



Girl Child: An Inferior Good in India

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Section I: Background:

The term Sex ratio is defined “as the number of females per 1000 males in the population” (Census, 2001). It is an important social indicator to measure the extent of prevailing equity between males and females in a society at a given point of time. It is mainly the outcome of the interplay of sex differentials in mortality, sex selective migration, sex ratio at birth and at times the sex differential in population enumeration (Census, 2001). The sex ratio is an important indicator of women’s status in society.

In Section I of this paper we discuss the background used for this study. Section II discusses the determinants of the model, empirical results achieved through its analysis and Section III discusses the conclusion of this paper.

In this section, we examine whether a girl child is an “inferior” good, in that it has a negative income elasticity of demand. If that is so, the chance of a girl child being actually born would be lower than that for a male child for relatively well off households, even though the children actually born might then go on to receive equal human capital endowments.

Amartya Sen (1990) found female deficit in the continents of Asia & Africa. Further, Ansley Coale(1991) had presented a low estimate of global deficit in sex

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ratio, suggesting that the total number of missing females is about 60 million and nearly half of this deficit is from China (29.1 million) and India (22.8 million) (Amartya Sen (1990), Ansley Coale (1991)).

The sex ratio is low for most States in India (Census of India (2001)). Gender discrimination is often carried out subtly in matters of health and education and seems to chiefly favour the males. Differences in the welfare and achievements of men and women as adults are rooted in the differences in investments they receive as boys and girls (Meera Kosambi, (2001)). According to Bennett (1992) gender based asymmetries characterize Indian Society where the incidence of female mortality and morbidity are high. Not only is the sex ratio at birth favourable to males, but gender determines the nutritional status of individuals, adversely affecting females in calorie and micro intake (Bennett (1992)).

One of the reasons for the tendency among parents to differentiate between boys and girls in matters of investment related to health and education is that the parents derive greater satisfaction from the economic success of their sons than from the success of their daughters (Paul Schultz, (1995)). Men are the direct beneficiaries of such a social structure. The family, as well as the higher orders in society, support and nurture this arrangement that is beneficial exclusively to men (Prem Chowdhry, (2001)). The literature illustrates that the given socio-economic situation has an impact on the sex ratios. Further, working mothers may attach greater importance to the survival of a female child. Maternal education helps in reducing child mortality as well as infant mortality, as well as helps in achieving planned number of births. Also, there would be an increase the survival of boys more than girls in case of limited income (Mamta Murthi, et al, (1996)).

Table 1: Sex Ratio in India

State code	India/State/Union Territory	Sex Ratio
	India	933
01	Jammu and Kashmir(JK)	892
02	Himachal Pradesh(HP)	968
03	Punjab(PU)	876
04	Chandigarh(CH)	777
05	Uttaranchal(UT)	962
06	Haryana(HA)	861
07	Delhi(DE)	821
08	Rajasthan(RA)	921

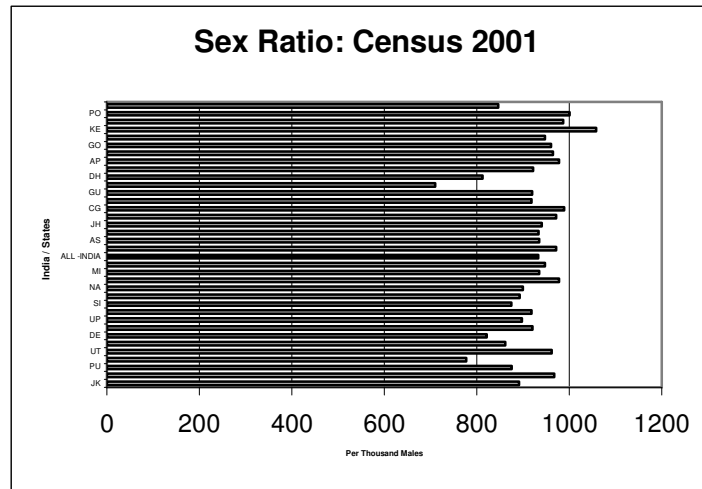
State code	India/State/Union Territory	Sex Ratio
09	Uttar Pradesh(UP)	898
10	Bihar(BI)	919
11	Sikkim(SI)	875
12	Arunachal Pradesh(AR)	893
13	Nagaland(NA)	900
14	Manipur(MN)	978
15	Mizoram(MI)	935
16	Tripura(TR)	948
17	Meghalaya(ME)	972
18	Assam(AS)	935
19	West Bengal(WB)	934
20	Jharkhand(JH)	941
21	Orissa(OR)	972
22	Chattisgarh(CG)	989
23	Madhya Pradesh(MP)	919
24	Gujarat(GU)	920
25	Daman and Diu(DD)	710
26	Dadra Nagra and Haveli(DH)	812
27	Maharashtra(MA)	922
28	Andhra Pradesh(AP)	978
29	Karnataka(KA)	965
30	Goa(GO)	961
31	Lakshadweep(LA)	948
32	Kerala(KE)	1058
33	Tamil Nadu(TN)	987
34	Pondicherry(PO)	1001
35	Andaman and Nicobar Islands(AN)	846

