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The Rising Price of Husbands: A Hedonic Analysis of Dowry Increases in Rural India

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Dowries in South Asia have steadily risen over the last 40 years and now often amount to over 50 percent of a household's assets. This paper attempts to investigate the reasons behind this increase. It adapts Rosen's implicit market model to the Indian marriage market and tests predictions from the model with data from six villages in South Central India and from the Indian census. It is found that a "marriage squeeze" caused by population growth, resulting in larger younger cohorts and hence a surplus of women in the marriage market, has played a significant role in the rise in dowries.

I. Introduction

This paper attempts to investigate the reasons behind the increase in real dowry payments that have been observed across South Asia over the last four decades (Epstein 1973; Lindenbaum 1981).[1] It adapts

This paper, which is adapted from chap. 1 of my dissertation (Rao 1990), has greatly benefited from the guidance of Jere Behrman, Anil Deolalikar, Andrew Foster, Robert Pollak, and Paul Taubman. Valuable suggestions were provided by an anonymous referee, Arup Banerji, Francis Bloch, Ken Chomitz, Meg Greene, Robert Lucas, Sherwin Rosen, Robert Willis, and Frank Zimmerman. The paper has profited from comments received in presentations at Chicago, Delaware, Florida State, Institute for Economic Growth (Delhi), Institute for Social and Economic Change (Bangalore), Maryland, Michigan, Pennsylvania, and the World Bank. Additionally, Mark Rosenzweig generously shared some data and insights. I gratefully acknowledge their help while remaining culpable for any errors. The research was supported by fellowships from the Compton and Hewlett foundations.

[1] "Dowry" is defined here as the net transfer at the time of marriage from the bride's family to the groom's; the reverse transaction is a "bride-price." As table 2 below indicates, the average dowry received by a son amounts to 68 percent of his household's assets. Such large sums have been observed to cause considerable hardship to families with daughters to be married (Srinivas 1984).

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Rosen's (1974) implicit market model to the Indian marriage market and tests the model with data from six villages in South Central India and from the Indian census. It is found that a "marriage squeeze" caused by population growth, resulting in larger younger cohorts and hence a surplus of women in the marriage market, has played an important role in the rise in dowries.[2]

Theoretical work on marriage transactions by economists has followed from Becker's (1981) model of marriage. He derives dowry and bride-price as the price of the joint value of the marriage over the utility in the single state of one of the spouses, when the division of "income" within the marriage is inflexible. Subsequently, some researchers have suggested that the rise in dowries was caused by the process of development that reduced the labor force participation rates of women (Rajaraman 1983). However, I am not aware of much empirical work on the subject.[3]

The paper is organized as follows: Section II sketches a theoretical model, describes the data, and develops an appropriate empirical specification; Section III outlines the results and concludes the paper.

II. Theory[4]

Consistent with rural South Asian marriage markets, I assume that marriage decisions are made by the household of each potential spouse. I further assume that the groom household maximizes a utility function that includes as arguments a vector of the desirable traits of the bride and her family, **W**, and consumption goods, X. A groom household's preferences are dependent on a vector of its own characteristics and the traits of the groom, **H**:

$$\mathbf{U} = \mathbf{U}(X, \mathbf{W}; \mathbf{H}). \tag{1}$$

This is maximized subject to a budget constraint that includes a dowry function, which maps differences in the traits of potential brides and grooms to a transfer value:

$$Y^H + \mathbf{D}(\mathbf{W} - \mathbf{H}; \mathbf{R}) = pX, \tag{2}$$

[2] This explanation was first suggested by Caldwell, Reddy, and Caldwell (1983).

[3] Deolalikar and Rao (1990) use the data examined in this paper to estimate the demand of groom households for dowries and brides. Consistent with South Asia's arranged marriage system, we find that grooms and brides are matched by both individual and household traits, and that household characteristics are more valued in the marriage market.

