much discussed in the literature (e.g. World Bank 2004).

Table 1.6 Gender Inequality in Education and Employment and Growth impact (EAP-MENA)

	1960s	1970s	1980s	1990s
Growth difference EAP-MENA by decades	**0.53**	**1.48**	**2.71**	**1.55**
Regression 9				
Education effect (ORED)	0.41	0.65	0.61	0.54
Regression 11				
Education effect (ORED)	0.18	0.29	0.27	0.24
Employment effect (FLFT)	0.75	0.86	0.96	1.06
Total Effect	0.93	1.15	1.23	1.3
Regression 13				
Employment effect (RACT)	1.15	1.36	1.62	1.73
Regression 14				
Education effect (ORED)	0.2	0.32	0.3	0.27
Employment effect (RACT)	0.79	0.94	1.11	1.19
Total Effect	0.99	1.26	1.41	1.45
Regression 15				
Education effect (ORED)	0.55	0.88	0.82	0.72
Employment effect (RACT)	0.63	0.75	0.89	0.95
Total effect	1.18	1.62	1.71	1.67

Source: Authors' computation based on Table 1.5. Since regressions 10, 12, and 16 did not include data from the MENA region, they are not included in the simulations.

Table 1.7 shows to what extent the growth differences between South Asia and East Asia can be explained by gender gaps in education and employment. Here the impact of larger educational gender gaps in South Asia plays a particularly large role. Depending on the specification, it can account for a growth difference between 0.2 and 1.4 percentage points. In contrast, the impact of employment effects is generally smaller, but is increasing over time. In fact, the ILO data we use showed smaller gender gaps in employment in South Asia than in East Asia in the 1960s and 1970s; if these level difference are to be believed, then South Asia's main problem has been, apart from their stubbornly high gender gaps in education, that female employment has expanded much slower than in East Asia and this is exacting a rising growth costs, compared to East Asia.

While these calculations nicely show the particular constraints in different regions, they cannot give clear answers to the question whether gender gaps in education or employment lead to higher growth costs. This depends to a significant degree on the education variable, the time period, and the sample. But we can say with more certainty that in relative terms, MENA's problem are more on the employment front, while in South Asia they are more on the education front (though rising on the employment front).

Table 1.7 Gender Inequality in Education and Employment and Growth impact (EAP-SA)

	1960s	**1970s**	**1980s**	**1990s**
Growth difference EAP-SA by decades	**2.26**	**3.86**	**0.19**	**0.79**
Regression 9				
Education effect (ORED)	0.57	0.5	0.67	0.73
Regression 10				
Education effect (YRED)	0.69	0.88	0.95	0.78
Regression 11				
Education effect (ORED)	0.25	0.22	0.29	0.32
Employment effect (FLFT)	-0.17	0.09	0.34	0.45
Total Effect	0.08	0.31	0.63	0.77
Regression 12				
Education effect (YRED)	1.08	1.11	1.19	1
Employment effect (FLFT)	-0.09	0.05	0.18	0.24
Total Effect	0.98	1.15	1.37	1.24
Regression 13				
Employment effect (RACT)	-0.37	-0.02	0.43	0.6
Regression 14				
Education effect (ORED)	0.28	0.25	0.33	0.36
Employment effect (RACT)	-0.26	-0.01	0.29	0.42
Total effect	0.03	0.24	0.63	0.78
Regression 15				
Education effect (ORED)	0.77	0.67	0.9	0.99
Employment effect (RACT)	-0.2	-0.01	0.24	0.33
Total effect	0.56	0.66	1.14	1.32
Regression 16				
Education effect (YRED)	1.3	1.34	1.44	1.21
Employment effect (RACT)	-0.13	-0.01	0.15	0.22
Total effect	1.17	1.33	1.59	1.43

Source: Authors computations based on Table 1.5

1.6. Conclusions and Caveats

The challenge of increasing the economic growth of a country is, as suggested here, to a considerable extent linked to the role played by women in the society. The costs of discrimination toward women in education and employment not only harm the women concerned, but impose a cost for the entire society.

In South Asia women are still in the twenty first century very much discriminated against in both education level and economic participation. In Middle East and North Africa the gender gap in education has been reduced from high levels, but gender gaps in employment remain pervasive. In contrast to some Asian countries, where export-oriented industries have led to a reduction of the gender gap in the labour market in the last decades, increased female education in MENA has not translated into higher labour market participation. Women in this region are encountering structural barriers[37] in employment but those barriers may also be social, cultural, and ideological (World Bank 2004).

Regarding the growth costs of gender inequality, we find the following:

Firstly, gender inequality in education reduces economic growth also in the 1990s. The findings from earlier studies that used data up until 1990 are largely confirmed through this expanded analysis although the impact of gender gaps in education in the 1990s in the panel specification is sensitive to the inclusion of specific regions in the 1990s.

Secondly, gender inequality in education in the Middle East and North Africa and South Asia region continues to harm growth in that region, but by decreasing amounts. This is due to the fact that gender gaps in education have been sharply reduced there over the past two decades, with much faster progress in MENA than in South Asia. As a result, we expect gender inequality in education to play a decreasing role in harming growth prospects in MENA and South Asia. While this is true in an absolute sense, it is not always true in a relative sense. As East Asia has closed its gender gaps in education much faster than South Asia, the growth differences accounted for by differences in gender gaps between the two regions mounted in past decades.

Thirdly, the panel analysis suggests that gender inequality in employment has a sizable negative impact on economic growth. Simulations suggest that MENA's and

[37] Structural barriers related to the economic reconstruction, recession and limited domestic and foreign investment.

South Asia growth prospects, when compared to other regions, are significantly reduced through this effect as the impact of gender inequality in employment is large and has been falling much slower than in other regions.

Thus a significant constraint to higher economic growth in those regions appears to be the substantial gender inequality persisting in education and employment. While these results are suggestive, we want to emphasize that the assessment of the impact of employment gaps is based on data that are measured with error and are often not fully comparable internationally. It is shocking that comparable labor force participation and employment data are not available for most developing countries. This is despite the fact that increasing numbers of household and labor force surveys are undertaken in these countries, but the results are not used to generate consistent and comparable data on employment, labor force participation and pay.[38] This remains a major challenge for the ILO and other international organizations charged with providing such data.

Also, the usual caveats of cross-country regressions apply, including omitted variable bias, model uncertainty, endogeneity, among others. We have tried to control for some of these issues, but more work will be needed to solidify the findings. Lastly, we need to acknowledge that our results concern the impact of gender gaps in education and employment on measured national output. To the extent that higher female labor force participation comes at the expense of reduced household labor, the economic and well-being losses of such a reduction is not included in our assessment. The extent to which this might be a problem is clearly an area of further research.

If our results are confirmed by further studies, this points to an urgent need of increasing female education level and their participation in the labour force. While our results suggests that changing the composition of the labour force to include more females (and thus fewer males) would have a positive effect on growth, a more realistic policy recommendation would be to develop an employment-intensive growth strategy that makes particular use of females. At the least, the results suggest that current barriers to female employment are not only disadvantageous to females, but also appear to reduce economic growth in developing countries, and particularly in MENA and South Asia

One should also bear in mind the findings from a large literature suggesting that gender inequality in education and employment also have a significant negative impact on

[38] This is particularly lamentable as these household surveys have been used by the World Bank to generate roughly consistent and comparable and publicly available poverty statitics for developing countries. It is a shame that ILO does not have the capacity, funding, or political will to use these same data to generate internationally comparable employment data.

other development goals such as reductions in fertility, child mortality, and undernutrition. Thus reducing existing gender inequality in education and employment will not only promote growth, but also further these other valuable development goals.[39]

[39] Abu-Ghaida and Klasen (2004) and King et al (2008) to estimate the magnitude of these effects.

Appendix Chapter 1

Table 1.8 List of Countries for our analysis by region

Middle East and North Africa	Sub-Saharan Africa	OECD	Latin American and Caribbean	Eastern and Central Europe
Algeria	Angola	Australia	Antigua and Barbuda	Albania
Egypt	Benin	Austria	Argentina	Armenia
Iran	Botswana	Belgium	Barbados	Belarus
Jordan	Burkina Faso	Canada	Belize	Bulgaria
Lebanon	Burundi	Czech Republic	Bolivia	Cyprus
Morocco	Cameroon	Denmark	Brazil	Estonia
Syria	Cape Verde	Finland	Chile	Latvia
Tunisia	Central African Republic	France	Colombia	Macedonia+
Yemen	Chad	Germany	Costa Rica	Poland
	Comoros	Greece	Cuba	Romania
East Asia and Pacific	Congo, Dem.Rep.	Hungary	Dominica	Russian Federation +
	Congo, Republic	Iceland	Dominican Republic	Slovak Republic
China	Cote d'Ivoire	Ireland	Ecuador	Slovenia
Fiji	Equatorial Guinea	Israel	El Salvador	Turkey
Hong Kong	Ethiopia	Italy	Grenada	Ukraine
Indonesia	Gabon	Japan	Guatemala	
Korea	Gambia, The	Luxembourg	Guyana	
Macao, China	Ghana	Netherlands	Haiti	
Malaysia	Guinea	New Zealand	Honduras	
Papua New Guinea	Guinea-Bissau	Norway	Jamaica	
Philippines	Kenya	Portugal	Mexico	
Singapore	Lesotho	Spain	Nicaragua	
Taiwan	Madagascar	Sweden	Panama	
Thailand	Malawi	Switzerland	Paraguay	
	Mali	United Kingdom	Peru	
South Asia	Mauritania	United States	St. Kitts and Nevis	
	Mauritius		St. Lucia	
Bangladesh	Mozambique		St.Vincent & Gren.	
India	Namibia		Trinidad and Tobago	
Nepal	Niger		Uruguay	
Pakistan	Nigeria		Venezuela, RB	
Sri Lanka	Rwanda			
	Sao Tome and Principe			
	Senegal			
	Seychelles			
	Sierra Leone			
	South Africa			
	Tanzania			
	Togo			
	Uganda			
	Zambia			
	Zimbabwe			

+ Data were not available for the entire period of analysis

Table 1.9 Annual per capita income and other non-economic Indicators by Region, 1960-1990

EAP	**1960**	**1970**	**1980**	**1990**	**2000**
Under five mortality	138.5	89.63	56.43	42	31.59
Total fertility	5.62	4.65	3.39	2.83	2.31
Life expectancy	52.57	59.87	64.94	68.76	71.55
Income per capita	1813	2963	5117	8930	11755
SA					
Under five mortality	228	192	154.6	109.4	80.64
Total fertility	6.3	6.02	5.54	4.31	3.45
Life expectancy	45.32	50.02	54.7	59.36	63.8
Income per capita	930	1099	1187	1660	2186
SSA					
Under five mortality	273.89	233.86	182.47	148.96	146.15
Total fertility	6.49	6.53	6.49	5.98	5.13
Life expectancy	40.4	44.3	48.08	51.18	49.06
Income per capita	1488	1868	2087	2182	2400
MENA					
Under five mortality	233.75	188.13	137.57	68.88	45.14
Total fertility	7.12	6.78	6.13	4.68	3.32
Life expectancy	47.89	53.08	58.55	64.86	68.37
Income per capita	1968	2762	3660	3499	4462
ECA					
Under five mortality	80.78	55.11	43.2	25.05	16.4
Total fertility	3.24	2.78	2.4	2.14	1.47
Life expectancy	66.15	68.77	69.59	70.79	71.59
Income per capita	2233	3650	5300	9323	7346
LAC					
Under five mortality	135.58	109	70.91	42.65	30.85
Total fertility	6.13	5.37	4.1	3.29	2.69
Life expectancy	57.25	61.64	65.72	69.14	71.56
Income per capita	3362	4270	5072	5471	7086
OECD					
Under five mortality	37.67	26.05	15.14	9.73	6.61
Total fertility	2.87	2.46	1.93	1.79	1.65
Life expectancy	70.19	71.72	73.8	75.76	77.73
Income per capita	8386	12024	15420	18875	23173

Source: Penn World Table 6.1 and WDI 2002. Please note that the data for ECA refer to only two observations before the 1990s (Cyprus and Romania). All are unweighted averages and might in some cases be affected by compositional changes.

Table 1.10 Education Indicators by Region, 1960-1999

East Asia and Pacific	**1960**	**1970**	**1980**	**1990**	**1999**
female education 25+ (OFED25+)	2.11	2.71	3.75	5.22	6.55
male education 25+ (OED25+)	4.11	4.74	5.59	6.81	7.8
total education 25+ (OTED25+)	3.13	3.73	4.68	6.02	7.18
ratio female-male education 25+ (ORED25+)	0.5	0.56	0.65	0.75	0.83
female education 15+ (FED)	2.74	3.53	4.46	5.46	6.7
male education 15+ (ED)	4.6	5.21	5.9	6.77	7.85
total education 15+ (TED)	3.68	4.38	5.19	6.12	7.28
ratio female male education 15+ (RED)	0.59	0.67	0.7	0.76	0.84
South Asia	**1960**	**1970**	**1980**	**1990**	**1999**
female education 25+ (OFED25+)	0.7	1.24	1.51	1.9	2.55
male education 25+ (OED25+)	1.77	2.37	3.2	3.83	4.49
total education 25+ (OTED25+)	1.27	1.72	2.39	2.89	3.54
ratio female-male education 25+ (ORED25+)	0.25	0.34	0.36	0.43	0.51
female education 15+ (FED)	0.89	1.3	1.86	2.68	3.23
male education 15+ (ED)	1.9	2.48	3.58	4.5	5.05
total education 15+ (TED)	1.42	1.91	2.75	3.62	4.16
ratio female male education 15+ (RED)	0.29	0.37	0.43	0.54	0.6
Sub-Saharan Africa	**1960**	**1970**	**1980**	**1990**	**1999**
female education 25+ (OFED25+)	0.92	0.97	1.37	1.92	2.63
male education 25+ (OED25+)	1.67	1.8	2.54	3.21	3.92
total education 25+ (OTED25+)	1.28	1.37	1.93	2.54	3.25
ratio female-male education 25+ (ORED25+)	0.43	0.45	0.47	0.55	0.62
female education 15+ (FED)	1.23	1.39	1.73	2.34	2.87
male education 15+ (ED)	2.05	2.32	2.76	3.52	3.92
total education 15+ (TED)	1.63	1.84	2.23	2.92	3.38
ratio female male education 15+ (RED)	0.48	0.52	0.6	0.62	0.7
Middle East and North Africa	**1960**	**1970**	**1980**	**1990**	**1999**
female education 25+ (OFED25+)	0.44	0.6	1.25	2.57	4.18
male education 25+ (OED25+)	1.36	2.1	3.23	4.99	6.39
total education 25+ (OTED25+)	0.91	1.34	2.24	3.78	5.29
ratio female-male education 25+ (ORED25+)	0.32	0.28	0.39	0.51	0.65
female education 15+ (FED)	0.65	1.17	1.86	3.17	4.77
Male education 15+ (ED)	1.76	2.85	3.58	5.11	6.52
Total education 15+ (TED)	1.21	2.01	2.72	4.14	5.65
ratio female male education 15+ (RED)	0.38	0.41	0.47	0.58	0.73

Table 1.10 to be continued

Continuation Table 1.10

Eastern Europe and Central Asia	**1960**	**1970**	**1980**	**1990**	**1999**
female education 25+ (OFED25+)	3.48	4.12	5.2	6.62	7.33
male education 25+ (OED25+)	5.28	5.66	6.82	8.02	8.32
total education 25+ (OTED25+)	4.34	4.87	5.99	7.32	7.82
ratio female-male education 25+ (ORED25+)	0.59	0.66	0.7	0.78	0.85
female education 15+ (FED)	5.24	5.9	6.56	8.24	7.57
male education 15+ (ED)	6.13	6.71	7.82	8.92	8.61
total education 15+ (TED)	5.66	6.29	7.18	8.57	8.09
ratio female male education 15+ (RED)	0.82	0.85	0.83	0.91	0.86
Latin America and Caribbean	**1960**	**1970**	**1980**	**1990**	**1999**
female education 25+ (OFED25+)	2.91	3.35	4.2	5.08	5.87
male education 25+ (OED25+)	3.42	3.93	4.65	5.42	6
total education 25+ (OTED25+)	3.16	3.63	4.42	5.25	5.94
ratio female-male education 25+ (ORED25+)	0.83	0.83	0.89	0.93	0.98
female education 15+ (FED)	3.3	3.88	4.81	5.52	6.08
male education 15+ (ED)	3.69	4.3	5.09	5.73	6.27
total education 15+ (TED)	3.49	4.09	4.95	5.62	6.18
ratio female male education 15+ (RED)	0.9	0.89	0.94	0.96	0.96
OECD	**1960**	**1970**	**1980**	**1990**	**1999**
female education 25+ (OFED25+)	6.39	6.91	7.84	8.4	9.12
male education 25+ (OED25+)	6.98	7.62	8.68	9.3	9.82
total education 25+ (OTED25+)	6.66	7.25	8.24	8.83	9.46
ratio female-male education 25+ (ORED25+)	0.91	0.9	0.9	0.9	0.93
female education 15+ (FED)	6.54	7.13	8.06	8.69	9.3
male education 15+ (ED)	7.11	7.7	8.66	9.27	9.85
total education 15+ (TED)	6.81	7.4	8.35	8.97	9.57
ratio female male education 15+ (RED)	0.91	0.92	0.93	0.93	0.94

Source: Barro-Lee (2000). All refer to unweighted averages.