Source: Primary Census Abstract: Census of India 2001

According to the 2001 Census the overall sex ratio in India stood at 933 females per 1000 males. The female-male ratio was 1058 females per thousand males, the highest, in the State of Kerala as against 710, the lowest, in Daman and Diu. Daman and Diu was followed by Chandigarh at 777. Overall the low female-male ratio, which indicates a bias against females in Indian society, is largely found in the

Northern States. It was 821 in the state of Delhi, 861 in the State of Haryana and 898 in Uttar Pradesh State. In the State of Maharashtra the sex ratio was 922:1000 (See Table 1).

Chart1: Sex Ratio in India



Source: Primary Census Abstract: Census of India, 2001

Section II: Determinants of the sex ratio

The issue of adverse sex ratio has serious implications for gender equity and justice. Econometric tests are conducted to understand the approximate determinants of sex ratio differences across Indian states. In particular, the aim is to find out if the girl child is an “inferior” good. This is examined by testing the coefficient on per capita income in a regression where the sex ratio at birth is a dependent variable. Additionally, the regression analysis is carried out to find whether there exists, if any, a relation between Sex Ratio at Birth (2001) and Male Literacy levels, Female literacy levels, Male Work Force Participation Rate, Female Work Force Participation Rate, Urban Population, and Per capita income for various states and union territories in India.

Table 2: Data used for the analysis

State/ Union Territory	Sex Ratio At Birth (20 01)	Male Liter acy (perc ent)	Female Liter acy (perc ent)	Male Worki ng Popula tion (perce nt)	Female Worki ng Popula tion (percen t)	Urban Popula tion (percen t)	Per Capi ta Inco me	Sex Rati o At Birth (199 1)
Himachal Pradesh	897	85.3	67.4	56.4	43.6	9.8	21570	951
Punjab	793	75.2	63.4	76.3	23.7	34.0	25625	875
Chandigarh	845	86.1	76.5	83.6	16.5	89.8	47680	899
Uttaranchal	906	83.3	59.6	63.7	36.3	25.6	13260	948
Haryana	820	78.5	55.7	68.2	31.8	29.0	24851	879
Delhi	865	87.3	74.7	87.1	12.9	93.0	44422	915
Rajasthan	909	75.7	43.9	61.8	38.2	23.4	13621	916
Uttar Pradesh	916	68.8	42.2	75.9	24.1	20.8	9320	927
Bihar	938	59.7	33.1	73.2	26.8	10.5	5007	953
Sikkim	986	76.0	60.4	63.0	37.0	11.1	18822	965
Arunachal Pradesh	961	63.8	43.5	60.8	39.2	20.4	15701	982
Nagaland	975	71.2	61.5	57.7	42.3	17.7	18911	993
Manipur	961	80.3	60.5	55.8	44.2	23.9	12683	974
Mizoram	971	90.7	86.7	56.3	43.7	49.5	19704	969