[4] More details of the theoretical model sketched here and of the empirical results can be found in Rao (1990). Rao (1993) explains the cultural and demographic underpinnings of the ideas in this paper. Stapleton (1989) develops a related model that examines the effect of marriage markets on intrahousehold resource allocation.

where Y^H is the premarital wealth of the groom household, and $\mathbf{R}$ is a vector of shifters of the dowry function that are not related to household traits, such as regional variations, caste variations, and the relative numbers of grooms and brides in the marriage market. The nonlinear hedonic dowry function $\mathbf{D}(\mathbf{W} - \mathbf{H}; \mathbf{R})$ maps differences in the traits of potential brides and grooms to a transfer value. If $\mathbf{D} > 0$, a dowry is received by the groom household from the bride household; if $\mathbf{D} < 0$, a bride-price is paid by the groom household to the bride household. Similarly, I assume that the bride household's utility $\mathbf{V}$ is defined over the bride household's consumption C and traits of the groom $\mathbf{H}$. The utility $\mathbf{V}$ shifts with the exogenously given set of the bride's traits $\mathbf{W}$:

$$\mathbf{V} = \mathbf{V}(C, \mathbf{H}; \mathbf{W}). \tag{3}$$

This is maximized subject to the following budget constraint:

$$Y^W - \mathbf{D}(\mathbf{W} - \mathbf{H}; \mathbf{R}) = pC, \tag{4}$$

where Y^W is the premarital wealth of the bride household. The marriage market determines who marries whom and at what price. For a pair of groom and bride households, it occurs at the point at which the ratios of the marginal utilities of spouse traits to consumption, of both households, are equal, while being tangential to the dowry curve. Thus for a given pair of households, equilibrium occurs at the point at which

$$\frac{\mathbf{U}_{\mathbf{W}_i}}{\mathbf{U}_X} = \mathbf{D}_{\mathbf{W}_i} = \frac{\mathbf{V}_{\mathbf{H}_i}}{\mathbf{V}_C} = \mathbf{D}_{\mathbf{H}_i}. \tag{5}$$

As Rosen (1974) demonstrates for a more general implicit market model, the hedonic dowry function $\mathbf{D}(\mathbf{W} - \mathbf{H}; \mathbf{R})$ can be interpreted as the locus of tangencies of the equilibrium matches. It gives the minimum (maximum) transfers available in the market, for each package of $\mathbf{W} - \mathbf{H}$, to bride (groom) households. If there are enough participants in the marriage market, potential partners waiting in the wings (e.g., widowers and migrants) would force this price function to be given exogenously. No bargaining would occur because negotiated dowries that differed from the competitive price would always be bid to a competitive level by another potential partner.[5]

[5] A referee has proposed an alternative to this model. Suppose that a potential groom and his family have traits $\mathbf{X}^m$, and a potential bride has traits $\mathbf{X}^f$. We can ask what the *minimum* dowry D^m is that will induce the man to marry. The dowry D^m is implicitly defined by $U^m(\mathbf{X}^m, \mathbf{X}^f) + D^m = V^m(\mathbf{X}^m)$, where U^m is the utility achievable by the man without a dowry, and V^m is the value of not marrying and continuing with the marital search. Similarly, D^f is the maximum dowry acceptable for the woman in the event of a marriage, such that $U^f(\mathbf{X}^m, \mathbf{X}^f) - D^f = V^f(\mathbf{X}^f)$. If $D^f < D^m$, the marriage

It is straightforward to show that a population with declining mortality will have larger younger cohorts than older ones (Keyfitz 1985). If women tend to marry older men, since the women belong to a younger and hence larger cohort, there will be a surplus of women in the marriage market. The severity of this "squeeze" will depend on the rate of population growth and the average age difference between spouses. Thus reductions in the equilibrium age difference will tend to equalize the excess supply of women in the marriage market.

Consider an equilibrium in the marriage market in which grooms and brides have been matched such that men marry younger women. An exogenous increase in the population growth rate would cause the entry of surplus women, from a younger cohort, into the marriage market. Consequently, the average age of potential brides would decrease, causing their average quality to "improve." This would result in further competition for scarce grooms, which would induce an upward shift in the dowry function. Furthermore, households of older potential brides would be willing to outbid the families of younger brides, since the younger brides would still be capable of searching for mates in a later marriage market.[6] Consequently, younger brides would not find mates in the current marriage market, and the marriage squeeze would be relaxed with a reduction in the average age difference between spouses.[7]