Table 1.11 Labor market Indicators by Region, 1960-2000

East Asia and Pacific	1960	1970	1980	1990	2000
male economic activity rate, 15-64 (MACT)	90.69	87.82	86.41	85.71	84.94
total economic activity rate, 15-64 (TACT)	66.43	67.25	69.84	71.07	72.47
ratio female-male economic activity rate, 15-64 (RACT)	0.45	0.52	0.61	0.66	0.7
female economic activity rate, 15-64 (FACT)	41.33	46.25	52.85	56.47	59.67
female share of labor force, 15-64 (FLFT)	28.52	32.41	36.13	38.66	40.31
female employee rate (EMPLF)		0.17	0.22	0.29	0.3
male employee rate (EMPLM)		0.39	0.43	0.46	0.45
ratio female-male employees (REMPL)		0.4	0.49	0.6	0.66
South Asia					
male economic activity rate, 15-64 (MACT)	92.5	90.4	88.6	87.61	86.22
total economic activity rate, 15-64 (TACT)	71.99	70.31	68.91	68.62	69.1
ratio female-male economic activity rate, 15-64 (RACT)	0.52	0.53	0.53	0.55	0.59
female economic activity rate, 15-64 (FACT)	48.61	47.84	47.22	47.88	50.87
female share of labor force, 15-64 (FLFT)	30.71	31.28	31.82	32.9	35.28
female employee rate (EMPLF)		0.05	0.06	0.1	0.08
male employee rate (EMPLM)		0.27	0.3	0.34	0.27
ratio female-male employees (REMPL)		0.15	0.18	0.27	0.26
Sub Saharan Africa					
male economic activity rate, 15-64 (MACT)	92.65	91.34	89.75	88.59	87.49
total economic activity rate, 15-64 (TACT)	80.81	79.49	78.13	77.17	76.57
ratio female-male economic activity rate, 15-64 (RACT)	0.75	0.75	0.75	0.75	0.75
female economic activity rate, 15-64 (FACT)	69.62	68.59	67.2	66.44	66.1
female share of labor force, 15-64 (FLFT)	43.45	43.59	43.53	43.56	43.48
female employee rate (EMPLF)		0.12	0.09	0.09	0.03
male employee rate (EMPLM)		0.46	0.27	0.26	0.08
ratio female-male employees (REMPL)		0.2	0.26	0.28	0.34
Middle East and North Africa					
male economic activity rate, 15-64 (MACT)	88.84	85.39	82.03	81.02	81.21
total economic activity rate, 15-64 (TACT)	55.44	54.04	53.49	54.34	57.62
ratio female-male economic activity rate, 15-64 (RACT)	0.24	0.27	0.31	0.34	0.41
female economic activity rate, 15-64 (FACT)	21.56	23.21	25.54	27.5	33.7
Female share of labor force, 15-64 (FLFT)	19.01	21.45	23.89	25.09	28.94
Female employee rate (EMPLF)		0.07	0.07	0.09	0.11
male employee rate (EMPLM)		0.56	0.53	0.56	0.58
ratio female-male employees (REMPL)		0.12	0.13	0.18	0.25

Table 1.11 to be continued

Continuation Table 1.11

Eastern Europe and Central Asia					
male economic activity rate, 15-64 (MACT)	88.67	84.83	83.76	81.47	80.31
total economic activity rate, 15-64 (TACT)	73.22	73.12	74.97	73.66	73.65
ratio female-male economic activity rate, 15-64 (RACT)	0.67	0.73	0.79	0.81	0.84
female economic activity rate, 15-64 (FACT)	59.42	62.18	66.24	65.85	66.97
female share of labor force, 15-64 (FLFT)	42.49	43.46	44.74	45.13	46
female employee rate (EMPLF)		0.25	0.38	0.41	0.31
male employee rate (EMPLM)		0.51	0.62	0.55	0.44
ratio female-male employees (REMPL)		0.45	0.57	0.68	0.6
Latin America and Caribbean					
male economic activity rate, 15-64 (MACT)	91.64	88.57	86.34	85.41	84.63
total economic activity rate, 15-64 (TACT)	59.55	59.45	61.12	63.43	65.78
ratio female-male economic activity rate, 15-64 (RACT)	0.3	0.34	0.41	0.49	0.56
female economic activity rate, 15-64 (FACT)	27.91	30.51	35.73	41.77	46.88
female share of labor force, 15-64 (FLFT)	22.93	25.24	28.87	32.77	35.63
female employee rate (EMPLF)		0.18	0.21	0.22	0.24
male employee rate (EMPLM)		0.51	0.48	0.4	0.42
ratio female-male employees (REMPL)		0.37	0.45	0.56	0.56
OECD					
male economic activity rate, 15-64 (MACT)	90.28	86.8	84.66	81.55	81.12
total economic activity rate, 15-64 (TACT)	63.35	64.99	68.64	70.57	72
ratio female-male economic activity rate, 15-64 (RACT)	0.41	0.5	0.62	0.73	0.77
female economic activity rate, 15-64 (FACT)	37.32	43.16	52.72	59.36	62.82
female share of labor force, 15-64 (FLFT)	29.45	33.11	37.96	41.48	43.06
female employee rate (EMPLF)		0.32	0.41	0.48	0.48
male employee rate (EMPLM)		0.65	0.64	0.62	0.59
ratio female-male employees (REMPL)		0.48	0.62	0.75	0.79

Source: WISTAT 3, LABORSTA (ILO Bureau of Statistics).

Note: All refer to unweighted averages. Employees data only until 1995. The male and female employee rate refers to the numbers of dependently employed as a share of the working age population. As it

Chapter 2. Gender bias in child mortality: Empirical evidence from India

Abstract

Despite the high mortality rates and the availability of a large and comprehensive microdataset, there is little research on the microeconomic determinants of gender bias in child mortality using such data in India. The aim of this paper is to fill this gap in the literature, focusing particularly on the country's gender differences in under-five child mortality. In this paper, using a very rich microdataset that comprises more than 90,000 ever-married women across 26 Indian states and a sophisticated method of estimation, the Cox proportional hazard model, the author finds that children under five face higher mortality rates if born in households that are poorer, with a large number of women, where the mother has little autonomy, the father is illiterate, the birth interval is small and the child has a twin. The author also finds that in India the sex of the child plays a significant role in determining the hazard rate. Girls under five are much more likely to die than boys, particularly if the girl has older sisters.

2.1. Introduction

Gender equality is a concern that is recognized as a development goal by the large number of countries worldwide who signed and ratified the United Nations Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW) and the Millennium Development Goals (MDG). In most countries, however, there is evidence of gender inequality in various spheres of life (i.e., education, employment and health). This paper focuses attention on a specific aspect of discrimination against women in India, gender bias in mortality.

Amartya Sen contributed much to the theoretical and empirical analysis of gender bias in mortality in the world (1989, 1990 and 1992). He developed a method to assess the cumulative impact of gender bias in mortality by estimating the additional number of females of all ages who could be alive if there had been equal treatment of the sexes among the cohorts that are alive today. In a series of papers in the late 1980s, Sen claimed that about 100 million women were dead as a result of unequal treatment in the allocation

of survival-related goods (concept of "missing women"). A number of other papers on the topic were written in the following decade. The absolute number of missing women computed by those authors differs from paper to paper but those numbers are always dramatically high, suggesting that gender bias in mortality is far from being a minor issue (Klasen 1999, Klasen and Wink 2002). Sen (1989, 1990 and 1992) and all other authors found that girls and women suffer from elevated mortality rate, particularly in South Asia and China.

Boys have a natural mortality disadvantage especially in childhood (Waldron 1993). Nevertheless this biological advantage of women over men in longevity can be different if there is asymmetry in basic life and death matters, including nutrition,[40] health care and medical attention. Sen argues that these differences result from the influence of social action and public policy in the country.

India with its 1.1 billion people[41] is a country of vast demographic diversity. Child mortality has declined in the past two decades but still remains high (76 children out of 1000 in 2006[42]). Relative survival chances for boys and girls have changed substantially (Murthi, Guio and Dreze, 1995). Girls' mortality, however, is still greater than boys and the share of "missing women" in the country is particularly high. In India despite high mortality rates and the availability of a large and comprehensive microdataset, there has not been much research on the microeconomic determinants of child mortality using such data. Most analyses of gender bias in mortality in India have been conducted using aggregate datasets or small household surveys (at the region, district or village level).[43] The main aim of this paper is to fill this gap in the gender bias in mortality literature.

Using a rich dataset for India (National Family Health Survey [NFHS] 1998-99), this paper investigates the determinants of child mortality in the first five years of life. Particular attention is given to the impact of specific explanatory variables (household composition and characteristics, mother's characteristics and prenatal care, father's and children's characteristics and especially gender) on child mortality.

[40] From birth, the gender of an infant testifies to its cultural needs. Evidence from villages as dispersed as Morinda in Punjab, Karnataka and Kuppam in Tamil Nadu suggests that male babies are breast-fed for longer than females. Das Gupta (1987), in her surveys of Ludhiana villages in Punjab, noted a tendency towards daughters being weaned on to a vegetarian diet and sons to a non-vegetarian one.

[41] Data source: World Bank 2007.
[42] Data source: Unicef 2008.
[43] Das Gupta, 1987.

The paper is organized in seven sections. Section one presents the theoretical model, section two surveys the existing literature on gender bias in mortality in Asia and introduces the variables commonly used in the literature. Section 3 presents the paper's methodology and section 4 the data used. Section 5 presents the empirical model and section 6 the results. Section 7 concludes while presenting some policy options and further areas of investigation.

2.2. Theoretical Model

In the literature, the allocation of resources among children and more specifically the sex-specific allocation of them have been investigated using as a framework an investment model (Hill and King, 1993).

Investment in child education, nutrition and health are not made by the primary beneficiaries but by their care givers. The household's decision-making to invest in education, health care and nutrition of their children can be represented by a simple intergenerational investment model that illustrates rates of return on investment in women. In that model authors stresses the importance of market incentives to invest in women. The family will rationally decide to invest more resources in the child that will provide higher rate of return on investment.

Rate of returns may be gender-specific. When this is the case the opportunity cost of a child's time varies by gender and such cost will lead to differences in rates of investment. Sex-specific investment in children will then depend on their potential economic contributions to the household now and later.

In this paper we show that when return on girls is lower for girls than boys, women will be discriminated against. Children in most developing countries are an alternative system of social security. In this case, the so-called "return" refers to child labour services to the household and to transfer of resources and care for aged parents. This return obviously depends on work opportunities for girls and boys within and outside the household and also from marriage arrangements. Dyson and Moore (1984) highlight that if after marriage girls settle with the husband's family and care only for the in laws (patrilocal marriage), the investment value of girls will be low. This low valuation is exacerbated if marriage customs involve dowries; whereby the marriage of a daughter becomes much more expensive than that of a son. In Asian societies with predominantly patrilocal marriages, dowry payments, poor female earning opportunities and strong

familial obligations for old age support, it seems predictable to find a larger excess of female mortality, as each family considers its own private benefit, comparing costs and returns.[44] In India this varies drastically from one state to another.

In our model we show that improved economic opportunities for women would increase their bargaining power and raise the investment values on daughters. This is particularly the case in some States in which women are more educated and have more economic opportunities (i.e. Kerala).

2.3. Literature review

To construct a model incorporating a large number of explanatory variables to potentially explain the tendency to neglect girls in India, we need to investigate the existing literature on gender bias in mortality. From this perspective, this section offers insights into the existing work on the topic, the theoretical framework for the analysis and a possible justification for incorporating some variables in our empirical model.

Most studies on gender bias in mortality show that unequal access to healthcare is the most important process driving excess female mortality and leading to a higher mortality for young girls (Basu 1999, Klasen 1999, Alderman and Gartler 1997). Differences in access to nutrition appear to be a smaller factor (Chen 1981, Sen 1992, Basu 1992). This comparative neglect of female children, generally worse in rural areas, appears to be particularly severe for later-born girls, especially for the girls with elder sisters (Das Gupta 1987, Dreze and Sen 1989, Klasen 1999).

The scarcity of economic resources is a necessary but not sufficient condition for experiencing gender bias in mortality. Poor households are forced to ration scarce resources allocated to nutrition and healthcare, which could disadvantage females, but many country studies notice that the poorest sections of the population experience less gender bias in mortality than slightly richer groups (Murthi, Guio and Dreze 1995, Klasen 1999).

Another point of interest for further investigation is provided by the dispute initiated by Das Gupta & Mari Bhat and Murthi & Dreze (1995, 1997, and 1999). The first two authors studied the relationship between fertility decline and gender bias in child

[44] For the society, however, the social benefits are different. There are relevant positive externalities involved in having a gender neutral society. The role of the policy maker should be to equalize the private and social benefits: in this case a good policy option would be to subsidize girls' schooling or to provide any help that justifies an investment in girls.

mortality, showing evidence for the spread of sex-selective abortion, especially among women with lower fertility. Murthi and Dreze (1999) found that the association between fertility and gender bias is firmly positive rather than negative, casting doubt on the argument used by Das Gupta and Mari Bhat. Further research is needed to settle this dispute. If a decline in fertility leads to the intensification of gender bias in India, it will be necessary to intervene immediately (Klasen, 2009) so the already existing large bias is not exacerbated.[45]

Last but not least, there is evidence that state policies can influence gender bias in mortality (Oster, 2009). State-supported free access to healthcare and nutrition would lessen the need to ration scarce resources (Asfaw, Lamanna and Klasen, 2010). Having state supporting policies that promote female education and employment would have a positive impact on the return on investment for girls and therefore improve circumstances for girls nationally (World Bank 2001).

Gender bias in health expenditures

While female mortality rates in excess of male rates in the reproductive years are likely to reflect the hazard of childbirth, the evidence for differential morbidity not directly or indirectly related to reproduction is not clear. In Bangladesh, Chen et al. (1981) conclude that while there is no gender difference in the incidence of disease, there may be gender difference in the duration and intensity of illness. Gender differences in clothing quality and expenditure may also influence health status (Das Gupta 1987). In cases from north India and Bangladesh, a marked gender imbalance in health expenditure on children is recorded (Das Gupta 1987) and the treatments given to females are often less orthodox. Mitra (1978) found that gender differences in child mortality rates from vitamin deficiency, respiratory and gastrointestinal diseases arise from relatively late stage of illness at which girls were brought for treatment.

Low availability of health facilities and low public expenditure on health per capita are other important aspects related to increased mortality rates. A conspicuous number of studies show that gender difference in mortality rates vary positively with the distance from home to treatment centre. Disadvantages in female access to treatment, especially at

[45] A number of cultural practices and customs appear to hurt females in some regions, including virilocal marriage patterns, ancestor worship undertaken by sons and high dowry for brides.

young age, may have a remarkable influence on future female health. Gender differentials in access to state medical facilities may be further extended to access to other types of state institutions and to political life at village level and beyond. Asfaw, Klasen and Lamanna (2007) find that the strong preference for boys in India is reflected in the higher chances for girls to die at home than boys.

Potential sources of discrimination

In India and Bangladesh despite the enactment of legislation after Independence to guarantee equal inheritance rights to men and women, women's control over property is thought to have diminished throughout the subcontinent in the past fifty years. There remains notable differences between south and north, with southern women having greater access to property.

Similarly despite the Dowry Prohibition Act of 1961, the practice of transferring resources on marriage as dowry is said to be increasing in prevalence and size both in the south and north of India. The commercialization of females via resource transfer at marriage is punitive for households with a preponderance of daughters. This phenomenon could be linked directly to another unfortunate practice, seclusion, which may restrict the selected woman to the interior of the home.

Female discrimination also manifests in wage work. Although they play a roughly equal role in agriculture production, women receive less for it. Other better-paid sectors of female activity, such as trade, are restrictive in their dependence on male sanction for physical premises, credit and prices.

Female education plays a fundamental role advantageous to the welfare of women and may be a major source of change in domestic productive and reproductive behaviour (especially fertility decisions). The rise in female literacy rates and the increasing confinement of illiteracy to those over the age of 25 indicates the possibility of a rise in female status over the next decades. Yet female literacy lags behind that of males, especially in north and centre of India, areas with a high concentration of scheduled castes and tribes.

Policy Debate

An interesting paper that contributes to the policy debate on effective policies benefiting disadvantaged groups is the one recently published in the Journal of Devleopment Economics by Oster (2009). The paper investigates weather increases in

access to social services decreases inequality in the level of these services between advantaged and disadvantaged groups. The paper, using a very large dataset of over 90,000 women (NFHS)[46] shows that in India there is a strong non-monotonic relationship between access to services and gender inequality, where at low levels of access to investments, there is no gender bias in investment while an increase in access increases investments for boys in India, generating inequality. This result is collaborated also in our analysis (see section on empirical results).

2.4. Methodology

Using a Cox proportional hazard model, this paper investigates which household, mother, father and child characteristics are associated with higher child mortality rates in India. Specifically we investigate if there is any significant difference in the survival rates of girls and boys. Our dependent variable is child mortality under five years of age. After surveying the existing literature, we include as explanatory variables household composition and characteristics (location, income, number of people in the household, etc.), mother, father and child characteristics (mother and father education, mother nutritional and health status, exposure to media, birth spacing, sex of the child, having older sisters, etc.).

Further, in the context of India, there are significant variations in child mortality across the various geographical regions. To capture those differences, we added state dummies into the model. While on the one hand there are states like Kerala that have demographic features typical of middle-income countries, there is also a large part of India (in particular the northern states) that scores among those world's least developed in terms of demographic indicators.

In order to conduct our analysis we use a very rich and representative dataset (NFHS 1998-99 for India) that comprises more than 90,000 ever-married women across 26 Indian states. India makes an interesting laboratory for the study of demographic processes. It has one sixth of the world's population and almost a quarter of under-five child deaths in the world (Black et al. 2003). Infant mortality in India has been gradually declining, having halved between the early-1970s and 2000, but the rate of decline is less impressive than that observed in some other South and South-east Asian countries.

[46] Using the same dataset we are using in our analysis.

The Millennium Development Goal to reduce the mortality rates among children under five by two thirds by 2015 (MDG 4) represents a huge challenge for India. In 1999, the under-five child mortality rate in India was 100 children per 1000; where the infant mortality was very high, 70 every 1000. Mortality rates overall decreased recently but the pace is not sufficient to ensure satisfying results in the next future and particularly the rates for girls' mortality are much higher.

2.5. The Data

The paper uses India's NFHS for 1998-1999.[47] Since the database was designed to strengthen and facilitate the implementation and monitoring of population and health programs, it provides state and national data on fertility, practice of family planning, infant and child mortality, maternal and child health, and utilization of health services provided to mothers and children.

The data analysis that follows is based on the interviews conducted with women who had at least one child younger than five during the survey period November 1998 to March 1999. The survey includes questions on mortality and morbidity on both the Household Questionnaire and the Woman's questionnaire. The Woman's questionnaire collects information on the survival status of all births and the age at death of children who died.