State/ Union Territory	Sex Ratio At Birth (20 01)	Male Liter acy (perc ent)	Female Liter acy (perc ent)	Male Worki ng Popula tion (perce nt)	Female Worki ng Popula tion (percen t)	Urban Popula tion (percen t)	Per Capi ta Inco me	Sex Rati o At Birth (199 1)
Tripura	975	81.0	64.9	71.7	28.3	17.0	1738 3	967
Meghalaya	975	65.4	59.6	58.6	41.4	19.6	1581 3	986
Assam	964	71.3	54.6	72.0	28.0	12.7	1113 2	975
West Bengal	963	77.0	59.6	75.9	24.1	28.0	1749 9	967
Jharkhand	966	67.3	38.9	65.9	34.1	22.3	1012 9	979
Orissa	950	75.3	50.5	68.7	31.3	15.0	9897	967
Chattisgarh	975	77.4	51.9	57.2	42.9	20.1	1203 2	984
Madhya Pradesh	929	76.1	50.3	62.8	37.2	26.7	1212 5	941
Gujarat	878	79.7	57.8	68.1	31.9	37.4	1960 7	928
Maharashtra	917	86.0	67.0	65.2	34.8	42.4	2405 5	946
Andhra Pradesh	964	70.3	50.4	62.1	37.9	27.1	1793 2	975
Karnataka	949	76.1	56.9	64.7	35.3	34.0	1829 6	960
Goa	933	88.4	75.4	71.8	38.2	49.8	5107 6	964
Kerala	963	94.2	87.7	75.5	24.5	26.0	2028 7	958
Tamil Nadu	939	82.4	64.4	64.9	35.1	43.9	2032	948

State/ Union Territory	Sex Ratio At Birth (20 01)	Male Literacy (perc ent)	Female Literacy (perc ent)	Male Worki ng Popula tion (perce nt)	Female Worki ng Popula tion (percen t)	Urban Popula tion (percen t)	Per Capi ta Inco me	Sex Rati o At Birth (199 1)
Pondicherry	958	88.6	73.9	75.5	24.5	66.6	6 3792 6	963
Andaman and Nicobar Islands	965	86.3	75.2	80.1	19.9	32.7	2599 9	973

Source: Census of India, 2001 and Economic Survey of India 2004-05

In the given regression equation Sex Ratio at birth (2001)(S_{il}) is considered as the dependent variable, while the other variables Male Literacy (M_{li}), Female Literacy (F_{li}), Male Work Force Participation rate (M_{wi}), Female Work Force Participation rate (F_{wi}), Urban Population (U_i), and Per capita incomes (P_i) of the states and Union Territories are the independent variables. The equation is written as follows:

Equation:

$$S_{il} = \alpha + \beta_1 M_{li} + \beta_2 F_{li} + \beta_3 M_{wi} + \beta_4 F_{wi} + \beta_5 U_i + \beta_6 P_i$$

where

S_{il} = Sex Ratio at Birth (2001) of Different States and Union Territories.

M_{li} = Male literacy rates of Different States and Union Territories

F_{li} = Female literacy rates of Different States and Union Territories

M_{wi} = Male Work Force Participation rates of Different States and Union Territories

F_{wi} = Female Work Force Participation rates of Different States and Union Territories

U_i = Urban Population of Different States and Union Territories

P_i = Per capita income of Different States and Union Territories

And α, β 's, are the intercept estimate and coefficient estimates of the variables, respectively.

From the literature, we expect female literacy to have a positive impact on sex ratio at birth (when we have controlled for all the other factors). If it is found that female education does not have any impact on improving the sex ratio, we can conclude that mere formal literacy does not make any dent on the practice of aborting female fetuses. In fact, more "literacy", in a high son-preferring society, might actually enable greater female feticide by giving women access to technologies of birth control. Hence, it is important to understand the relationship between women's literacy and sex ratio at birth. Similarly, does an improved extent of male literacy have any impact on this practice? Is literacy liberating for men in the context of this pernicious practice?

The relationship between per capita income and sex ratio at birth is also important. To speak in an economic jargon, is a girl child an "inferior" good, the demand for which declined with rising income? Wealthier states also have better access to sex determination technologies. It is also possible that in wealthy states, the incentive for female feticide is particularly high because there is great wealth that households might want to pass on to their male descendants, rather than have it go out of the family with the married daughter's share. On the other hand, if better economic prospects make parents less dependent upon male children in their old age, better per capita incomes will reduce the incidence of female feticide.

The relationship between female and male work participation rates and sex ratio at birth is also quite important. Higher female work participation rates might imply better value for women as workers and hence ought to raise the value of a girl child, controlling for everything else. Hence, theoretically, we would expect to see a better sex ratio in societies where more women are working than in societies where women's work outside the household is not valued greatly.