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will not take place; if $D^f \geq D^m$, there will be gains to this marriage and the two parties will bargain over D, settling on a value in the range $[D^m, D^f]$. The expected transfer would be

$$ET = \int_{T_m()}^{T_f()} tg(t; \mathbf{X}^m, \mathbf{X}^f)\,dt,$$

where g describes the distribution of bargaining outcomes. Thus the dowry transfer would be a very complicated function of $\mathbf{X}^m$ and $\mathbf{X}^f$, with a change in either affecting both the limits of integration. In such a model the dowry function is clearly not given exogenously to households but is negotiated between them. Aside from issues of specification, the estimation of the dowry function, which in this case is an approximation of ET, would be affected by selectivity bias because some women would stay single, and only the dowries of successful negotiations would be observed. However, data on unsuccessful negotiations are not available. In India 99 percent of the men are married by the age of 25 and 99 percent of the women are married by the age of 20, giving a very small age window in which men and women can search for a spouse. Thus it would be very difficult to correct for selectivity, and an achievable empirical specification of the proposed model would be similar to the one employed in this paper. Besides, both the competitive implicit market model and the bargaining model would have similar interpretations of the main focus of this paper, the effect of macro variables on the marriage market.

[6] There are severe social and economic pressures associated with having an older unmarried daughter in South Asia (Srinivas 1982).

[7] In fact, the singulate mean age at marriage of women in the region surveyed has gone up from 15.57 years in 1931 to 19.86 years in 1981; for men it has increased from 23.6 years to 25.48 years, resulting in a reduction in the age difference from

Data

The data that will be used to examine this model are taken from a random sample of 40 households per village, from six villages in three districts of rural South Central India. The surveys were conducted by the International Crops Research Institute for the Semi-arid Tropics (ICRISAT). The institute initiated a household and agriculture survey in these villages in 1975 for a period of 5 years in three villages and for 9 years in another three; in 1983 it conducted a retrospective survey on marriage.[8]

Information on age distributions, to give an idea of demographic patterns, and ratios of male to female labor force participation were gathered for each of the three districts from the census of India from 1921 to 1981. After putting all the information from the various sources together and eliminating those households with missing data, one is left with a sample of 141 households, spread more or less evenly across the three districts, for the analysis. Most marriages had transactions on both sides associated with them, reflecting ritual gift exchanges between the two families. To isolate the "price" component of the transfers, to the extent possible, I look at the net value of the transfer, that is, transfers received by the grooms minus transfers paid. Additionally, to get real values of the dowry transactions, all transfers have been valued at the 1984 rupee value of gold.

Estimation

A quadratic specification of the dowry function is estimated as

$$\begin{aligned}\mathbf{D} = A &+ B^{1i}(W_i + \mu^{W_i} + \mu^i - H_i - \mu^{H_i} - \mu^i) \\ &+ B^{2i}(W_i + \mu^{W_i} + \mu^i - H_i - \mu^{H_i} - \mu^i)^2 \\ &+ B^3\mathbf{R} + B^4 S + (\boldsymbol{\delta}^{\mathbf{W}} + \boldsymbol{\delta} - \boldsymbol{\delta}^{\mathbf{H}} - \boldsymbol{\delta}) + \epsilon,\end{aligned} \tag{6}$$

where the i terms index a particular trait, the μ terms represent measurement error, the $\boldsymbol{\delta}$ terms represent a vector of unobserved individual traits that affect the dowry, S is the marriage squeeze index, $\mathbf{R}$ is a vector of region dummies and the labor force participation

8.03 to 5.62 years. As Bergstrom and Lam (1991) show, following Pollak's (1990) two-sex model, it takes very small adjustments in the average age difference between spouses to achieve equal numbers in the marriage market under reasonable regimes of population growth and average age difference.

[8] The districts are Akola and Sholapur in Maharashtra and Mahbubnagar in Andhra Pradesh. Despite being retrospective, the marriage data are probably accurate. In South Asia, marriage costs typically have a substantial impact on a household's assets, and marriage is the central event in the life of most women. See Walker and Ryan (1990) for a description and analysis of other aspects of the ICRISAT sample.