The dependent variable

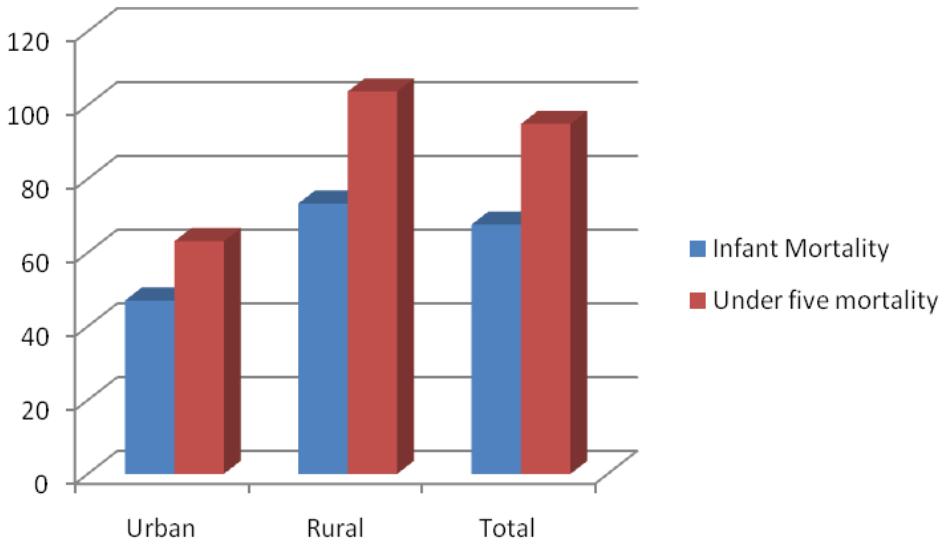
Infant and child mortality rate in India is very high (Figure 2.1). One out of 15 children born in the five years preceding the survey (1994-98) died within the first year of life and one in every 11 died before reaching age 5. Those results show that child survival programs in India need to be intensified to achieve further reductions in infant and child mortality[48].

[47] This survey was funded by the United State Agency for International Development (USAID) and UNICEF. The dataset can be downloaded from the following website: http://www.measuredhs.com/.

[48] The reliability of mortality estimates calculated from retrospective birth histories depends upon the completeness with which deaths of children are reported and the extent to which birth dates and ages at death are accurately reported and recorded. Estimated rates presented for infant and child mortality are subject to both sampling and non sampling errors. The method for calculating the probabilities presented in this papers follows the methodology of Rutstein (1984). The mortality estimates are not rates, but are true probabilities, calculated according to the conventional life-table approach.

Rural mortality rates are considerably higher than urban mortality rates. Child mortality rates are almost twice as high in rural areas as in urban areas and infant mortality is 56 percent higher in rural area as in urban.

Figure 2.1 Mortality estimates for rural and urban areas in India



Source: NFHS-2, 1998-99.
Note: The first five-years period preceding the survey do not include the months in which the interview took place. Rates are specified on a per-thousand basis

Figure 2.1 shows that in the 4 years preceding the survey the infant mortality rate in rural setting was very high (73.3 every 1000 infants) and the same was for under five morality rates (103.7 every 1000 children).

The probability of dying in early childhood is higher in some population groups than in others (see Table 2.1). The overall infant mortality rate declines sharply with increasing education of mothers, as expected, ranging from a high of 87 deaths per 1000 live birth for illiterate mothers to a low of 33 deaths per 1000 live births for mother who have at least completed high school.

All the infant and child mortality rates are much higher for Hindus than for Muslims. The infant mortality rate is 31 percent higher and the child mortality rate is 28 percent higher for Hindu children than for Muslim children. This is also explained by the differential in mortality by region.

Mortality rates vary drastically by gender. In most populations in the world, there are some more live births for boys than for girls. This numerical difference usually decreases in infancy, because of higher mortality of boys during the neonatal and subsequent period and is reflected in an average advantage is of 10-15% for females in infancy. In industrialized countries males often continue to be slightly more prone to die in their childhood. In areas where child mortality remains high, sex differences in post-infant death rates are infrequently reported.

Table 2.1 Infant and child mortality by background and demographic characteristics

	Infant mortality	Under-five mortality
Mother's education		
Illiterate	86.5	122.8
Literate (middle completed)	58.5	75.8
High school completed and above	32.8	37.1
Religion		
Hindu	77.1	107
Muslim	58.8	82.7
Christian	49.2	68
Sex of the Child		
Male	74.8	97.9
Female	71.1	105.2

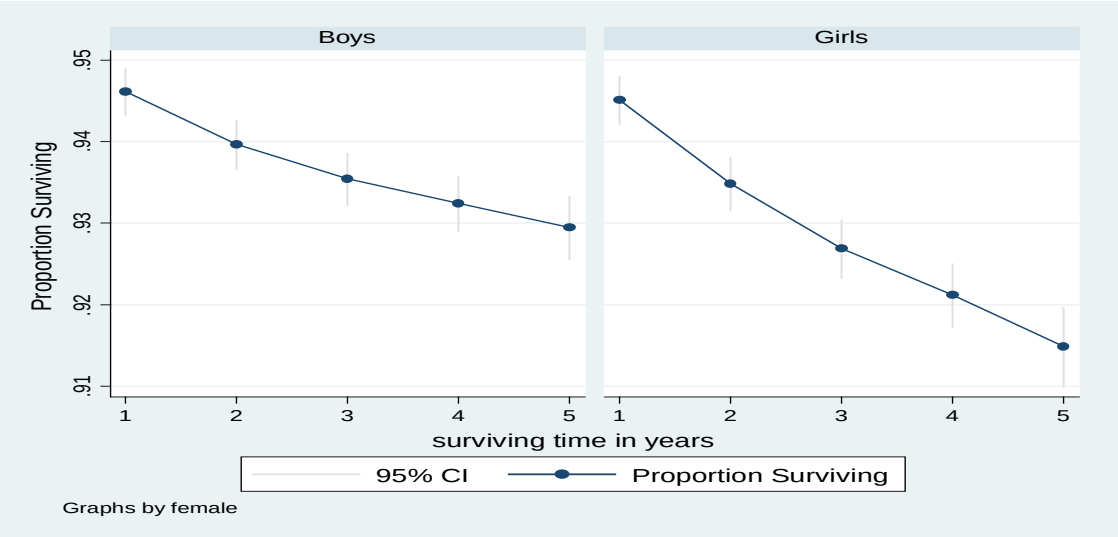
Source: NFHS-2, 1998-99

Table 2.1 shows that differently from around the world in India female mortality rate below age five years is slightly higher that the male mortality rate (105 deaths per 1000 live births for females compared with 98 deaths per 1000 live births for males). This pattern is much more evident in rural areas (106.4 deaths for 1000 live births for males and 117 for females). Excess female mortality occurs mainly after the first year of life. The infant mortality rate during the 10 year before the survey is slightly higher for boys (75 deaths per 1000 live births) than for girls (71.1 deaths per 1000 live births).

Figure 2.2 shows the survival chances for boys and girls under five. In India girls at all ages have much lower survival rates than boys and the differential in survival rates increases drastically over childhood; this is reflected in a much steeper survival curve for girls.

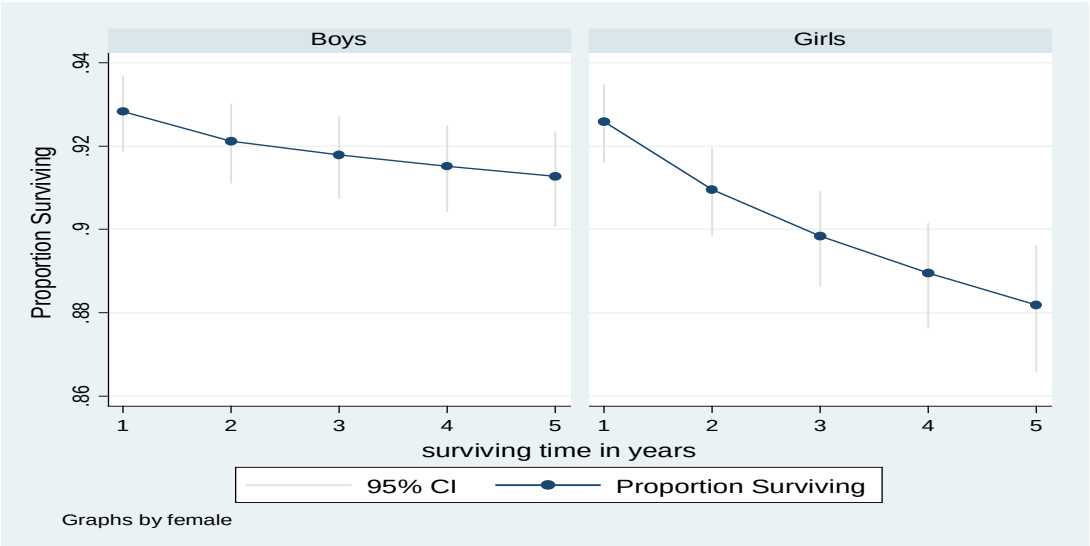
The results is even more striking if we consider some states in which child mortality rates are very high (Figure 2.3).

Figure 2.2 Proportion of boys and girls under age five surviving in India



Source: NFHS-2, 1998-99[49]

Figure 2.3 Proportion of boys and girls under age five surviving in Uttar Pradesh



Source: NFHS-2, 1998-99

The Explanatory Variables

Sample characteristics of the major explanatory variables used in the model are presented with mean and standard deviations in Table 2.2. These explanatory variables can be divided into the following categories: household composition and characteristics, mother, father and child main characteristics.

[49] Figures reported in this session are sample means and standard deviations based on the sample of ever-married women that have at least one child under age five.

Household characteristics and composition

In the household category we group variables that characterize the family. The large majority of households live in rural areas (75%). For household standard of living concerns, we have built an index based on various elements[50] that categorize the household levels as low, middle or high. Following this categorization, almost half of our sample belongs to the middle class, 34% to the low and the remaining to the high. Increased income typically leads to some decline of mortality chances; but the "income effect" can be slow and weak. Other personal characteristics, such as female literacy, often have a more powerful influence on demographic outcomes.

In our sample the household composition varies dramatically. On average size of a standard household is between seven and eight people. Most household heads are male.

Maternal/Mother's characteristics

As we mention in the literature review, a large number of mother characteristics can potentially influence child mortality in India. Dyson and Moore (1983) and other studies argue that mortality and *women's status* are linked. Women's status is thought to increase age at first marriage, to reduce the importance of son-preference and the patriarchal family structure.

Chronic energy deficiency in mothers can cause excessive in child mortality rates. In developing countries low energy intake of women is common, particularly during pregnancy and lactation, and the high incidence of low birth weight infants and growth faltering at an early age has been attributed to maternal undernutrition (Kramer, 1987). Maternal undernutrition in poor communities has been perpetuated for many generations, and recently the body mass index (BMI) has been introduced to define chronic energy deficiency (Ferro-Luzzi *et al.,* 1992). The BMI measures the body fat based on height and weight that apply to both adult men and women. Three grades of BMI were suggested to categorize chronic energy deficiency as mild (17.0-18.4), moderate (16.0-16.9) and severe (<16.0), (grade I, grade II and grade III respectively).

The limitation of research on maternal nutrition is its almost exclusive preoccupation with infant outcomes: birth weight, breast milk production and infant

[50] The standard of living index is a composite index calculated by the International Institute of Population Sciences and ORC Macro and is based upon household ownership of possessions/consumer durables and land/livestock. An exhaustive explanation of the index is in Mohamed, Barriere and Otto (1997).

growth (Kramer 1987). Little consideration is given to the repercussions of reproduction on maternal nutritional status and *vice versa.* In our sample, average mother body mass index is 19.9, but for younger mothers (under 20) this index indicates on average a mild undernutrition for mothers.

Characteristics indicating the *independence of women* are their capacity to set money aside and their degree of freedom to go to the market. Only 55.2% of the women interviewed are allowed to have their own savings. A quarter of the women interviewed can go to the market without the permission of their husband or the male head of the household, while 74% has either to ask permission or is not allowed to go at all. This degree of freedom could have an impact on the household decision processes in which the mothers are usually involved, resulting in positive outcomes for children (i.e., decisions on what to cook, etc.).

Other than private income, *mother's education* is considered in the literature to be the most important variable in influencing fertility decisions and child mortality. Lagerlof (2003) argues that higher education for girls increases the opportunity cost for women to have children especially if they have the opportunity to work, and that this eventually reduces fertility. This link between female education and fertility decline is now recognized worldwide. The relation between maternal education and child mortality, however, requires further investigation (Murthy et al., 1995). What seems obvious is that educated women are likely to be more knowledgeable about nutrition, hygiene and health care. This aspect of maternal education may be particularly significant given the uninformed and deficient nature of child care practices in large parts of rural India. In our sample more than 50% of the mothers interviewed had no education, 16.1% primary, 22.1% secondary and less than 8% higher education.

Women's *participation in the labor force* is another variable considered very important for child survival. Involvement in gainful employment often enhances effectiveness of women's agency roles in society and family, including those connected with child care. In our sample, one third of the women work. This is a very low percentage compared to other countries in the region.

The exposure to media is a variable that provides information on maternal seclusion. Programming on radio and TV includes government programs to inform people on important health and social issues, for example child vaccination. Over 40% of the sample did watch TV or listen to the radio at least once a week.

In addition to these characteristics of mothers, we need to investigate variables of access to medical care during the pregnancy. Unfortunately most variables commonly used in the literature are recorded only for some mothers in our dataset. We limit the analysis using the number of antenatal visits and the number of tetanus vaccination during the pregnancy for mothers. We notice on average that mothers were visited less than three times during their pregnancy.

Father characteristics

There is a large literature showing that higher male education neither improves child nutrition nor reduces fertility. It actually seems that husband's occupation could have an impact on fertility decisions. For example, farmers may desire more child labour for faming or for work in domestic industry, cheap child labor is requested. In developing societies where children are valuable means of insurance in old age and there is no widespread or national system of social security, this may result in easy and near universal marriage (Das Gupta 1999).[51] There is little evidence in the literature on the impact of father characteristics on on mortality.

Concerning *father education level and labor* participation we find the following: 29% had no education, 18% primary education, 37% secondary and 16% higher. The percentage of fathers working is very high at 98.3%.

Investigating the *characteristics of children*, we notice that on average in our sample each family has fewer less than three children. The percentage of twins is extremely low at less than 1.5%.

Many authors find empirical evidence for *birth spacing* influencing child survival (Das Gupta, 1990). The claim is that an increase in succeeding birth intervals improves children survivals. This might indicate that birth of a new child shifts a significant proportion of the household resources away from the older children to the younger (Makepeace and Pal, 2001). In our sample we find that the average birth interval is little less than 3 years in India.

[51] It is interesting to investigate the reasons given by population to have children. There is a study conducted in Karnataka (southern Indian state) showing that 32% of the family want to have a child for insurance purposes, 24% want to have a child of opposite sex to existing children, 10% to provide help to their mothers. Iyer (2002) shows that in Ramanagaran, in the southern Indian state of Karnataka, the 201 rural women interviewed recognized the need for children especially to contribute to the household's activities or insurance in old age, but they realize that the additional child would be expensive to rear and this cost would be especially high if they have a daughter.

Table 2.2 Descriptive Statistics (mean and standard deviation, based on the sample of ever married women that have at least one child under age 5)

Variables	mean	Sd
Household Characteristics		
Rural	0.746	0.436
Urban	0.254	0.436
Hindu	0.741	0.438
Muslim	0.148	0.356
Christian	0.066	0.248
Sikh	0.020	0.141
Household low index of living standard	0.339	0.473
Household middle index of living standard	0.483	0.5
Total number in the household	7.575	3.87
Number of women eligible in the household	1.425	0.784
Woman head of the household	0.064	0.244
Age of the head of the household	43.029	14.832
Total number of Children	2.974	1.668
Mother Characteristics		
Body mass index	19.891	3.096
Age at first marriage	17.277	3.268
Age at first birth	24.443	5.423
Allowed to set money aside	0.552	0.497
Allowed to go to the market	0.256	0.436
No education	0.544	0.498
Primary education	0.161	0.368
Secondary education	0.221	0.415
Work	0.342	0.474
Watch TV weekly	0.411	0.492
Listen to radio weekly	0.335	0.472
Maternal Child care		
Antenatal visit (number)	2.826	3.229
Tetanus vaccination while pregnant (number)	1.636	1.141
Father characteristics		
No education	0.289	0.453
Primary education	0.183	0.387
Secondary education	0.365	0.481
Work	0.983	0.13
Child and Childbirth characteristics		
Female	0.480	0.5
Twin	0.015	0.12
Previous birth interval	34.158	19.232

Source: Authors computation based on NFHS 1998-99

Child characteristics

Becker (1991) argues that if households are subject to credit constraints, competition among siblings for limited resources may give rise to parental preferences for certain children over others. The existence of bias in the allocation of critical life-sustaining resources has micro-foundations in the household-level evaluations of the relative worth of female versus male children. To the extent that the value of a male child is perceived to be greater than that of a female, scarce life-sustaining resources are likely to be disproportionately allocated to male rather than female children (Kishor 1995). The question arises whether the availability of resources to the household will influence their allocation. Making life-sustaining resources less scarce will diminish the economic need to discriminate in their allocation. Nonetheless, if the economic and cultural worth of female children is found to be inversely related to the number of siblings, and more particularly to having older sisters, this is going to have an effect on their survival rates. In our model, we investigate whether girls with older sisters are discriminated against in particular in the allocation of limited life-sustaining resources.

Variations across states in India

The *regional variation* in our sample is very large. In the south of India consanguineous unions are quite common even today, while in the north they are not, and religion may be a factor influencing consanguineous relationships (Iyer 2002). The economic theory behind this practice is to minimize risk by retaining income strictly within the family, as well as facilitating better opportunities to monitor the behavior of family members. It also reduces the need for paying dowry. In general it appears that women are perceived in better terms in south India than in the northern states. This has been attributed not only to marriage practices but also to the nature of social organization in south India where female education rate is higher, women have more autonomy and mobility, and largely proactive regional governments have taken a deep interest in promoting literacy and a small family ideal. In fact, those governments have recognized those two subjects as key potentials for growth.