Similarly, Urbanisation might impact sex ratio at birth in various ways. Urban areas have a relatively better availability of sex determination techniques, making it

easier for parents to carry out female feticide. However, Urbanisation might also be associated with more working women, smaller and nuclear households, better education and health facilities for women, better and higher paid job opportunities for women, improving women's decision making power within the household. Also, urban households are more likely to be exposed to information and propaganda about gender equity and be generally less traditional. Hence, it is also instructive to see the relationship between Urbanisation and sex ratio at birth.

Section III: Results of the Analysis:

After running the regression on the given data, the results indicate the adjusted R-square as 0.2233. This would suggest that 22.33 per cent of the variation in the dependent variable Sex Ratio at Birth has been explained by the regression equation and that there may be other factors accounting for variance in this model that are not captured here.

The estimated equation is as follows:

Equation 1:

$$S_{il} = \underset{(0.0103)}{5.1574} - \underset{(-1.717^*)}{2.7552} M_{li} + \underset{(2.815^{***})}{3.0889} F_{li} + \underset{(1.984^*)}{9.9869} M_{wi} + \underset{(2.128^{**})}{10.782} F_{wi} \\ + \underset{(0.5308)}{0.41021} U_i - \underset{(-2.104^{**})}{0.0041249} P_i$$

Note: Figures in the parentheses are the *T*-ratios

: *significant at 10%, **significant at 5% and ***significant at 1%

: Adjusted R-square was 0.2233

The signs of the variables Female literacy, Male work participation rates, Female work participation rates, Urban Population indicate a positive relation with Sex Ratio at birth (2001), unlike the variables Per capita income and Male Literacy.

From the above equation, we see that female literacy (significant at 1%) improves the sex ratio. In states where the female literacy rate is higher, the sex ratio at birth is also likely to be higher. Hence women's education does seem to have an important role in improving the sex ratios at birth. Male literacy however has the reverse impact, with states with higher male literacy showing adverse sex ratios at birth. Thus, for males, literacy per se does not counteract other incentives that households might have for aborting female fetuses. Female work participation rates as well as male work participation rates have a positive influence on the sex ratio at birth. The greater the work participation for men and women, the greater is the improvement

in the sex ratio at birth. Fruitfully employed couples do not generally distinguish between the male and the female child as they do not think about the offspring only as an asset. For women, work experience gives her a voice in decision-making processes and control over resources. This has a direct bearing on the improvement of sex ratio at birth.

The relationship between per capita income and sex ratio at birth however is negative. Wealthier states will have a worse sex ratio at birth. In this case, better access to sex determination techniques, as well as higher incentives to keep the property intact in male lineages seems to outweigh the other factors like reduction of parental dependence on male children. Urbanisation appears to be unrelated to sex ratio at birth.

One variable missing from the regression model above is the historicity of specific areas, which have been determined by their demographic regimes. For example, the sex ratio in a state might be adverse because that state has historically had a social structure that discriminates against women. The historical factor seems to have had a long-term impact on the gender discrimination that is prevalent in the state.

A very similar study was done by Griffiths et al (2000) in which they have based their analysis on Mayer's suggestion (1999) that historical demographic factors could have a large effect on sex ratios in a country undergoing demographic transition. Their findings indicated that small differences in mortality at young ages persisting over a long period along with the sex ratio at birth result in a highly masculine population sex ratio (Griffiths et al, (2000)).

Another similar study was done carried out by S Sudha and S Irudaya Rajan (2003). In their paper they examined the levels and trends of estimated sex ratios at birth and sex ratio of mortality risk in India. They presented the mortality sex ratios noting the areas where female deaths outweighed those of males (S Sudha and S Irudaya Rajan (2003)).

Satish B Agnihotri (2003) discussed the results of the Census 2001 where the sex ratio decline among children in 0-6 age groups is prominent in the urban areas. Their results showed that the masculine sex ratios among the prosperous groups, both in rural and in the urban areas. Also it indicated a greater decline in the sex ratios in the urban areas in comparison to the rural areas (Satish B Agnihotri (2003)). Mahendra Premi (2001) examines the Census 2001 with regard to sex ratios. He found that all the states that have shown large declines in child sex ratio between 1991 and 2001 – Punjab, Haryana, Himachal Pradesh, Gujarat, Maharashtra, Chandigarh and Delhi – are economically well developed and have recorded a fairly high literacy rate (Premi M (2001)).