TABLE 1

PEARSON CORRELATIONS

A. GROOM AND BRIDE TRAITS

	BRIDE			
GROOM	Age	Height	Parents' Land at Age 15	Years of School
Age	.70	−.02	−.02	−.03
	(.00)	(.83)	(.79)	(.69)
Height	−.08	.37	.21	.09
	(.33)	(.00)	(.00)	(.23)
Parents' land at age 15	−.09	.31	.40	.31
	(.19)	(.00)	(.00)	(.00)
Years of school	−.06	.18	.40	.42
	(.38)	(.02)	(.00)	(.00)

B. TRAIT DIFFERENCES

	"Youth" Difference	Height Difference	Land Difference	School Difference
"Youth" difference	1.0			
Height difference	−.02	1.0		
	(.85)			
Land difference	−.11	−.09	1.0	
	(.15)	(.26)		
School difference	−.17	.04	−.01	1.0
	(.02)	(.58)	(.88)	

NOTE.—The probability that the null hypothesis $\rho_0 = 0$ cannot be rejected is in parentheses.

ratio, and ϵ is the truly exogenous random error term. All the trait differences are specified as female − male. Since this specification differences the traits of brides and grooms, the sources of error common to both husbands and wives (μ^i and δ) are eliminated. Thus if there is a common measurement error in surveying husbands and wives, it is differenced out. The identical components in the unobserved traits are also eliminated; for instance, if grooms are just as handsome as their brides are beautiful, unobserved beauty is differenced out. Part A of table 1 shows that assortative mating is very high across all the traits. Thus a specification that included the traits of both spouses as explanatory variables, without differencing them, could be potentially affected by multicollinearity. A specification that includes the traits as differences gets around this problem by focusing on the impact on relative differences between the traits of the spouses.[9]

[9] Also, the correlation between observed differenced traits is low enough (see part B of table 1) that it is likely that the differences in observed traits would be poorly correlated with differences in unobserved traits.

The choice of the marriage squeeze indicator takes some care, since it has to indicate the relative numbers of men and women who attain marriageable age in a particular cohort. To correspond with the ages at which the largest proportion of women and men get married, I use the ratio of women in the 10–19 age group to men in the 20–29 age group in each of these districts during the census year closest to their year of marriage. The ratio of female to male labor force participants is also used as a shifter of the dowry function to get at the question of the relative reduction in female economic status over time.[10]

III. Results

Table 2 gives the standard deviations and means of the variables used. There is substantial variation in the net dowry transfer, and the mean marriage squeeze ratio indicates that, on average, there are 1.22 men for every woman in the marriage market. It is important to note that this is also an area in which female mortality at younger ages exceeds male mortality (Miller 1981), resulting in more men than women in the *total* population almost since the turn of the century. Thus a surplus of women over men at marriageable ages indicates population growth fast enough to outweigh the fact that there are more women than men in the *same* age cohort. There is evidence of a significant increase in net real dowry transfers over time: The Pearson correlation of the net dowry transfer and year of marriage is .15, with a probability of nonrejection of the null hypothesis of .02.

Figure 1 provides more information about the time-series and cross-sectional variation in the sex ratio. Mahbubnagar district seems to have undergone the earliest turnaround in the ratio in favor of men between 1941 and 1961, followed by Sholapur between 1941 and 1961, and Akola in 1961. The most likely explanation for this is that the districts experienced mortality declines in the late 1920s, 1930s, and 1950s, respectively. Rates of permanent interdistrict migration are rather low in all three districts (Walker and Ryan 1990), indicating that migration is unlikely to be a factor in explaining the variations. Similarly, since total sex ratios and sex ratios in the same age groups are not very different across the districts, sex differentials in mortality are not likely to explain much of the variation either.

[10] The second step of hedonic estimation procedures would require using consistent estimates of eq. (6) to estimate marginal valuation conditions, which would regress the derivatives of each trait on household characteristics. However, as Epple (1987) and others have observed, without the right instruments, it can be very difficult to get unbiased and consistent estimates of marginal valuation regressions, and I therefore do not estimate them.