Our sample reveals clear regional patterning of gender differences in girls' mortality: excess female mortality is greatest in the north and central states. There is not only a large variation in gender differences in mortality across states but also in the actual levels of female and male mortality. To capture the state variation in child mortality, we use states dummies in our model.

2.6. The Empirical Model

The econometric method used is a hazard regression model. The main objective of this econometric hazard analysis is to understand the relative impact of a set of explanatory variables in determining child survival in India. Moreover, we are interested in investigating whether or not the sibling composition has an impact on girls' mortality.

A very popular hazard method widely used in demographic studies, as well as in biomedical and econometric duration applications, is the Cox proportional hazards model (Cox, 1972). The Cox proportional hazard model is a semi-parametric model that postulates that the logarithm of the hazard function is a linear function of the covariates:

$$h(t/z) = h_0(t) * \exp(\beta' z) \qquad (2.1)$$

Where $h(t/z)$ is the hazard function at time t, given a vector of covariates z, $h_0(t)$ the baseline hazard and the β coefficients are estimated from the data.

Cox's method does not assume particular distribution for the survival times, it could be constant, increasing, decreasing or anything else we can imagine, but it is assumed that whatever the shape, it is the same for everyone. The effects of the different variables on survival are constant over time and are additive in a particular scale.

The advantage of the semi-parametric Cox model is that we do not need to make assumptions about the hazard baseline, $h_0(t)$, assumptions about which we may be wrong and which, if we are wrong, could produce misleading results. On the other hand, the cost is loss in efficiency; if we knew the functional form of $h_0(t)$, we could definitely do a better job of estimating β.

The β regression coefficients for each explanatory variable in the model (i.e., mother and father education, sibling composition, sex of the child etc.) give the proportional change that can be expected in the hazard related to changes in the explanatory variables (estimated using maximum likelihood). There is the obvious need to test the assumption of a constant relationship between the dependent variable and the explanatory variables, the so-called proportional hazards assumption.

Interpreting a Cox model involves examining the coefficients of each explanatory variable, where a regression coefficient with a positive sign for an explanatory variable means that the hazard is higher for higher values of the explanatory variable and vice versa

for a negative sign.[52] For simplicity in the estimation, in Table 2.3 we present the results directly after computing the exponential factor: in other words, we present the hazard ratio directly.

Table 2.3 Proportional Hazard model

	Hazard Ratio	Std. Err.	P>|z|	Hazard Ratio	Std. Err.	P>|z|
Household Characteristics						
Rural	1.094	0.116	0.398	1.097	0.116	0.384
Household low index of living standard	1.369	0.226	0.057	1.371	0.226	0.056
Household middle index of living standard	1.288	0.188	0.083	1.286	0.188	0.085
Total number in the household	0.827	0.018	0	0.827	0.018	0
Number of women eligible in the household (over 18)	1.985	0.133	0	1.986	0.133	0
Woman head of the household	0.818	0.127	0.194	0.815	0.126	0.186
Age of the head of the household	1.009	0.003	0.001	1.009	0.003	0.001
Mother Characteristics						
Allowed to set money aside	1.094	0.077	0.2	1.092	0.077	0.213
Body mass index	1.033	0.012	0.007	1.033	0.012	0.007
Allowed to go to the market	0.835	0.075	0.045	0.835	0.075	0.045
No education	1.437	0.393	0.185	1.441	0.394	0.182
Primary education	1.312	0.356	0.317	1.313	0.356	0.316
Secondary education	1.253	0.328	0.389	1.253	0.328	0.389
Work	1.082	0.082	0.298	1.081	0.082	0.299
Watch TV weekly	0.911	0.084	0.312	0.912	0.084	0.318
Listen to radio weekly	0.97	0.083	0.725	0.968	0.083	0.706
Health status of the mother						
Antenatal visit	0.974	0.035	0.462	0.975	0.035	0.48
Tetanus vaccination while pregnant	0.895	0.039	0.011	0.895	0.039	0.012
Father characteristics						
No education	1.341	0.199	0.048	1.34	0.199	0.049
Primary education	1.259	0.193	0.134	1.26	0.194	0.132
Secondary education	1.322	0.183	0.043	1.325	0.183	0.042
Work	1.051	0.272	0.849	1.041	0.27	0.878
Child characteristics						
Female	1.138	0.074	0.048	0.913	0.115	0.467
Twin	5.351	0.861	0	5.332	0.857	0
Has older brother	1.12	0.093	0.17	1.12	0.093	0.172
Has older sister	1.133	0.095	0.138	0.973	0.107	0.804
Previous birth interval	0.982	0.003	0	0.982	0.003	0
Interaction term						
Girl having an older sister				1.352	0.199	0.04
Regional Dummies	YES			YES		

Source: Authors computation based on NFHS 1998-99

[52] Exponential individual coefficients have the interpretation of the ratio of the hazards for a one-unit change in the corresponding covariate for continuous explanatory variables.

Test

Prior to estimating the hazard model of child survival, there is the need to test the validity of the proportionality assumption for covariates that are likely to have a significant effect on child mortality and for which the proportionality assumption seems to be a restriction. We tested, in particular, for equality and proportionality of hazards with respect to several dichotomous covariates (our variables of particular interest, sex of the child, state of residence, asset classes and education level) and continuous covariates (total household members, number of women in the household). What we found is that the hypothesis of proportionality assumptions for covariates cannot be rejected.

In addition we tested that we adequately parameterized the model, and we ensure that we chose a good specification for the estimation. In general for specification tests, one searches for variables to add to the model. Under the assumption that the model is correctly specified, adding new explanatory variables will add little or no explanatory power to the model and, therefore, one tests that these variables are "insignificant." Tests of the proportional hazards assumption also follow that scheme.

Grambsch and Therneau (1994) use a specific method for checking the proportional hazards assumption. This method is based on analysis of residuals where the idea is to retrieve the residuals, fit a smooth function of time to them and then test whether there is a relationship and that the log hazard function is constant over time. Thus rejection of the null hypothesis indicates a deviation from the proportional hazards assumption.[53] The validity of the proportional hazards assumptions for the overall goodness-of-fit of the estimated models can be judged using the test by Grambsch and Therneau (1994) based on adjusted Shoenfeld residuals (1982).[54] The test shows that we chose a good specification for the estimation.

2.7. Results

Our analysis investigates whether a specific explanatory variable increases or decreases the hazard of mortality of children and to what extent. The estimated models include a large number of explanatory variables that can be categorized as follows:

- Household characteristics (rural or urban residence and household wealth)

[53] Stata stphtest command is based on the generalization by Grambsch and Therneau (1994). This test assumes homogeneity of variance across risk sets.
[54] See Global Test in STATA for results please contact the author.

- Household composition (number of eligible[55] women in the household, sex and age of head of the household)
- Mother characteristics (index of nutritional status, education level, exposure to media, access to labor force, freedom of movement)
- Maternal child care (number of antenatal visits and tetanus vaccination during pregnancy)
- Husband characteristics (education level and labor force participation)
- Children and childbirth characteristics (existence of twin, older brother or sister, birth interval with the previous sibling and sex of the child)[56]

All models were tested and passed the proportional hazards and omitted variables tests. Table 2.3 shows the results of the two Cox-proportional hazard models reporting the hazard ratio, standard error and p-value. This section reports the estimates of the econometric hazard model for child mortality, presenting the results by categories of explanatory variables.

In our estimation wealth and income effects on girls' and boys' mortality in India are big; not only for poor households but also for middle class households that still face a hazard rate 29% higher than the remaining population. Poor families with few resources cannot afford to provide proper food and clothes, health coverage and education to either their girls or to their boys[57]. On the other hand, households with more resources could make deliberate decisions on how to allocate those resources (Murthi, Guio and Dreze 1995).

The increasing number of household members and the existence of a female head of household decrease the hazard rate of dying. Nonetheless, an increasing number of eligible women in the household seems to increase the hazard rate drastically.

Parental characteristics

Mother's characteristics play a very significant role in explaining child mortality in India. A larger body mass index and the independence of the mother (expressed by the freedom of going to the market) appear to have an impact on the survival probability.

[55] Eligible women refer to female aged 15-49 who slept in the house the night previous the interview.
[56] In all regressions we control for state variation, adding to the model state dummies.
[57] Differently from Oster 2009, we find a monotonic relationship betwee health and gender bias in mortality.

There is some evidence in the literature that higher status of women relative to men may contribute to an equitable allocation of resources. Maternal education is considered by the majority of the authors working on demographic transition to be the driving variable for changes. Literacy of women, marriage patterns, female labor force participation and fertility are all related to one another and to female autonomy. The more literate a woman, the higher the age at marriage and, in general, the lower the required dowry and associated marriage costs. Most of these variables have reciprocal relationships with female autonomy, and this female autonomy is likely to reflect the higher worth of females in society with consequent results for female survival (Kishor, 1995).

In our model we notice that mothers' education does not have a significant impact on child survival.

Murthi et al. (1995) interestingly find empirical evidence that female literacy, education and labor force participation not only increased women's empowerment but also reduced gender bias in mortality in India. They conclude their analysis by highlighting that education is the most powerful influence and the engine of immediate change in child mortality among social factors. This observation could be fundamental for Indian policy initiatives aimed at reducing gender differentials in child mortality. In our work, however, once we introduce an interaction variable between education and gender we find no significant evidence on girls' survival.[58] Our model does indicate that having an illiterate father increases child hazard by 34%.

Concerning maternal health care and children's characteristics, our model shows that mothers who took prenatal tetanus vaccinations have much lower child mortality rates. Other variables of mothers' health were excluded from the model because of data availability.

Children's characteristics

Birth interval is another variable that the literature has used extensively to explain higher rates of mortality within households. We find that longer intervals between births increases survival chances of children. In contrast, being a girl, having a twin brother or having sisters has a large negative impact on the survival chances of the child.[59]

Our model shows drastic discrimination against girls. Their hazard rate is over 13% higher than boys. Particularly we find that girls' survival chances are lower if they have an

[58] If interested in these results contact the author at flamanna@worldbank.org.
[59] Only less than 1.5% of our sample has a twin brother or sister.

older sister (see interaction variable in column 4); in fact, girls with older sisters are 23% more likely to die before reaching age five.[60]

Variations across states

In order to capture state differentials in child mortality, we introduced state dummies in our model. Results reflect the relative advantage of children living in one state over another, suggesting that in some states health access, hygienic habits and nutrition levels are negatively affecting child mortality. The extreme cases are Meghalaya, Haryana, Madhya Pradesh and Uttar Pradesh[61] where mortality chances are seven to eight times higher than in Kerala.[62]

2.8. Conclusion

The childhood mortality data shows a declining trend in India. Previous demographic and economic research investigating child mortality and gender differentials in child mortality used small sample sets confined to some districts or regions of India. This paper is a first attempt to use a rich microdataset on mortality outcomes of children that covers the entire country.

In this paper using a Cox proportional hazard model, we investigate the determinants of under-five girls and boys' mortality rates in India. The results indicate that children born in households that are poorer, with a large number of eligible women, where the birth intervals are low, with little maternal autonomy and low access to prenatal services are at higher risk of death during their first five years of life than other children.

Above all, being born female bestows a major social disadvantage for childhood mortality. Having an older sister exacerbates this difference in mortality rates. To witness not only major reductions in under-five mortality rates but also an improvement in gender bias in mortality in India in the near future, the country requires major policy thrusts in the areas of female empowerment and female socio-economic independence.

[60] Those numbers refers to the linear combination of sex and having an older sister in the empirical estimations processed in STATA, where the combination is highly significant.
[61] Those differences are significantly big and an interesting follow up paper could consider to further investigate state and regional variance in child and especially in girls mortality.
[62] Kerala is the omitted state in our model since it is considered to be the most developed state with respect to all socio-economic indicators. If interested in having the coefficients of the state dummies, contact the author.

State variations appear to be a very important point of consideration when investigating child mortality in India. States like Uttar Pradesh experience much higher mortality rates than Kerala, specifically higher girls' mortality rates.

Beside intervention programs focused on high-risk groups, other policies may be effective in increasing child survival and in reducing the gender gap in mortality in India. Gender differentials seem to respond favourably to changes in the status of women relative to men. Special attention should be given to specific states that appear to experience excessive child and, in particular, girls' mortality rates.

Issues for further investigation and policy options

In South Asia, evidence of discrimination in feeding practices and nutrient allocation within the family certainly exists. Nutrient allocation is certainly problematic under conditions of scarcity, but no consistent allocative pattern emerges, even within the large class of the poor in times of scarcity. Instead, the gender impact of discrimination, its social incidence and severity all vary regionally through the subcontinent. Further investigation of the reasons for the apparent great diversity of allocative practices is necessary.

What seems to vary in India is the modus operandi of the patriarchy among classes, household composition, education level and different regions. The problem with gender bias in mortality is not only biological. It can be explained by gender differences in access or entitlement to health care, as well as by access or entitlement to nutrients. It is a social relationship affected by material carier the content of which is undergoing change. There is the need, therefore, to have gender specific plans to improve the chances for survival of girls. These plans should include nutritional education aimed at mothers with advocacy for gender neutral or positively discriminating nutritional therapy; an increase in the economic status of women; improvements in women's education and an increase in the aggregate household food supply through the public administration system.

State intervention should also play an important role in India to reduce child mortality and to close the existing gap between sons' and daughters' mortality. If for instance, the state had to provide free access to healthcare and nutrition, the need to ration scarce resources would lessen; in the framework of our model, this intervention should lead to an increase in child survival rate. On the other hand, if the aim of policy makers is to intervene in the existing gender gap in mortality, activist state policy should be designed

and implemented in female education and employment. Further investigation is needed in this direction.

Chapter 3. Gender inequality in Health Care Utilization in India between 1986 and 1996: Is there any Progress?[63]

Abstract

In the paper we show that the health care utilization of girls had shown significant improvements between 1986 and 1996 using the 42nd and 52nd Indian National Sample Surveys. The probability of girls getting medical help during illness and the amount of health care expenditure devoted to girls both in absolute terms and in relation to boys during the time under consideration improved drastically. These results indicate that the increase in return on investment for girls in the past decades lead to a different household behaviour with respect to health care utilization in India. The paper also shows that there is a large variance in the improvement in health care utilization for girls across the country, with some States showing little improvement and some other, particularly in the south drastic improvements. Those findings urge policy makers to focus on strategies that will increase homogeneously across India the return on investment for women.

3.1. Introduction

Studies from demographers, physicians, epidemiologists, and other disciplines have shown that women have inherent biological and behavioural advantages of living longer than men at all age levels in the same socio-economic environment (Hart, 1988; UNDP, 1995; Waldron, 1995; WHO, 1998; Gjonca et al., 1999; Kalben, 2002). This fact is known since 1750 when mortality rates were computed from the first Swedish national census (Kalben, 2002). It has also become clear that an improvement in social, cultural, and economic conditions enhances this biological advantage of women (WHO, 1998). Results from developed countries also show that women have lower mortality rates than men at all age levels. Gjonca et al (1999:1-2) show that 'infant and childhood mortality is

[63] This chapter is co-authored with PhD Abay Asfaw, Ministry of Agriculture, United States and Professor Stephan Klasen, University of Goettingen, Germany.

higher for boys than for girls, and these higher death rates for males continue throughout their entire life span'.

However, this biological advantage of women could not be realised in South Asian countries. Various researchers, using different demographic techniques, have shown that the sex ratio ((total male population/total female population) × 100) in India is one of the highest in the world. For instance, the sex ratio at the beginning of the twentieth century was 103 and it increased to 107 in 1981, while the ratio was decreasing elsewhere (Sen, 1988). It is generally hypothesised that this higher than demographically normal sex ratio in South Asian countries including India reflects social, cultural, familial, behavioural, and other discriminatory behaviour of households, communities, and sometimes governments against girls and women. It also exposes the discriminatory practices of the society against women in these parts of the world (Sen, 1989). Das Gupta & Mari Bhat (1997) studied the relationship between fertility decline and gender bias in child mortality, showing the increasing evidence for the spread of sex-selective abortion, especially among women with lower fertility.

Between 1986 and 1996, the sex ratio for children under 10 has shown a significant improvement in India[64]. It declined from 110 in 1986 to 108 in 1996. This pattern is observed almost in all different age categories of children (0-1, 2-4, and 5-9 years). The sex ratio has declined from 117 to 107 and from 109 to 105 in the age groups 0-1 and 1-4 years, respectively, during the time under consideration.

Various factors may explain the sex ratio decline in the country. Large progress was made in increasing education and employment opportunities for women in India in that decade. The return on investment for girls increased largely and this is automatically reflected in a different behavior of household towards girls and therefore in a decline in sex ratio.

In this study, we show that the increased return on investment for girls can lead to a significant reduction in health care utilization disparities between boys and girls and to a decline in sex ratio. To verify our argument, we examine if there was a reduction in health care utilization disparities between girls and boys during the time under consideration.

[64]Analysis based on the 42nd and 52nd Indian National Sample Survey (NSS). Using the census data results are different (Klasen and Wink, 2002 and 2003).

3.2. Methods

Various methods can be used to examine the pattern of gender inequalities in health care demand behavior of households and consequently on the utilization of health care services between boys and girls. In this study, we use two different methods to examine such trends between 1986 and 1996. First, we use the need-standardized method developed by Wagstaff, et al. (1991), and Wagstaff & Doorslaer (2000) to examine whether boys and girls are treated equally in getting medical care given illness. This method helps us to examine how children get equal treatment for equal medical 'need', regardless of their sex, location, income of their parents, etc., in 1986 compared to that of 1996. One major problem in such analysis is finding a good proxy to measure 'need'. In the literature demographic and morbidity variables are used as indicator of need (Wagstaff & Doorslaer, 2000). In this study, we use age and severity of illness as a proxy for need. Since we are measuring gender inequity in health care utilization of children given illness, these variables are expected to be a good proxy for need.