The purpose of Vani Borrah and Sriya Iyer's (2005) paper was to propose a new idea that is to show that, far from being independent of each other, the sex ratio and family size by religion are highly related. Taking into account the sex ratio at birth, the econometric analysis done by Vani Borrah and Sriya Iyer's (2005) the findings indicated that a husband being literate served to raise the sex ratio – both at birth and of currently living children – but that the effect of husband's literacy was stronger for Muslims and Dalits than it was for Hindus. Several other variables – most remarkably the prosperity of the household and the occupations of the parents – also exercised a significant influence but their influence on the sex ratio did not vary either by religion or by caste (Vani Borrah and Sriya Iyer (2005)). The studies conducted by authors like, Siddhanta S et al (2003), Acharya A R (2004), Bardhan P K (1982), Rustagi P (2006) have among other issues, also analysed the relation between patriarchy, gender discrimination, intolerance towards females, general prosperity and how they have adversely affected the female sex ratio (Siddhanta S et al (2003), Acharya A R (2004), Bardhan P K (1982), Rustagi P (2006)). Sex ratios at birth thus become crucial to the understanding of the changing patterns of female deficits in the overall (N Krishnaji (2000)).

Hence, if this important variable, of historical demographic regime is omitted from the regression, we might run into an omitted variable bias. The other variables that are included in the study may actually have correlations with this omitted variable. The sex ratio at birth in 1991 is used as a proxy to measure a state's historical attitudes in the matter of gender discrimination at birth. Below, the matrix of correlations is presented, between the sex ratio at birth in 1991 and the other variables that have been included as independent variables in the above regression.

Table 3: **Correlation matrix of S_{i0} and the other variable (with the inclusion of outliers)**

	S_{i1}	M_{i1}	F_{i1}	M_{wi}	F_{wi}	U_i	P_i
S_{i0}	0.94231	-0.19273	-0.05943	-0.45060	0.46398	-0.40469	-0.33991

From table 3, it can be seen that S_{i0} is significantly correlated with per capita income, Urbanisation, female work participation rate, and the male work participation rate. There is clearly a case for including the sex ratio at birth in 1991 in the estimated regression equation. That is historical demographic regime could play an important role in indicating the existing adverse sex ratios.

The following is the estimated regression after including the sex ratio at birth in 1991:

Equation 2:

$$S_{i1} = - \frac{664.73}{(-3.116^{***})} + \frac{0.647}{(0.9168)} M_{li} - \frac{0.0094222}{(-0.01901)} F_{li} + \frac{1.2621}{(0.5452)} M_{wi} \\ + \frac{0.64762}{(0.2981)} F_{wi} + \frac{0.15498}{(0.3982)} U_i - \frac{0.0011461}{(-1.284)} P_i + \frac{1.5318}{(13.78^{***})} S_{i0}$$

Note: Figures in the parentheses are the T-ratios

: *significant at 10%, **significant at 5% and ***significant at 1%

: Adjusted R-square was 0.88

The adjusted R square of the regression jumped to 0.88 after including the sex ratio at birth in 1991. However, all the other variables have become insignificant, except the constant, which has now become significant. Does this imply that the historical demographic regime is over-archingly important in this context? The estimated equation seems to imply that once the effect of the historical demographic regime is brought into the picture, other variables do not matter. If this finding is valid, we have very little hope from policies like increasing women's literacy or work participation rates. This may call for further investigation. If history single handedly determines the current sex ratios, how do we understand the changing regional pattern of sex ratios at birth?