TABLE 2

MEANS AND STANDARD DEVIATIONS OF VARIABLES

Variable	Mean	Standard Deviation
Net dowry transfer (1984 rupees)	4,792.19	32,835.99
"Dowry" (percentage of assets before marriage)	67.77	106.61
Groom's age at marriage	21.07	4.78
Bride's age at marriage	14.40	4.89
Age difference (wife minus husband)	−6.67	3.48
Groom's schooling (years)	2.57	3.35
Bride's schooling (years)	.82	2.01
Difference in schooling	−1.75	2.89
Groom's height (cm)	162.24	6.21
Bride's height (cm)	149.44	4.78
Difference in height (cm)	−12.80	6.40
Groom's father's landholdings when groom was 15 (hectares)	14.28	35.56
Bride's father's landholdings when bride was 15 (hectares)	14.05	45.24
Difference in landholdings (hectares)	−.23	43.92
Year of marriage	54.15	10.36
Ratio of number of women aged 10–19 to men aged 20–29 in the district	1.22	.13
Ratio of number of female workers to male workers	.61	.39
Mahbubnagar district	.34	
Sholapur district	.37	
Akola district	.29	
Highest caste rank	.39	
Second caste rank	.18	
Third caste rank	.23	
Lowest caste rank	.20	

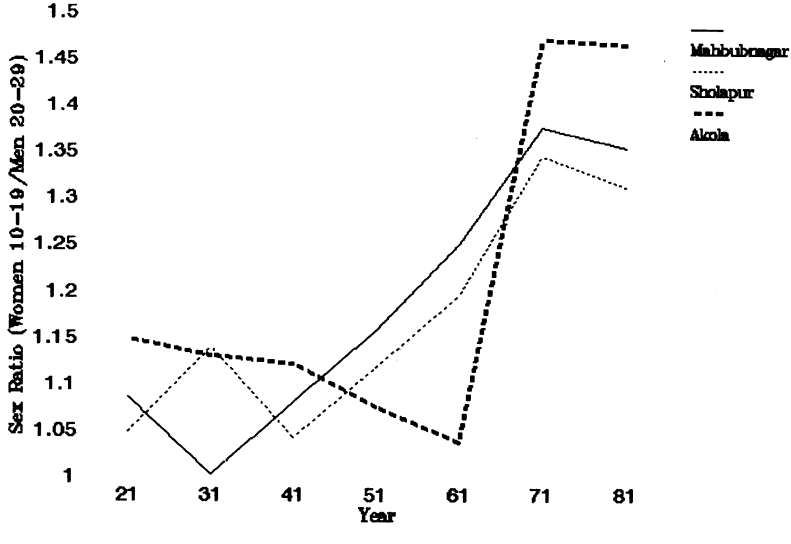

FIG. 1.—Sex ratio (women 10–19/men 20–29)

The estimates of the dowry function are reported in table 3: column 1 reports estimates excluding year of marriage, column 2 includes it, and column 3 includes it with its square and cube. The district sex ratio, which is an index of the degree of the marriage squeeze, is significantly associated with increases in net real dowries. This suggests that an increase in the number of women in the marriage market relative to the number of men causes dowries to go up. This result does not seem to be merely capturing unexplained variations over time. Including a variable for the year of marriage, as shown in column 2, does not considerably change the coefficient of the sex ratio, and column 3 demonstrates that including squared and cubed terms of the marriage year raises the coefficient of only the sex ratio. The effect of the labor force ratio, however, is not significant, disputing the idea that a reduction in the relative female labor force participation rate has had an effect on dowries.

The difference in land owned by the parents of each spouse before the marriage significantly reduces net dowries. It is interesting to note that none of the individual traits of the bride and groom such as schooling or height seems to matter. While this might be a result of the small sample size, it may also indicate that household characteristics matter more in choosing mates in the Indian marriage market. The estimated effect of the age difference is also not significantly different from zero. The effect of the small sample size is probably made worse in this case by a great deal of measurement error in the variable. Surveys and censuses conducted in India have long been notorious for misreporting age (Dandekar 1966) since birth dates are rarely recorded. Consequently, it is difficult to detect anything meaningful about age effects.[11]

The marriage squeeze mainly manifests itself in these regions by forcing dowries to rise and reducing age differences between spouses. However, a surplus of women in the marriage market should, more generally, shift the distribution of marital resources in favor of men. Divorce in these regions is practically nonexistent and rates of polygamy are very low, but figure 2 indicates that men at the fringes of the marriage market may find it easier to find a spouse. It plots the ratio of unmarried widowed men and unmarried widowed women against time. In all three districts, this ratio has significantly declined between 1961 and 1981, which is consistent with the notion that the

[11] In theory one could use instrumental variable methods to correct for misreporting of age, but in practice it was not possible to find an appropriate instrument. However, Rao (1993) presents estimates of the effect of the marriage squeeze on the singulate mean age at marriage, calculated from census data, which show that age differences at marriage are significantly reduced by increases in the number of marriageable women.