We use indirect standardization method using linear and non-linear regression models to examine the distribution of health service utilization in the absence of differences in need factors between girls and boys (O'Donnel, et al. 2008). For linear specifications, the following model can be used.

$$y_i = \alpha + \sum_j \beta_j x_{ji} + \sum_k \gamma_k z_{ki} + \varepsilon_i \qquad (3.1)$$

where y_i is the health service utilization indicator of child i, x_{ji} is need indicator j of child i, and z_{ki} is non-need indicator k of child i and ε_i is a random error term with zero mean and constant variance.

Then, the predicted or 'x-expected' ($\hat{y}^x{}_i$)values of utilization of y_i can be computed using the OLS coefficients of α, β and γ, the actual values of need variables, and the sample mean values of control (or non-need) variables as follows.

$$\hat{y}^x{}_i = \hat{\alpha} + \sum_j \hat{\beta}_j x_{ji} + \sum_k \hat{\gamma}_k \bar{z}_k \qquad (3.2)$$

Then, the indirectly standardized utilization of health services can be computed as a difference between observed and expected utilization, plus the sample mean.

$$\hat{y}_i^{IS} = \bar{y} + y_i - \hat{y}_i^x \qquad (3.3)$$

The difference between need-expected ('x-expected') and the actual health utilization variable y between boys and girls measures the level of gender discrimination in the utilization of health care service y.

The indirectly standardized health utilization variable can be used to compute concentration indices (CI) which measures horizontal inequality. In the case of non-linear models, marginal effects should be used to approximate need-expected values (see World Bank Technical Note #13 for the details so as in O'Donnel, et al. 2008).

Second, we use bivariate and multivariate models to examine the effect of sex on probability of seeking medical care given illness between 1986 and 1996. It is hypothesized that the impact of sex on the various health care utilization indicators declines through time.

3.3. Sources of Data and Measurement of Variables

The data sources for this study are the Indian National Sample Surveys (NSS). The Indian NSS data are nationally representative data sets and collect information on socio-economic conditions of the population as well as on the economic and operational features of informal enterprises and establishments in the country (Saha, 2002). Since its inception in 1950, 56 country-wide NSSs focusing on different issues were collected. For this study we use the 42nd (July 1986 to June 1987) and 52nd (July 1995 to June 1996) round surveys since they are exclusively devoted to health and related issues. The data sets contain extensive information on expenditure, pregnancies, mortality, ailments, immunization and other health care variables for children of age 0-4 years, maternity care and family planning services, utilisation of medical services, etc. for both rural and urban households. The 42nd round covered 32,909 rural households in 48 sampled villages and 18,077 urban households in 104 sampled blocks in all states and union territories. In the 52nd round, 71,269 rural and 49,654 urban households were surveyed. In this study, a total of 267493 (80745 from the 42nd and 186750 from the 52nd rounds) children younger than ten were considered.

Both the 42nd and 52nd rounds collected information on spells of ailments of household members during last 15 days, medial and non-medical expenses incurred for treatment, and sources of finance for treatment. The surveys also collected information on the incidence of hospitalization (inpatient care) during the last 365 days and on medical and non-medical expenses for each hospitalized patient. In this study, health care utilization is measured by visit to medical care given ailments during the last 15 days before the survey and by the amount of non-medical cost incurred for outpatient treatments given outpatient medical help and by non-medical inpatient expenditures given

hospitalization. Since the physicians usually decide the type of medical tests to be carried out, the drugs to be used, the number of days to be hospitalized, etc., direct medical expenditures were not considered in the analysis. Appendix 1 presents the descriptive statistics of the variables used in the analysis.

3.4. Patterns of Gender inequality in Health Care Utilization

As it is the case in most developing countries, illness may not necessarily lead to demand for medical care in India owing to various reasons. First, some households who reported illness of children might not think that they need medical help. Second, even those households who perceived health problem of their children and the need for medical help might not be able to translate this need into effective demand. As a result, there can be variation between perceived illness and actual demand for health care. This discrepancy can have different effect on the probability of getting medical help between boys and girls if parents have special sex preference.

Both the 42nd (conducted in 1986) and 52nd (conducted in 1996) Indian NSSs collected information on whether each household member suffered from any ailment during last 15 days preceding the day of survey, and whether the ailment was treated or not. In 1986, out of 12,717 children who were sick, 85 percent got medical help. There was statistically significant difference in seeking medical help given illness between boys and girls. Only 83 percent of girls got medial attention given illness compared to 86 percent of boys and this difference was statistically significant (Chi2 = 23.64 and significant at 0.00 level). This difference holds for all age categories as shown in Table 3.1.

After a decade, the proportion of children treated for sickness reported during the last 15 days before the survey increased by 1 percentage point to 86.21 percent. More interestingly, while the percentage of boys treated did not show significant change between 1986 and 1996, the percentage of girls treated increased by 2 percentage points from 83.24 to 85.25 percent. As Table 3.1 shows, this change was observed in almost all age categories, particularly in the infant age category.

Table 3.1 Percentage of children treated for sickness reported during the last 15 days before the survey

Age category	1986			1996		
	Boys (%)	Girls (%)	Pearson Chi^2 (pr.)	Boys (%)	Girls (%)	Pearson Chi^2 (pr.)
0-1 years	89.8	86.7	7.27(0.01)	90.67	88.28	4.90(0.03)
2-4 years	86.01	82.75	9.1(0.00)	86.65	84.22	3.39(0.07)
5-9 years	84.37	81.64	6.59(0.01)	83.45	83.22	0.02(0.86)
Total	86.35	83.24	23.64(0.00)	86.98	85.25	5.82(0.02)

Source: Computed form the 42nd and 52nd Indian National Sample Survey

Health expenses given illness

While expenses incurred for treatment of ailments such as purchase of medicines, diagnostic tests, consultation fees, etc., may not significantly vary by gender (since they usually depend on the decision of medical practitioners), expenses on other non-medical health expenses such as transport other than ambulance, lodging charges of escort(s), attendant charges, personal medical appliances, etc., can significantly vary by gender. In other words, the decision to buy non-medical services can be influenced by parental gender preferences.

Out-patient non-medical health expenses

Table 3.2 presents expenses related to non-medical health costs incurred for treatment of ailments (out-patient) by sex, age group, and year. In 1986, parents spent 28.7 percent more money for non-medical health expenditure of boys than for girls and this difference was statistically significant (F-test 11.77 and significant at 0.00 levels). As table 2 shows, this gender biased non-medical health expenditure was much higher in the infant age category (0-1) than in the other two age groups. Parents' non-medical spending for infant boys was 43.4 percent higher than for infant girls.

After ten years, this discrepancy has declined significantly and the amount of non-medical out-patient health investment on boys was only 21 percent higher than that of on girls. This improvement was highly profound in the infant age group. Parents spent only 7 percent more for infant boys than for infant girls in 1996 and the difference was no longer statistically significant as shown in Table 3.2.

Table 3.2 Non-medical out-patient health expenses (in Rupees.) for boys and girls

Age category	1986			1996		
	Boys	Girls	ANOVA F-test (pr.)	Boys	Girls	ANOVA F-test (pr.)
0-1 years	68.56	47.81	12.20 (0.00)	43.55	35.77	0.41 (0.52
2-4 years	70.32	56.3	2.38 (0.12)	36.86	34.18	6.86 (0.00)
5-9 years	71.51	57.47	3.61 (0.05)	43.34	30.16	1.10 (0.29)
Total	70.29	54.63	11.77 (0.00)	52.33	42.58	0.63 (0.42)

Source: Computed form the 42nd and 52nd Indian National Sample Survey

In-patient non-medical health expenses

Significant improvement was also observed in the amount of non-medical in-patient health expenses between 1986 and 1996 (see Table 3.3). Parents spent nearly 30 percent more on non-medial expenses for hospitalized boys than for hospitalized girls in 1986. This discrepancy, however, declined to 24.8 percent in 1996. Significant decline was observed again in the infant age groups as the table shows. While parents' non-medical in-patient expenditure on infant boys was 102 percent higher than on infant girls in 1986, it declined to 22.8 percent in 1996.

Table 3.3 Non-medical in-patient health expenses (in Rs.) for boys and girls

Age category	1986			1996		
	Boys	Girls	ANOVA F-test (pr.)	Boys	Girls	ANOVA F-test (pr.)
0-1 years	155.61	77.75	5.76 (0.00)	210.03	171.00	1.07 (0.30)
2-4 years	145.79	91.43	3.38 (0.00)	307.35	206.24	3.30 (0.06)
5-9 years	256.22	241.27	0.01 (0.90)	293.04	252.63	0.92 (0.33)
Total	191.80	147.83	0.72 (0.30)	273.89	219.52	4.12 (0.04)

Source: Computed form the 42nd and 52nd Indian National Sample Survey

Patterns across states

Significant variation was observed in the proportion of girls who got medical help given illness compared to boys across states. The first two columns of Table 3.4 present the ratio of the percentage of boys (compared to girls) treated for sickness reported during the last 15 days before each survey by state. The third column gives the percentage change. Negative values indicate an improvement in the proportion of girls treated compared to boys during the time under consideration. States such as Orissa, Assam, Madhya Pradesh, Uttar Pradesh, Jammu Kashmir, Tamil Nadu, and Maharashtra have

shown significant improvement in the proportion of girls treated compared to boys between 1986 and 1996.

Table 3.4 Patterns of access to health care and sex ratio in 1986 & 1996 by state

State	Ratio of percentage of boys treated compared to girls			Child sex ratio (number of boys/number of girls)*100		
	1986	1996	% change: (1996-1986)/ 1986	1986	1996	% change: (1996-1986)/ 1986
Rajasthan	1.00	1.03	2.30	125	112	-10.40
Orissa	1.00	0.86	-14.00	111	100	-9.91
Kerala	1.00	1.00	0.00	111	102	-8.11
Gujarat	0.99	1.06	7.07	116	107	-7.76
Assam	1.07	0.97	-9.35	127	119	-6.30
Maharashtra	1.05	1.02	-2.86	108	103	-4.63
Madhya Pradesh	1.11	1.03	-7.21	109	106	-2.75
Tamil Nadu	1.03	1	-2.91	107	105	-1.87
Karnataka	0.97	0.98	1.03	103	102	-0.97
Jammu Kashmir	1.01	0.97	-3.96	108	107	-0.93
Uttar Pradesh	1.06	1.01	-4.72	112	111	-0.89
West Bengal	1.01	1.01	0.00	105	105	0.00
Himachal Pradesh	0.97	1.03	6.19	106	106	0.00
Haryana	0.99	0.99	0.00	109	110	0.92
Tripura	0.99	1.22	23.23	106	112	5.66
Punjab	1.03	1.04	0.97	112	124	10.71

Source: Computed form the 42nd and 52nd Indian National Sample Survey

As shown in the last three columns of the table, these states have also achieved significant reduction in their child sex ratio during the time under consideration. States such as Kerala, Rajasthan, etc., who have achieved equal access of health care to both boys and girls have significant improvement in child sex ratio. Interestingly, states with high gender discrimination in getting medical help or states who did not achieve significant improvements in the proportion of girls treated compared to boys such as Punjab, Himachal Pradesh, Haryana, and Tripura did not show a reduction in the child sex ratio during the time under consideration.

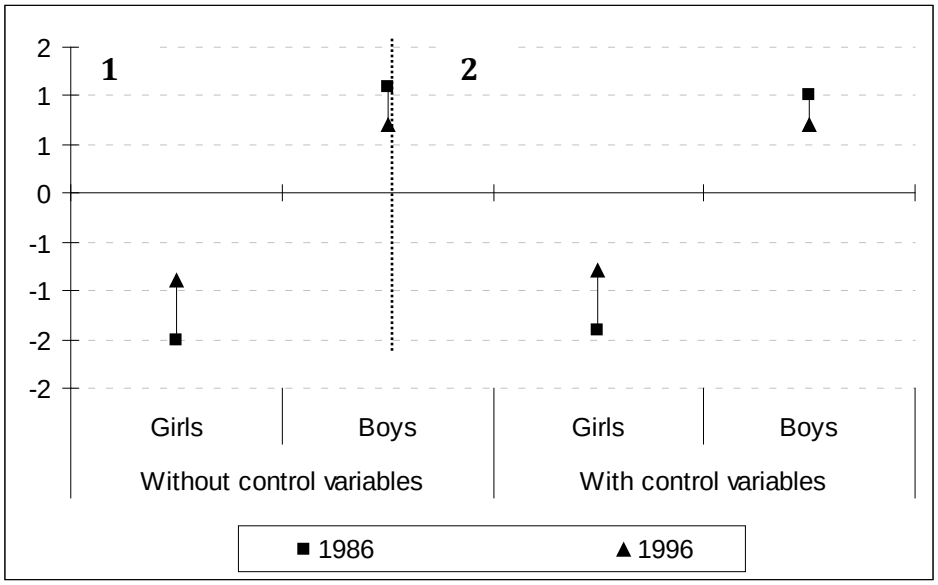
3.5. Econometric Analysis

We use equations (1) and (2) to estimate need-based health care utilization by boys and girls including probability of getting medical help given illness, the amount of non-medical money spent for outpatient care given visit, and the amount of non-medical money spent for inpatient care given hospitalization in both rounds (for the need-based methodology see O'Donnel, et al. 2008). Age categories (0-1, 2-4, and 5-9) and severity of illness measured by the number of days ill before getting medical treatment (in outpatient case) and number of days hospitalized (in in-patient case) were used as need indicator variables. We use three indicators: the probability of getting medical help given illness, the amount of non-medical health expenditure for out-patient visit, and the amount of non-medial expenditure for in-patient visit. The whole results are presented in Appendix 2.

First, let us start with the probability of getting medical help given illness. For the sake of clarity, results relating to actual and need based probability of getting medical help given illness are presented in Figure 3.1 separately for boys and girls and for 1986 and 1996. As the first panel of Figure 3.1 shows, on the average, the probability of girls to get medical care given illness was 1.5 percent less than would be expected based on their need in 1986 (the square point). On the other hand, the probability of boys to get medical help given illness was 1.1 percent higher than their expected need in the same year. Interestingly, significant improvements were observed in the probability of girls to get medical help in 1996 both in absolute and in relative terms.

After a decade, the difference between actual visit and need-predicted probability of getting medial care declined (in absolute terms) from 1.5 percent to 0.9 percent (the triangle point). At the same time, the probability of boys to visit medial service providers more than their expected need shrank from 1.1 percent to 0.7 percent. This implies that the difference between the actual visit and need-predicted probability declined by 40% for girls. During the same period, the excess (in comparison to their need) probability of boys to get medical care shrunk by 36 percent. This shows that during the time under consideration, the probability of girls to get medical care had improved both in absolute terms and in comparison to that of boys.

Figure 3.1 Difference between actual and need based probability of getting medical help for girls and boys



Notes:

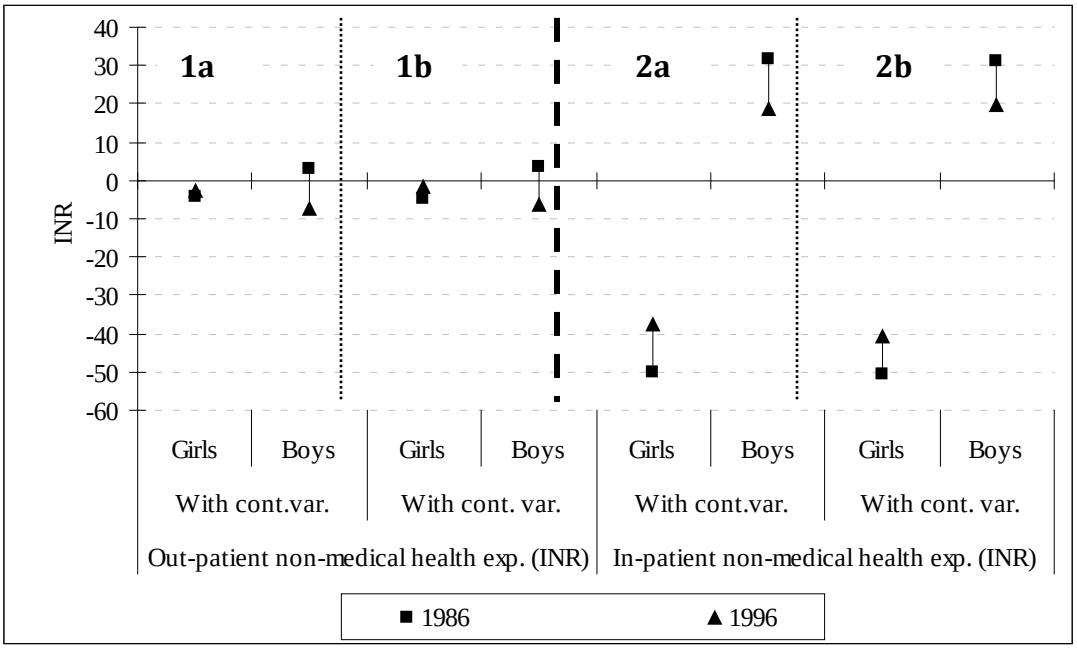
1. ■ & ▲ measure the difference between actual and need based probability of getting medical help (given illness) in 1986 and 1996, respectively. If children get medical attention based on their need, the difference should be zero. A movement towards the origin for both girls and boys shows a decline in the gender gap.

Source: Computed form the 42nd and 52nd Indian National Sample Survey

For robustness check, the need-predicted values were recomputed using control variables. Per capita expenditure, location (urban/rural), social class, and family size were used as control variables. The detailed results are presented in Appendix 2 and the summary is shown in the second panel of Figure 3.1. The results show that even after controlling various factors, the difference between actual visit and need predicted visits of girls declined significantly both in absolute and in relative terms (compared to boys).

Second, we examine the amount of money spent on non-medical health expenditure for out-patient and in-patient visits (Figure 3.2). In 1986, the amount of out-patient expenditure for girls was INR 4.37 less than would be expected on average given their need and INR 3.25 higher for boys (panel 1a of Figure 3.2). The difference is very striking in the case of non-medical expenses for hospitalization (panel 2a). While there was no statistically significant difference in the number of days hospitalized between boys and girls, parents spent INR 31.43 more on boys than their expected need and INR 50.32 less for girls than would be expected based on their need.