One approach to take here is that since the sample size is small, one or two large outliers might unduly influence the estimated regression. Hence, the outliers were searched for and identified, two on the basis of the visual inspection of the estimated residuals from the above equation. The two major outliers were Rajasthan and Sikkim, both with large negative residuals. A re-run of the regression by omitting these two states produced the following results:

Table 4: **Correlation Matrix of S_{i0} and the other variables (after the exclusion of outliers)**

	S_{i1}	M_{li}	F_{li}	M_{wi}	F_{wi}	U_i	P_i
S_{i0}	0.95803	-0.20814	-0.11732	-0.49387	0.50564	-0.42903	-0.37653

Table 3: **Correlation matrix of S_{i0} and the other variable (with the inclusion of outliers)**

	S_{i1}	M_{i1}	F_{i1}	M_{wi}	F_{wi}	U_i	P_i
S_{i0}	0.94231	-0.19273	-0.05943	-0.45060	0.46398	-0.40469	-0.33991

From Table 4, it can be seen that S_{i0} continues to be significantly correlated with per capita income, Urbanisation, female work participation rate, and the male work participation rate. This further strengthens the case for including the sex ratio at birth in 1991 in the estimated regression equation. In comparison with correlation matrix in Table 3, the correlation between S_{i0} and S_{i1} strengthens further. Also the correlation between the variables S_{i0} and Male literacy, Female literacy, Male working population, Female working population, Urbanisation, and Per capita income, all of them improve.

Equation 3:

$$S_{i1} = \underset{(-5.856^{***})}{-877.93} + \underset{(0.4088)}{0.19538} M_{li} + \underset{(1.316)}{0.41109} F_{li} + \underset{(2.275^{**})}{3.1527} M_{wi} + \underset{(1.711)}{2.2712} F_{wi} + \underset{(2.086^{**})}{0.47910} U_i - \underset{(-3.513^{***})}{0.0018639} P_i + \underset{(14.82^{***})}{1.5777} S_{i0}$$

Note: Figures in the parentheses are the T-ratios

: *significant at 10%, **significant at 5% and ***significant at 1%

: Adjusted R-square was 0.93

The adjusted R square of this regression improves further to 0.93. The variable sex ratio at birth in 1991 continues to remain positive and highly significant. Hence, there is a great deal of persistence of the historically observed demographic regime. However, many other variables also become significant. Male work force participation rates have now become more significant. Thus, higher is the proportion of workers among total males, the better is the sex ratio at birth. This variable is significant at 5%. Gainfully employed men tend to attach no major significance to the sex of the child because they perceive that the gender is not a determinant of professional and social success. Exposure to people who are successful in their professional lives forces them to abandon any bias related to sex. This awareness on

the one hand and the emotional fulfillment that they seek through the offspring are the reasons for the improvement in the sex ratio at birth, with men who are well employed. We find a similar relationship between female work participation rate and the sex ratio at birth, though this variable is now significant only at 10%. The relationship between improved male participation rate and sex ratio at birth is intriguing and needs to be explored further. Female and male literacy are no longer significant, though Urbanisation has become significant after the effects of demographic regimes have been factored in. States with more people living in urban areas do have a better sex ratio at birth, the argument about the easy of access to sex determination techniques notwithstanding. Urban areas are less traditional, as urban men and women are better exposed to information and media. Urban girls have far better chances of becoming economically contributing members of the household. All these factors are seen in the estimated regression. However, per capita income remains strongly negatively associated with sex ratio at birth. The girl child is indeed an “inferior” good. The issue of property division seems to be important in determining sex ratio at birth. Wealthier households would like to retain the family property within the male lineage, which seems to be an important driver of adverse sex ratios over and above all other variables.

A calculation of the Income Elasticity for Sex ratio at birth further strengthens the above argument. The calculation is done by using the formulae:

$$\text{Income Elasticity for Sex Ratio at Birth} = \frac{\text{Coefficient of Per capita Income} \times \text{Average of Per capita income}}{\text{Average of Sex Ratio at Birth}}$$

The Coefficient of Per capita income as seen in Equation 3 is -0.0018639 while the average of the Per capita income of the States is 20409.3871 and the average of the Sex ratio at birth (2001) is 932.4516129. The elasticity of income thus calculated was -0.04079682. This showed that wealthier the states were lower was the sex ratio at birth.

The conclusion arrived at from the above findings is that the girl child is indeed an inferior good. Wealthier families are less likely to want a girl child. Thus, gender discrimination might appear through a lowered chance of being born. The declining sex ratio indicates the deterioration of female’s status in society and violates the right to birth as well as the right to life of the females. To reduce gender inequality we require more efforts coming from the public sector as well as non-government organizations which would help in changing the social outlook of the people.

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