Figure 3.2 The difference between actual and need based out-and in-patient health expenditure for girls and boys



Note: The value of out-patient expenditure is divided by 10 for scaling purpose.

Again significant improvements were observed in these indicators in 1996. After a decade, the difference between actual and need predicted out-patient health expenditure for girls declined (in absolute terms) by almost half from IRN 4.37 to IRN 2.81. At the same time the same figure for boys declined from IRN 3.25 to IRN-7.6. Similar pattern is observed in the case of non-medical in-patient health expenditure (panel 2a). The difference between actual and need predicted non-medical in-patient health expenditure for girls declined (in absolute terms) from IRN -50.32 in 1986 to IRN 37.74 in 1996. This is a 26 percent improvement. In the case of boys, the amount of excess (based on their need) non-medical in-patent health expenditure declined from IRN 31.43 to IRN 18.43. Again for robustness check, the figures were estimated using control variables. The results presented in panels 1b and 2b of Figure 2 show similar patterns. These results clearly indicate that the health care demand behavior of households towards girls has improved significantly between 1986 and 1996.

A probit model was also estimated to examine the impact of sex variable on the probability of getting treatment given illness in 1986 and 1996. The results are presented in Table 3.5. The first column shows the bivariate relationship between getting medical care given illness and gender. The results indicate that boys were 3.1 percent more likely to get medical help given illness than girls in 1986. After a decade, though boys were still

more likely to get medical care given illness, the marginal effect declined by 1.4 percentage point. In 1996, the probability of boys to get medical care given illness was only 1.7 percent higher than girls.

Table 3.5 Getting medical care given illness (Marginal coefficients of a probit model)

Variable	1986	1996	1986	1996
Sex (1 of boy & 0 otherwise)	0.031*** (0.006)	0.017** (0.007)	0.021*** (0.005)	0.015** (0.007)
Age 0-1 years			Reference	Reference
Age 2-4 years			-0.037*** (0.008)	-0.041*** (0.009)
Age 5-9 years			-0.049*** (0.007)	-0.062*** (0.009)
Severity of illness			0.169*** (0.004)	0.041*** (0.008)
Family size			0.004*** (0.001)	0.009*** (0.001)
Ln per capita exp			0.050*** (0.006)	0.092*** (0.009)
Urban			0.052*** (0.005)	0.065*** (0.007)
Scheduled tribe or caste			-0.062*** (0.007)	-0.020*** (0.008)
No of observation	12716	9346	12682	9319
Wald chi2(1) and (8)	23.53	5.81	704.57	404.62
Prob > chi2	0.000	0.016	0.000	0.000
Log pseudo likelihood	-5366.19	-3746.43	-4726.846	-3518.089
Pseudo R2	0.002	0.001	0.118	0.060

Note: Figures in brackets are robust standard errors.

Source: Computed form the 42nd and 52nd Indian National Sample Survey

To take into account the impact of other factors on the probability of getting medical care, a multivariate model was run and the results are presented in the last two columns of Table 3.5. Almost all the need (age group and severity) and control factors took the expected signs and were statistically significant. Ceteris paribus, the marginal impact of sex on the probability of getting medical care given illness has declined by 0.6 percentage point. Keeping all other factors at their mean value, the probability of boys to get medical help given illness has declined from 2.1 percent in 1986 to 1.5 percent in 1996. The significance level of the sex variables has also declined from 0.1 in 1986 to 0.5 in 1996.

3.6. Conclusion

In this study, we show that the increased return on investment on women in India in the past decades is reflected in the decline in health care utilization disparities between girls and boys.

In the decade from 1986 to 1996, there has been a drastic increase in the percentage of children treated for various sicknesses in India. Though the percentage of boys treated when ill remained higher than that of girls in 1996 (86.98 % versus 85.25 %), we show that for all age-groups there was an increase in the percentage of girls treated when sick. Significant improvements were also observed in the amount of money invested on the non-medical out- and in- patient medical services.

Interesting patterns were also observed across states. Significant improvement was also seen in the percentage of girls who got medical help compared to boys particularly in Orissa, Assam, Madhya Pradesh, Uttar Pradesh, and the like. These states are considered the states in which women made larger advances in terms of economic and employment opportunities.

The econometric results also revealed significant improvements in the health care demand behavior of households towards girls. The difference between actual visit and the need-predicted probability of getting medical help for girls has declined from 1.5 percent in 1986 to 0.9 percent 1996. At the same time, the probability of boys to visit medial service providers more than their expected need declined from 1.1 percent to 0.7 percent during the time under consideration. Similar improvements were also observed in all indicators especially in the amount of money parents spent on non-medical expenses for hospitalized girls. The bivariate and multivariate regression results also showed that the marginal impact of sex on the probability of getting medical help given illness declined from 3.1 to 1.7 percent and from 2.1 to 1.5 percent between 1986 and 1996, respectively.

These promising results have important policy implications and needs to be addressed in a timely manner. Evidence of gender inequality in heath care utilization is still wide spread in India and only a sharp and homogenous increase in the return on investment for girls across the country will produce the expected results in the next decades.

Appendix Chapter 3

Table 3.6 Descriptive Statistics of the Variables Used in the Analysis

Variable (for children under ten years old)	Mean	
	1986	1996
Total children under ten	80,759	163,585
Age group 0-1 (%)	17.38	22.85
Age group 2-4 (%)	31.35	27.52
Age group 5-9 (%)	51.27	49.63
Percentage treated given ailments	84.99	86.21
Number of days sick in the last 15 days	0.20	0.22
Number of days hospitalized (given hospitalized)	9.93	9.18
Non-medical health expenses for outpatient care (INR)	28.21	40.20
Non-medical health expenses for inpatient care (INR)	256.44	206.25
Family size	8.27	6.53
Percentage of scheduled tribe/caste	25.72	33.37
Per capita monthly expenditure (INR)	11983.56	35892.61

Table 3.7 Distribution of children's actual and need-predicted utilization of health care services by sex and year

Year		Probability of getting medical care given illness		Out-patient non-medical health expenses (INR)		In-patient non-medical health expenses (INR)	
	Without control variables						
		Girls	Boys	Girls	Boys	Girls	Boys
1986	Actual	0.832	0.863	23.48	31.74	203.04	289.81
	Needed predicted	0.847	0.852	27.85	28.49	253.36	258.38
	Difference (actual -predicted)	-0.015	0.011	-4.37	3.25	-50.32	31.43
1996	Actual	0.852	0.87	35.77	31.47	172.39	225.88
	Needed predicted	0.861	0.863	38.58	39.07	210.13	207.45
	Difference (actual - predicted)	-0.009	0.007	-2.81	-7.6	-37.74	18.43
	With control variables						
1986	Actual	0.832	0.863	23.48	31.74	203.04	289.81
	Needed predicted	0.846	0.853	28.27	28.24	253.42	258.44
	Difference (actual -predicted)	-0.014	0.01	-4.79	3.5	-50.38	31.37
1996	Actual	0.852	0.87	35.77	31.47	172.39	225.88
	Needed predicted	0.861	0.863	37.21	38.07	212.87	206.06
	Difference (actual - predicted)	-0.009	0.007	-1.44	-6.6	-40.48	19.82

Source: Computed form the 42nd and 52nd Indian National Sample Survey

Chapter 4. Intra-household Gender Disparities in Children's Medical Care before Death in India[65]

Abstract

The existence of excess female mortality in India and other South Asian countries is no longer contentious. The less known issue is the reasons for such excess female mortality in the country. In this study, we argue that intra-household gender-discrimination in receipt of medical attention can be one of the most important factors for the unbalanced sex ratio in the country. The 52nd Indian National Sample Survey, which collected for the first time detailed verbal autopsies information was used. Place of death, which indicates whether a person got medical help immediately before her/his death, was used as a health indicator variable. The multinomial logit results showed that keeping all other factors constant, girls were 1.7 percent less likely to die in hospital than their brothers. The coefficients of different interaction variables also revealed that the probability *of infant and very young girls with live female siblings to die in hospital was extremely low. The robustness of the regressions results was also checked using different indicators. The results confirmed that girls were highly discriminated against in being hospitalized and in the number of times being hospitalized before their death compared to boys. Therefore, in addition to the current effort of the government to control female feticide, effort should be put in reducing the current intra-household gender-disparities in getting medical care at least for life threatening illnesses.*

4.1. Introduction

While the magnitude varies from one study to another (depending on the data and the standard sex ratio reference level used), the excess female mortality in India and other

[65] This chapter is co-authored with PhD Abay Asfaw, Ministry of Agriculture, United States and PhD Professor Stephan Klasen, University of Goettingen, Germany.

South Asian countries is no longer contentious (Sen, 1992; Coale, 1991; Klasen, 1994). It is also only in that part of the world that the life expectancy of women at birth is lower or equal to men, despite the biological advantage of women as a group to live longer than men (Hart, 1988; UNDP, 1995; Waldron, 1995; WHO, 1998; Gjonca et al., 1999; Kalben, 2002). Even for infants (aged less than one) the mortality of girls was 1.3 times higher than boys in India (Khanna et al., 2003). This fact seems paradoxical since these countries have relatively high economic performance, including high per capita income and growth, high medical personnel, and medical facilities population ratios, compared to countries in Sub-Sahara Africa. The non-responsiveness of this discrimination to the improvement in the economic status of households (Hill and Upchurch, 1995; Kurz and Johnson-Welch, 1997) also makes the issue of excess female mortality a serious concern in this region.

Factors related to social, cultural, familial, behavioural, and other discriminatory behaviour of households, communities, and sometimes governments against girls and women can be some of the reasons for the higher than expected female mortality in South Asian countries. Therefore, there is a crucial need to investigate factors and mechanisms that jeopardised the biological advantage of women to live longer than men and consequently produced millions of 'missing women' and an unbalanced sex ratio in this part of the world.

Several factors including sex-selected abortion, gender discrimination in nutrition especially among young children, discrimination in access to health care, labour markets, education, and other opportunities, and intra-household/ community discrimination against women/girls are hypothesized in the literature for this excess female mortality in the region. Gender discrimination in intra-household food distribution (nutrition) has long been identified as a major factor for excess female mortality in the region. However, several recent findings reveal that there is no significant evidence of gender discrimination in nutrition among children (Chaudhury, 1987; Das Gupta, 1987; Gopalan, 1987; Basu, 1989; 1993; Walker and Ryan, 1990; Kurz and Johnson-Welch, 1997; Hazarika, 2000 and Svedberg, 2006). Very recently, sex-selective abortion (Booth, et al., 1994; Khan et al., 1996; Sudha & Arnold, 1999; Arnold 2002) has received greater attention as one of the major factors for the unbalanced sex ratio in the region. In this study, we argue that intra-household discrimination in health care behaviour of households against girls can be one of the most important factors for the unbalanced sex-ratio in the region.

Various authors examined gender discrimination in the provision of health care services. Despite some researchers could not find statistically significant gender

differences in access to some types of health care services (Jatrana, 2003), there is evidence indicating gender discrimination in health care utilization in India, Bangladesh and Pakistan (Rajeshwari, 1991; Singh et al., 1962 ; Aziz, 1977 ; Chen et al., 1981; Miller 1981; Murthy, 1982 ; Das Gupta, 1987; Chaudhury, 1988; Wadley, 1993; Greenspan, 1994; Sood and Nagla, 1994; Rajeshwari, 1996; Kurz and Johnson-Welch, 1997; Gangadharan and Maitra, 2000).

This study provides fresh evidence on intra-household gender discrimination against girls (aged from 1 day to nine years) in getting medical attention before their death in India. Unlike most of the previous studies, which focused on small sample sizes and on illness symptoms, this study used a nationally representative data set and examined the existence and magnitude of gender discrimination in getting medical attention at the last critical time of life[66]. More specifically, the study examines whether girls were discriminated against in getting medical help before their death. We argue that although mortality differences between girls and boys can be the result of biological factors, disparity in getting medical attention between girls and boys before death reveals gender discrimination.

Out of several indicators that measure medical attention before death such as causes of death, whether medical attention was sought before death, number of times hospitalized, etc, we used place of death variable as a main indicator for various reasons. First, in contrast to developed countries where almost everybody gets medical attention before death and where to die is a matter of choice[67], place of death (in hospital, at home, at nursery, etc.) is a crucial indicator of whether deceased individuals got proper medical attention before their death in developing countries like India (Gupta and Sankar, 2002). Second, the one-year recall period used in the national sample survey (see next section) is less likely to affect the reliability of the place of death information compared to other health indicators.

[66] The only exception in this area was the work of Gupta and Sankar (20002). However, the main focus of the study was on various factors that affect lack of medical attention before death. As a result gender did not get enough attention and the interaction of gender with other variables was not examined. Moreover, the study took only one indicator (medical attention before death) in the analysis.

[67] See for instance, Westerling, 1996; Axelsson and Christensen, 1996; Polissar et al., 1987; Pritchard, et al., 1998; Costantini et al., 2000; Feudtner et al., 2002, Lock and Higginson, 2005.

The study also focuses on infants and children (aged from one day to nine years) for two reasons; first because the excess of female mortality is much larger among children than adult and second because the chance of children to get medical care totally depends on the decision of parents. This helps us to clearly see the level intra-household gender discrimination in seeking medical help. Focusing on children will also avoid biological differences and gender differential in exposure to risks and deaths (occupation, pregnancy, gender violence, death due to old age, etc.) that may potentially affect the chance of getting medial care and consequently the place of death. The imbalance in the proportion of deaths between girls and boys is also high for this age group in India (BMJ, 2003; Khanna, et al., 2003).

Out of several South Asian countries the study focuses in India for various reasons. First, the country has the highest share of missing women in the world (Klasen and Wink, 2002) and currently the problem has reached a critical point where it affects the sex balance (UNICEF, 1990; WHO, 1992; Pande, 2000). Second, while female mortality is lower in infancy and early neonatal period (WHO, 2000), it is higher for females than for males in India (WHO, 2000, BMJ, 2003). Third, as we shall explain soon, India has a data set that can be used to address the issue of gender discrimination in getting health care before death.

The remaining part of the paper is organized as follows. Section two presents the data source and measurement of variables and section three explains the methodology used in the study. Finally, section four and five present the results and conclusion of the study.

4.2. Source of data and Measurement of Variables

The Indian National Sample Survey (NSS) data were used in this study. Since 1950, the National Sample Survey Organization of India has been collecting major information on socio-economic conditions of the population as well as economic and operational features of informal enterprises and establishments (Saha, 2002). In this study the 52nd round NSS conducted between July 1995 and June 1996 were used. Two-stage stratified sampling procedure was adopted. At the first stage, 7,663 rural villages and 4,991 urban blocks were identified all over the country and at the second stage 71,284 rural and 49,658 urban households were surveyed.

The 52nd round collected information on utilization of health care services, morbidity, problems of aged persons, and participation in education. For the first time in

the long history of the NSS, the 52nd round also collected detailed information about deceased family members. Detailed verbal autopsies including name and sex; age at death; time elapsed since death; cause of death; place of death; medical attention before death; whether hospitalized during last 365 days; and number of times hospitalized was collected. The recall period was one year before the survey.

From Schedule 25.0 of the 52nd NSS, place of death (at home, in public hospital, in government hospital, during transport, at other places) was selected as a main indicator of getting medical attention before death. This variable is expected to measure the real concern of parents to save the lives of their children. Various factors that may influence the place of death of children such as age and sex of the child; location (urban/rural), income (approximated by monthly household expenditure), family size and composition, and social status (whether or not the household belongs to scheduled tribe or scheduled caste) of the household; and age, education, and sex of the household head, etc., were used as explanatory variables. The definition and descriptive statistics of the variables are presented in Table 4.1. Deceased children and infants aged from one day to nine years were considered.

Table 4.1 Descriptive statistics

Variable	Mean	SD
Age of the head	41.359	13.408
Male headed households (1 if the head is male & 0 otherwise)	0.943	0.232
Per capita expenditure (Rupee)	43041.95	28461.02
Location (1 = urban & 0 otherwise)	0.258	0.438
Social status (1 if scheduled caste/tribes & 0 otherwise)	0.335	0.472
Head's education (1 if completed primary & above & 0 otherwise)	0.359	0.480
Family size	5.869	3.128
Gender of the deceased child (1 if girl & 0 otherwise)	0.476	0.500
Age of the deceased child	1.442	2.249
No of female siblings younger than 15	0.949	1.138

Source: Authors computation based on 52nd NSS

4.3. Methodology

The probability of observing nominal outcomes such as places of death can be modelled using various nominal outcome models. In this study, a multinomial logit model

was used to examine the determinants of dying at different places. The survey provided information for five different locations in which individuals die: at home, during transport, in government hospitals, in private hospitals, and at other places. Then, the likelihood of a child to die in any of the above places, say place *j* can be presented as:

$$\Pr(y_i = j) = f(X_i, Z_i),\ j = 1,...,m \tag{4.1}$$

Where X_i is a vector of individual characteristics of dead child *i* such as sex, age at death, Z_i is a vector of household level variables of child *i* such as education, age, and sex of the household head, income, social status, location, and the like.

Based on a multinomial model, the probability of child *i* will die at place *j* is given by

$$\Pr(y_i = j) = \frac{\exp(\beta_j' X_i + \gamma_j' Z_i)}{\sum_{l=1}^{m} \exp(\beta_l' X_i + \gamma_l' Z_i)} \tag{4.2}$$

Where β and γ are vector of parameters to be estimated. Note that since information on outcomes' characteristic is not available, all the explanatory variables represent the characteristics of child *i* or her/his family and therefore vary over the outcomes. If there is any gender discrimination in the place of death, the coefficient of the sex variable should be statistically significant.

4.4. Results

Descriptive Analysis

Out of 3,506 individuals deceased during one year before the survey, 26 percent were children and infants aged from one day to nine years. From the total deceased children, infants (less than one year old) accounted for 68.35 percent followed by children aged between 1 and 4 (20.00 percent) and 5 and 9 (11.65 percent). Overall, 67.58 percent of children died at home, 26.15 died in hospital and 2.31 and 3.96 percent died during transport and other places, respectively. Various factors including accessibility of medical facilities, area of residence, income and education of parents might affect the place of death of children. Table 4.2 presents some descriptive statistics.

As expected, for all age groups rural children were more likely to die at home compared to urban children and the differences were statistically significant for young children (Person χ^2 test). For instance, while 41 percent of infants had a chance of dying in hospitals in urban areas, only half of them had this chance in rural areas.

Though not statistically significant (χ^2 test) at 5 percent level, 36.84 percent of children from the richest quintile died in hospital compared to 22.54 percent children from the poorest quintile. In general income did not have an important influence on the place of death of children. This was unexpected result since children from rich households were expected to die at hospitals more often than children from poor households.

The last column of the table to the left shows gender differences. Under normal circumstances, there should not be differences in the place of death for girls and boys. However, the table reveals that at all age groups girls were more likely to die at home than boys and the differences were statistically significant in the case of infants and 1-4 years old children. Boys were also more likely to die in hospital than girls at all age groups. Overall 33 percent of boys died in hospitals compared to only 19 percent of girls. The difference was much higher in the case of infants. While 35% of boys died in hospital only 17 percent of girls had this chance.

This pattern remained the same even after controlling the place of residence and income of households as shown in Figures 4.1 and 4.2. In both rural and urban areas girls were less likely to die in hospital than boys and the differences were very striking in the case of infants.

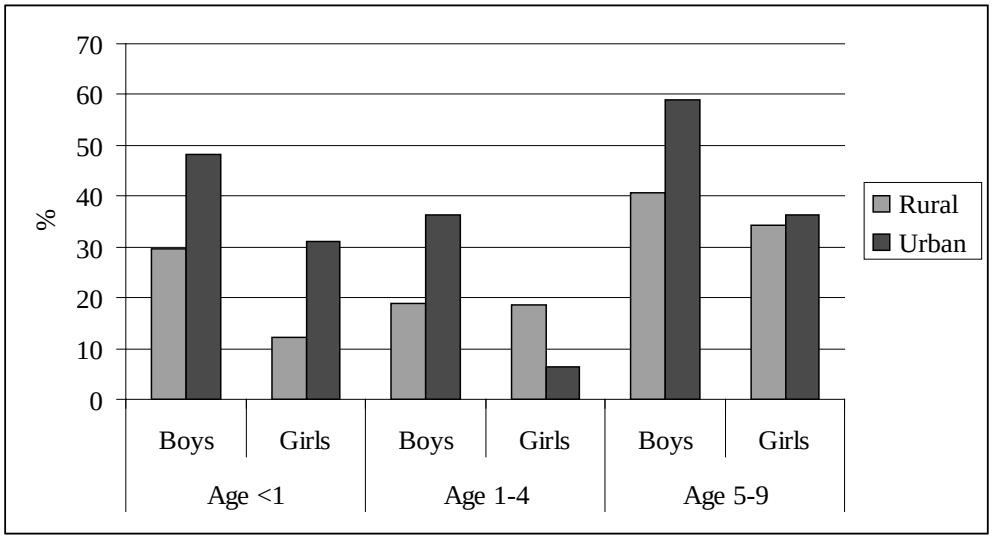
In urban areas 31 percent of infant girls died in hospital compared to 48 percent boys. In rural areas the discrimination was even worse. Despite 30 percent of infant boys died in hospital, only less than half of infant girls got this chance. Similar pattern was observed across different income quintiles. Except for the age group 5-9, boys were more likely to die in hospital than girls for all income quintiles. The last two rows of Table 4.2 also indicate that girls with live female siblings (younger than 15 years old) were the most disadvantaged groups in getting medical help before their death.

Table 4.2 Place of death for different age group children by location, income, and gender

		Place of death				
Age group	Variable	At home	Hospital	During transport	Other places	Pearson chi^2
	1. Location					
<1 year	Rural	72.48	21.80	2.45	3.27	21.49*** (0.000)
	Urban	55.63	40.85	0.00	3.52	
1-4 years	Rural	74.78	18.70	1.74	4.78	6.78* (0.079)
	Urban	67.69	21.54	7.69	3.08	
5-9 years	Rural	53.85	37.18	2.56	6.41	1.69 (0.639)
	Urban	42.86	50.00	3.57	3.57	
0-9 years	Rural	71.11	22.52	2.22	4.15	18.35*** (0.000)
	Urban	57.45	36.6	2.55	3.4	
	2. Income					
<1 year	1st quintile.	69.67	22.95	1.64	5.74	15.33 (0.224)
	5th quintile.	58.06	36.56	1.08	4.30	
1-4 years	1st quintile.	77.46	14.08	1.41	7.04	16.04 (0.189)
	5th quintile.	69.77	27.91	0.00	2.33	
5-9 years	1st quintile.	45.00	50.00	5.00	0.00	11.59 (0.479)
	5th quintile.	37.50	62.50	0.00	0.00	
0-9 years	1st quintile.	69.95	22.54	1.88	5.63	19.06* (0.087)
	5th quintile.	59.21	36.84	0.66	3.29	
	3. Gender					
<1 year	Girls	77.33	17.33	2.22	3.11	20.18*** (0.000)
	Boys	60.21	34.86	1.41	3.52	
1-4 years	Girls	77.56	16.03	2.56	3.85	3.208 (0.361)
	Boys	68.35	23.02	3.60	5.04	
5-9 years	Girls	53.85	34.62	5.77	5.77	4.18 (0.243)
	Boys	48.15	46.30	0.00	5.56	
0-9 years	Girls	74.60	18.94	2.77	3.70	23.37*** (0.000)
	Boys	61.22	32.70	1.89	4.19	
Girls * <1 year* female siblings		83.17	11.88	0.99	3.96	17.56 (0.001)
Boys* <1 year* girl siblings		60.36	36.04	1.80	1.80	

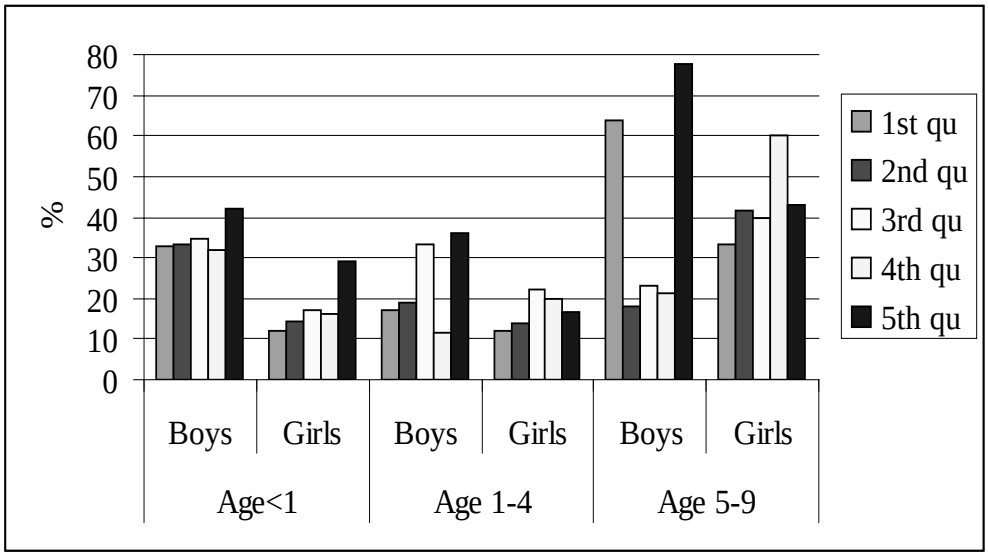
Standard errors in parentheses * Significant at 10%; ** significant at 5%; *** significant at 1%
Source: Authors computation based on 52nd NSS

Figure 4.1 Percentage of children died in hospital by sex, age, and location



Source: Authors computation based on 52nd NSS

Figure 4.2 Percentage of children died in hospital by sex, age, and income quintile



Source: Authors computation based on 52nd NSS

All results indicate that girls, especially infant girls, were more likely to die at home without getting medical attention at the last critical time of their lives and this was true both in urban and rural areas, and across different income groups. Girls with sisters younger than 15 years of age were particularly vulnerable. Therefore, discrimination in seeking medical help against infant girls might be one possible explanation for the imbalance sex ratio in the country.

Multinomial logit results

A multinomial logit model was estimated to determine whether gender affected the likelihood of place of death of children. Before presenting the final results of the model, we examined various specification and related issues. First, we test for combining any of the five outcomes (places of death). An outcome *j* is said indistinguishable with outcome *k*, if none of the independent variables significantly affect the odds of outcome *j* versus outcome *k* (Long and Freese, 2003). In the light of the loglikelihood test results and common sense, government and private hospital and home and other outcomes were combined and three mutually exclusive places of death were created (at home, in hospital, and during transport). Second, we test for the independence of irrelevant alternative (IIA) assumption of the multinomial logit model using both Hausman-McFadden and Small-Hsiao tests. Both tests showed that IIA assumption holds, i.e., odds (Outcome-*j* vs Outcome-*k*) are independent of other alternatives. Third we examine the variance inflation factors (VIF) to test for the existence of multicolinearity. The variance inflation factor is an index which mearures how much the variance of the coefficient is increased because of collinearity. VIF ranges from 1.0 to intifinity where VIFs greater than 10.0 are generally seen as indicative of severe multicolinearity. The computed VIF was 1.06 indicating absence of any significant multicolinearity.

Two individual variables, viz., sex and age of the deceased child, eight household level variables viz. sex, age, age square, and education level of the household head; number of live female siblings younger than 15 years of age, income, location, and social status of the household were included in the model (see Table 4.1 for definition and descriptive statistics of these variables). In addition to individual and household level variables, 77 district level dummy variables were included in the regression to take into account unobserved district level factors that might affect the place of death of children. The results of the multinomial model are presented in Table 4.3.

Death at home (versus death in hospital and during transport) was the reference (comparison or base) category. The coefficients of the district level dummy variables were omitted for brevity of presentation**.** The LR chi^2 test is significant rejecting the hypothesis that all of the regression coefficients across both models are simultaneously zero. The McFadden's pseudo R^2 is 0.22. Since direct interpretation of the coefficients is difficult, marginal coefficients were computed and presentment for statistically significant variables.

Table 4.3 Determinants of place of death: Multinomial logistic regression results

Variable	Place of death				
	Hospital		During transport		At home
	Coeff.	Marg eff.	Coeff.	Marg eff.	Marg eff.
Age of the head	0.074		-0.001		
	(0.057)		(0.069)		
Age square of the head	-0.001		-0.000		
	(0.001)		(0.001)		
Male headed household	0.284		0.051		
	(0.462)		(0.554)		
Ln per capita expenditure	0.241		-0.033		
	(0.241)		(0.288)		
Location (1 = urban)	0.369		0.621**	0.00003	-0.01211
	(0.244)		(0.292)		
Scheduled caste/tribes	-0.079		0.158		
	(0.250)		(0.293)		
Head's education(1 if completed primary and above)	0.508**	0.0163	0.939***	0.00005	-0.01644
	(0.217)		(0.260)		
Ln family size	0.031		-0.123		
	(0.219)		(0.261)		
Age of the deceased child	0.227***	0.0068	0.077		-0.00681
	(0.042)		(0.061)		
Num. of female siblings younger than 15	-0.082		-0.123		
	(0.101)		(0.122)		
Gender of the deceased child (1 if girl)	-0.584***	0.0174	-1.071**	-0.00005	0.01748
	(0.208)		(0.268)		
70 district level dummy variables					
Constant	-5.433*		-0.465		
	(3.044)		(3.658)		
Observations	907				
Log likelihood	-563.35478				
LR chi2(158)	299.81				
Prob > chi2	0.0000				
Pseudo R2	0.2102				

Standard errors in parentheses * Significant at 10%; ** significant at 5%; *** significant at 1%
Source: Authors computation based on 52nd NSS

Age and sex of the household head took the expected negative sign indicating that children in older and female headed households were less likely to die in hospital or during transport than children in young and male headed households. However, both variables were not statistically significant at the ten percent level. Income also took the expected positive sign but was not statistically significant in explaining place of death.

Though consistent with the descriptive statistics, this result is counter intuitive. However, similar results were reported by other authors. For instance, Khanna et al. (2003) found that poverty did not explain sex discrimination in infants' death in urban India. Kurz and Johnson-Welch (1997) also concluded that increasing household income alone might not be sufficient to reduce gender discrimination in India.

As expected, children in urban areas were more likely to die in hospital or during transport than at home. Education level of the household head was the other most important variable that determined the place of death of children. Children with educated household heads (primary and above education) were 1.63 and 0.01 percent more likely to die in hospital and during transport, respectively than children with less than primary school household head, all other variables remaining constant. However, the interaction between education and gender variables was insignificant (not shown in the table) indicating that education did not affect gender differences in the place of death of children. Consistent with the descriptive analysis, the probability of dying outside home increased in child age, ceteris paribus. Keeping all other variables constant, a one year increase in the age of a child decreased the likely of dying at home by 0.68 percent. Other variables such as social status, family size, number of female siblings in the household did not have statistically significant impact on the place of death.

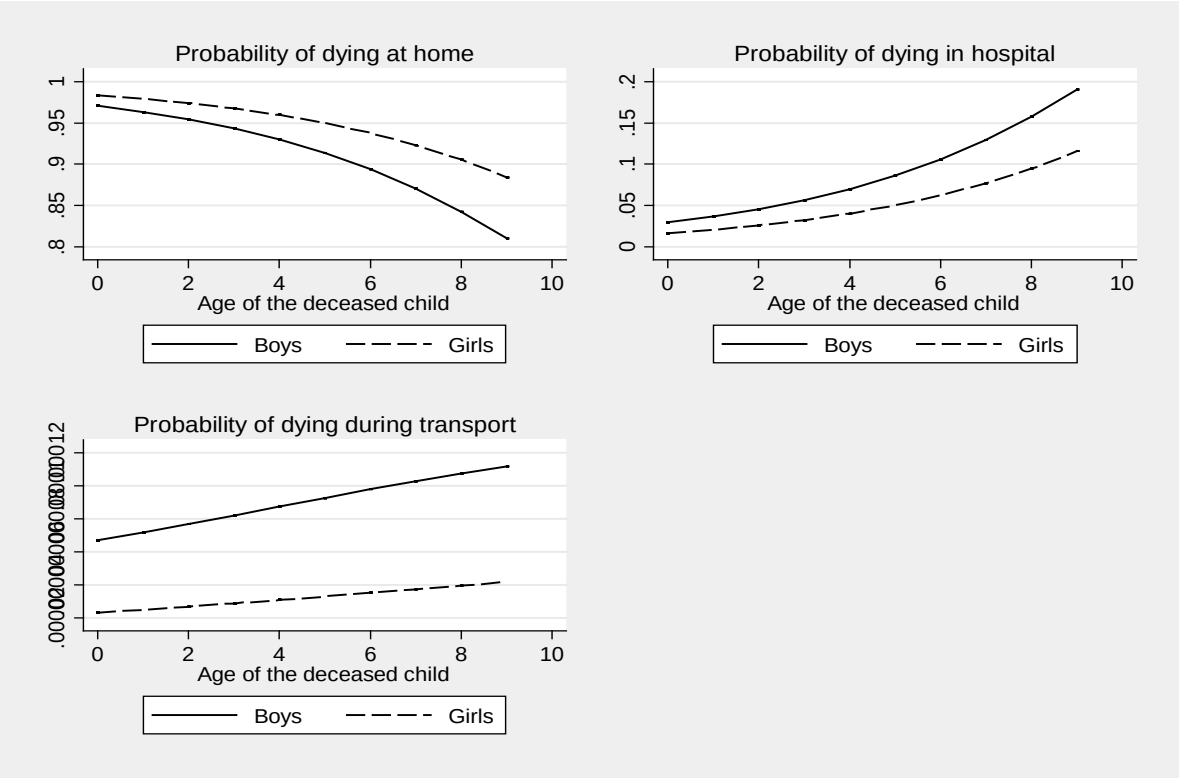
Our main interest variable, gender, took the expected positive sign in the case of dying at home and negative signs in the case of dying in hospital and during transport and was statistically significant in all cases. The marginal coefficient of the home outcome showed that all other variables remaining constant, girls were 1.8 percent more likely to day at home than boys. In other words, boys were 1.8 percent more likely to die in hospital and 0.01 percent during transport than girls keeping all other factors constant. This clearly indicates that controlling for all other factors, girls were less likely to get medical attention immediately before their death than boys.

The effect of various factors such as age of the deceased child and number of female siblings in the household on the place of death of children may vary by gender. We hypothesized that young girls and girls with female siblings were less likely to get medical attention before death than boys. We used two methods to examine these possibilities. First, we plot the probability of dying at different places as a function of age of the deceased child and number of female siblings in the household by gender keeping all other factors constant at their mean values. Second we created interaction variables between age

and gender and number of female siblings and gender and add these interaction variables in the model.

Figure 4.3 presents the probability of dying at home, in hospital, and during transport as a function of age of the deceased child by gender keeping all other variables constant. As expected, at all age levels girls were more likely to die at home and less likely to die in hospital or during transport than boys. However, consistent with previous results, their probability of dying in hospital or during transport increases as their age increases.

Figure 4.3 Probability of dying at different places as a function of age of the deceased child

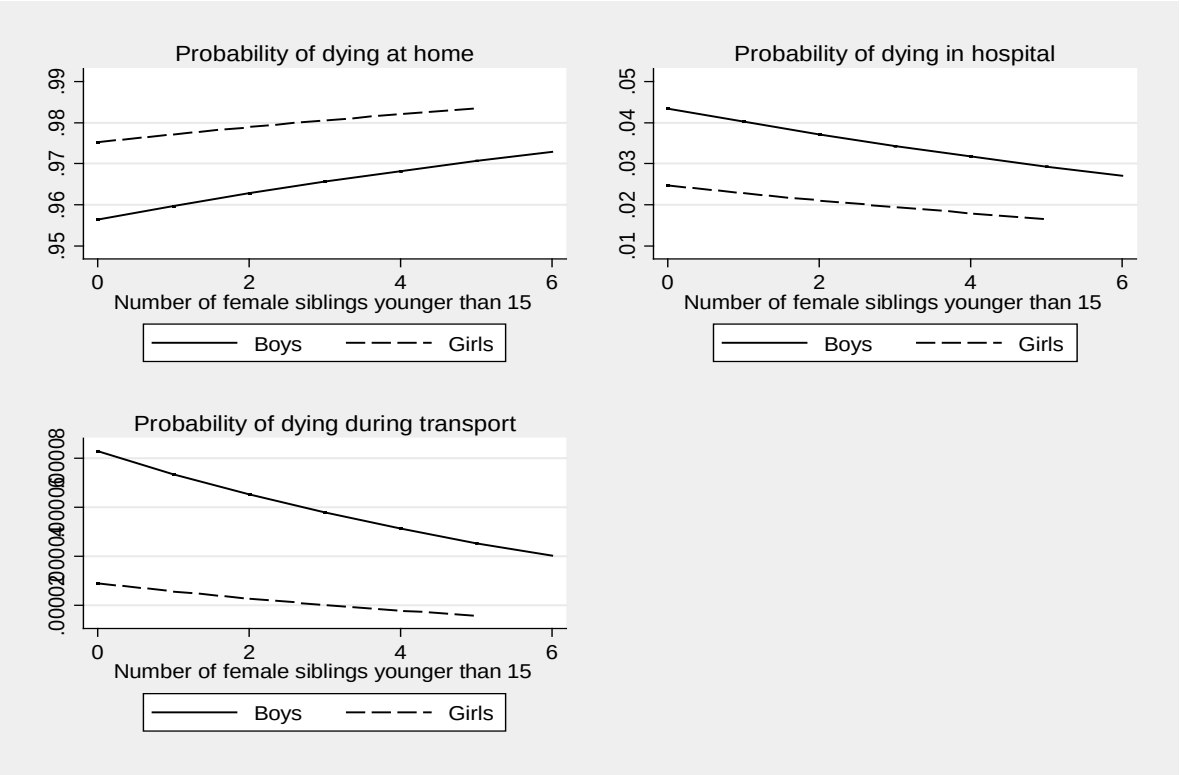


Source: Authors computation based on 52nd NSS

Figure 4.4 portrays the probability of dying at different places as a function of number of female siblings in the household by the gender of the deceased child. The figure shows that, all other things remaining constant, as the number of female siblings in the household increased the chance of girls to die at home increased significantly compared to their brothers. Girls with female siblings had also small chance of dying in hospital or during transport compared to boys and this small chance significantly decreased as the number of female siblings in the household increased.

Interaction variables between gender and age and gender and number of female siblings in the household were also included in the multinomial estimation and the results are presented in Table 4.4.

Figure 4.4 Probability of dying at different places as a function of number of female siblings



Source: Authors computation based on 52nd NSS

The coefficients of all the interaction variables took the expected signs and were statistically significant in most of the cases. The interaction between age and gender variable showed that as age increased the likelihood of a girl to die during transport (compared to dying at home) increased, all other things remaining constant. More interestingly, after controlling gender and other variables in the model, girls with female siblings were less likely to die in hospital than girls with no or few female siblings and boys.

However, as pointed out by Ali and Norton (2003) and Norton (2004), the exact interpretation of interaction terms in nonlinear models such us ours is not straight forward. Therefore, we use graphs to examine the impact of the interaction terms and the results are

presented in Figures 4.5 and 4.6[68]. These figures are expected to give more precise picture (than the one presented in Figures 3 and 4) since the interaction effects are included.

Table 4.4 Determinants of place of death with interaction variables: Multinomial logistic regression results

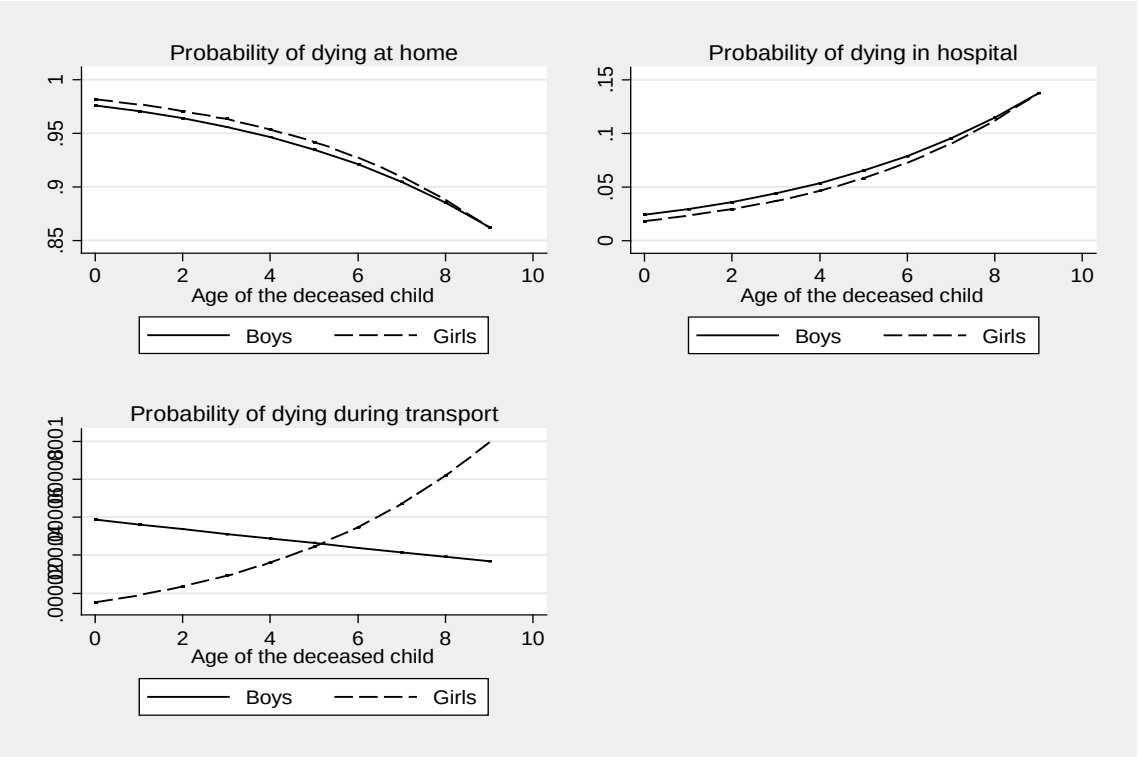
Variable	Place of death	
	Hospital	During transport
Age of the head	0.073	0.009
	(0.057)	(0.069)
Age square of the head	-0.001	-0.000
	(0.001)	(0.001)
Male headed households	0.283	0.127
	(0.465)	(0.567)
Ln per capita expenditure	0.210	-0.022
	(0.243)	(0.292)
Location (1 = urban)	0.365	0.647**
	(0.246)	(0.294)
Scheduled caste/tribes	-0.092	0.135
	(0.250)	(0.295)
Head's education (1 if completed primary and above)	0.492**	0.897***
	(0.218)	(0.261)
Family size (in Ln)	0.027	-0.120
	(0.220)	(0.263)
Gender of the deceased child (1 if girl)	-0.277	-1.355***
	(0.303)	(0.388)
Age of the deceased child	0.208***	-0.038
	(0.057)	(0.087)
Gender X age of the deceased child	0.031	0.261**
	(0.082)	(0.121)
No of female siblings younger than 15	0.063	-0.073
	(0.123)	(0.143)
Gender X Number of female siblings younger than 15	-0.393*	-0.098
	(0.200)	(0.256)
70 district level dummy variables		
Constant	-5.158*	-0.733
	(3.067)	(3.709)
Observations	907	
Log likelihood	-559.01	
LR chi^2 (162)	308.49	
Prob > chi2	0.0000	
Pseudo R2	0.2163	

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Source: Authors computation based on 52nd NSS

[68] We use the xi3 command available in STATA.

Figure 4.5 portrays the probability of dying at home, in hospital, and during transport as a function of age of the deceased child by including the interaction effect between age and gender of the deceased child.

Figure 4.5 Probability of dying at different places as a function of age of the deceased child (interaction between age and gender included)



Source: Authors computation based on 52nd NSS

Consistent with Figure 4.3, infants of both sexes were more likely to die at home than children. At the same time the probability of girls to die at home was higher and to die in hospital was lower than boys at all age levels. In contrast to Fig. 4.3, Fig. 4.4 clearly showed that these differences decreased as the age of the child increased.

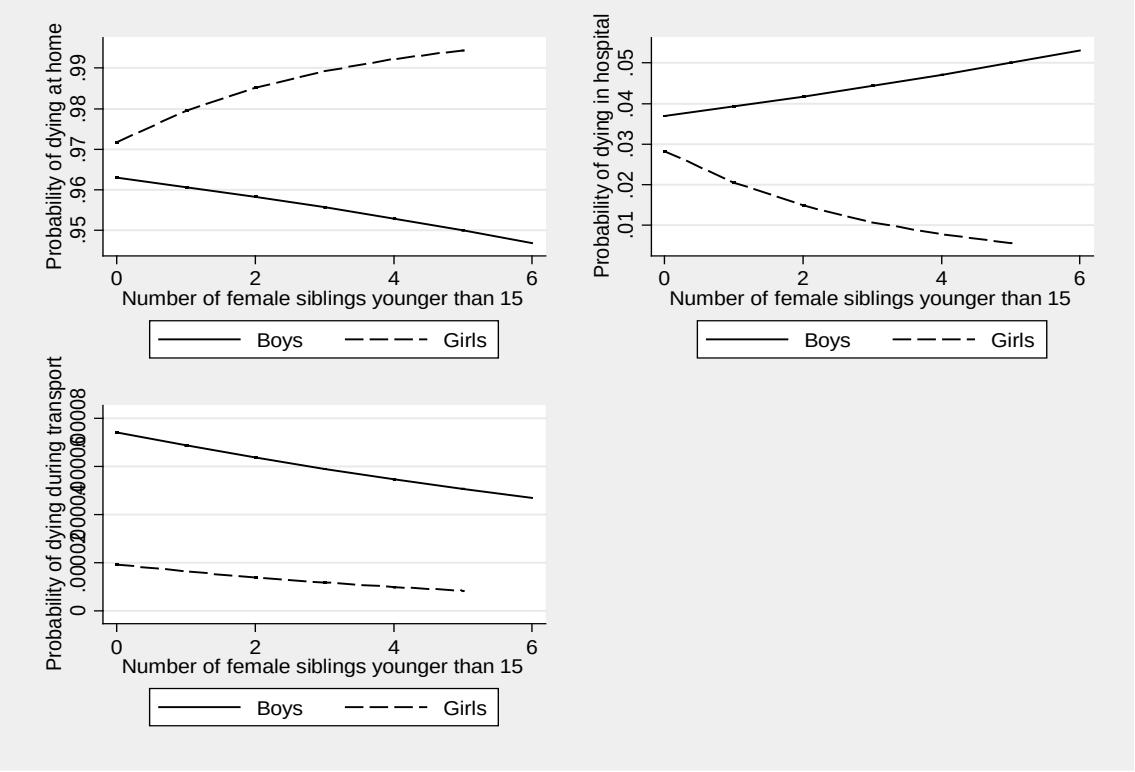
Fig. 6 also showed very interesting results. The probability of boys to die at home decreased as the number of female siblings in the household increased while the probability of girls to die at home significantly increased as the number of female siblings increased.

The probability of girls to die in hospital also significantly decreased as the number of female siblings in the household increased. These results can be clearly seen by the funnel shape of the first two graphs of Fig. 6. However, the number of female siblings in

the household was less likely to affect the difference in the probability of dying during transport between boys and girls.

All these results clearly indicate that there is significant gender discrimination in place of death in India. Boys were more likely to die in hospital and during transport to hospital than girls and girls were more likely to die at home. Particularly, infant girls with female siblings were unlikely to get medical help at the last critical time of their lives. This clearly shows that female infanticide can be one of the most important factors for the current imbalanced sex ratio in the country. Therefore, the focus of policy makers should not be limited to reduce medical termination of pregnancy based on fetal sex, but should also focus on the health care demand behaviour of households to ensure equality in medical access between boys and girls especially at their earlier life.

Figure 4.6 Probability of dying at different places as a function of number of female siblings (interaction between number of female siblings and gender included)



Source: Authors computation based on 52nd NSS

Robustness test

Place of death is a good indicator of gender discrimination in access to medial care in developing countries especially for children. However, dying at home may not necessarily imply deprivation of medical attention before death. Therefore, we used three

additional indicators to examine gender discrimination in getting medial help before death in India. First, we examined whether the deceased child did not receive any medical attention before death. Overall 28 percent of deceased children did not get any type of medial help before death and there was no statistically significant difference between boys and girls. Second, we examined whether the child was hospitalized for treatment before death during last 365 days before the survey. The data showed that 38 percent of boys hospitalized before their death while only 26 percent of girls hospitalized before their death and the difference was statistically significant at less than one percent (Pearson χ^2 test). Finally, we examined the number of times the deceased child was hospitalized during last 365 days preceding the day of the survey. On the average, boys were hospitalized 0.42 times while girls were hospitalized only 0.3 times.

We used the above three variables to examine gender discrimination in getting medical help before death. We used logit specification in the case of hospitalization and getting any medical help before death and OLS method in the case of number of times hospitalized before death. The results are presented in Table 4.5.

In all models the gender variable took the expected sign though not statistically significant in the case of no any medical help before death[69]. The marginal coefficient of the gender variable in the case of hospitalization before death indicated that, all other things remaining constant, the probability of girls to be hospitalized before their death was 12 percent less than boys. The OLS result also revealed that the average number of times girls were hospitalized before their death was 0.11 less than that of boys (the average was 0.36 times). All these results confirm that there was noticeable and statistically significant difference by sex of the child in getting medical help before death. Overall, girls were more likely to be denied medical attention before their death than boys.

[69] Gupta and Sankar (2002) also found insignificant coefficient for sex using the same data set and indicator. Their results showed that gender did not make a difference in getting medical attention before death.

Table 4.5 Robustness test

Explanatory variable	Dependent variable		
	Hospitalization before death (Logit results)	No medical attention before death (Logit results)	Number of times hospitalized before death (OLS results)
Age of the household head	0.060	-0.029	0.012
	(0.045)	(0.041)	(0.009)
Age square of the household head	-0.001	0.000	-0.000
	(0.000)	(0.000)	(0.000)
Female headed household	0.458	-0.263	0.004
	(0.380)	(0.361)	(0.082)
Ln per capita expenditure	0.173	-0.641***	-0.023
	(0.193)	(0.208)	(0.044)
Location (1 = urban)	0.451**	-0.456**	0.118**
	(0.197)	(0.225)	(0.047)
Scheduled caste/tribes	0.010	0.152	-0.038
	(0.198)	(0.194)	(0.045)
Head's education(1 if completed primary and above)	0.247	0.048	0.114***
	(0.177)	(0.186)	(0.041)
Ln family size	0.054	-0.145	0.004
	(0.177)	(0.181)	(0.040)
Age of the deceased child	0.174***	-0.020	0.048***
	(0.037)	(0.039)	(0.009)
Number of female siblings younger than 15	-0.050	-0.059	-0.014
	(0.078)	(0.082)	(0.018)
Gender	-0.637***	-0.059	-0.114***
	(0.167)	(0.167)	(0.038)
Constant	-3.613	6.407**	0.450
	(2.442)	(2.562)	(0.556)
Pseudo R^2/ R^2	0.14	0.09	0.20

Standard errors in parentheses
* Significant at 10%; ** significant at 5%; *** significant at 1%

Source: Authors computation based on 52nd NSS

4.5. Conclusion

The excess female mortality in India and other South Asian countries is no longer contentious. The ambiguous and controversial things are the reasons for such excess female mortality in the country. The non-responsiveness of this excess female mortality to the improvement in the economic status and educational level of households also makes the issue more complicated. Several factor including female feticide, gender discrimination in nutrition, health care, labour markets, education, and other opportunities

are cited in the literature for this excess female mortality in the region. Using unique verbal autopsies information collected in the 52nd Indian National Sample Survey and econometric models, this study provides new evidences on intra-household gender discrimination against girls in getting medical attention before death. We argue that compared to mortality differences between girls and boys which can be partly explained by biological factors, disparities in getting medical attention before death reveal gender discrimination potentially attributed to behavioural factors.

From several indicators that measure medical attention before death, we used place of death variable as a main indicator. Unlike developed countries where place of death is a matter of choice, in developed countries like India place of death is a crucial indicator of access to medical care at last critical time of life. Particularly in the case of non-adults it measures the real concern of parents for their children. The study also focused on infants and children (aged from one day to nine years) since their chance of getting medical help totally depends on the decision of their parents. This helps us to clearly see the level of intra-household gender discrimination in the health care decision of households.

The multinomial logit results showed that girls were highly discriminated against in getting medical help immediately before their death. The marginal coefficient of the gender variable showed that boys were 1.7 percent more likely to die in hospital and 0.01 percent during transport than their sisters, ceteris paribus. The coefficients of the interaction between age and gender and number of female siblings and gender also clearly pointed out part of the girls which were highly vulnerable to such discrimination. Controlling for all other factors, the probability of very young girls with live female siblings to die in hospital was extremely low and this probability decreased significantly as the number of live female siblings in the household increased. The robustness of the results was also tested using three different indicators that measures access to health care before death. Except in the case of 'any medical attention before death' indicator, the results of the two indicators confirmed the existence of statistically significant gender discriminations. Boys were more likely to be hospitalized before their death and the average number times boys were hospitalized before their death was 0.11 higher than their sisters.

Generally, the results of this study clearly indicated that girls, particularly infant girls were discriminated in receiving medical attention before their death compared to their brothers. This implies that reducing this discrimination can help to improve the current falling sex ratio in the country. Therefore, in addition to the current effort of the

government to enforce the law which makes fetal sex determination and medical termination of pregnancy on the basis of fetal sex illegal, more should be done to improve the medical access of girls at least for life threatening sicknesses to the level of their brothers. This action coupled with reducing female foeticide may help to improve the declining sex ratio in the country. Looking at future research work on this topic, it would be useful to examine the type, spatial variation (across different regions and between rural and urban settings), and dynamic (through time) of intra-household gender disparities and their relationship with the current imbalance in sex ratios in the country.

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