TABLE 3

ESTIMATES OF THE DOWRY FUNCTION (Ordinary Least Squares)

Variable	1	2	3
Intercept	−97,254.00	−105,951.00	−23,476.00
	(2.9)	(2.7)	(1.8)
Husband's age minus wife's age	1,080.09	1,626.34	1,711.36
	(.5)	(.7)	(.7)
Wife's height minus husband's height (cm)	−453.29	−579.35	−247.47
	(.3)	(.4)	(.2)
Wife's parents' land minus husband's parents' land (hectares)	−280.99	−291.58	−285.21
	(2.8)	(2.9)	(2.8)
Wife's schooling minus husband's schooling (years)	−1,570.31	−1,748.23	−1,788.34
	(1.0)	(1.1)	(1.1)
(Age difference)^2	−28.13	−48.04	−51.93
	(1.0)	(.4)	(.4)
(Height difference)^2	−52.21	−55.25	−36.47
	(1.0)	(1.0)	(.7)
(Parents' land difference)^2	.80	.81	.78
	(2.5)	(2.5)	(2.4)
(Schooling difference)^2	−100.69	−104.82	−107.34
	(.6)	(.6)	(.6)
District sex ratio (females 10–19/males 20–29)	67,143.00	60,692.00	78,287.00
	(2.8)	(2.4)	(2.8)
District labor force ratio (females/males)	−460.58	307.85	2,056.67
	(.1)	(.0)	(.3)
Year of marriage	...	257.92	−7,944.70
		(.8)	(.8)
(Year of marriage)^2	...	...	192.20
			(1.0)
(Year of marriage)^3	...	...	−1.40
			(1.1)
Sholapur district	11,726.00	11,537.00	12,055.00
	(1.7)	(1.7)	(1.8)
Akola district	27,746.00	25,839.00	28,830.00
	(3.4)	(3.0)	(3.3)
Highest caste rank	10,155.00	8,703.29	9,967.27
	(1.2)	(1.0)	(1.2)
Second caste rank	564.59	−672.72	−116.30
	(.1)	(.1)	(.0)
Third caste rank	−1,608.78	−2,663.41	−2,279.89
	(.2)	(.3)	(.3)
$\bar{R}^2$	.141	.139	.141
F-statistic (prob > F)	2.5	2.4	2.3
	(.002)	(.003)	(.004)

NOTE.—t-ratios are in parentheses; number of observations is 141.

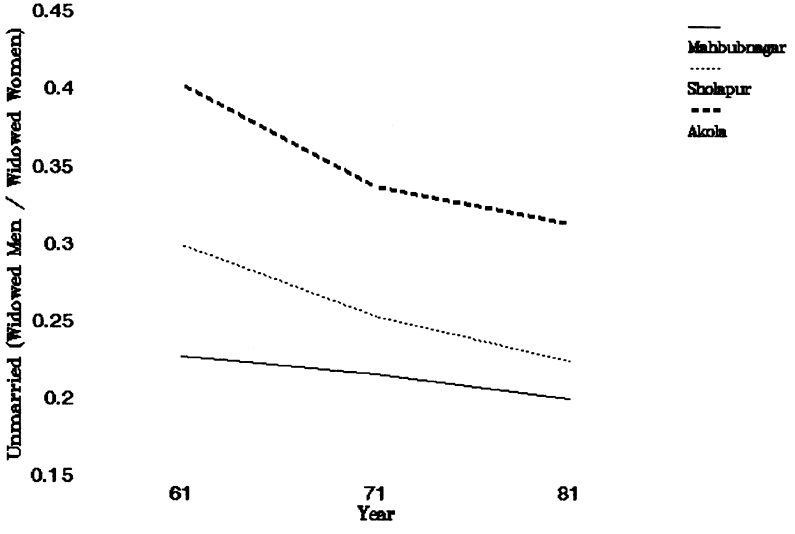

FIG. 2.—Ratio of unmarried widowed men to unmarried widowed women

remarriage rates of widowers have gone up relative to the remarriage rates of widows.[12]

To conclude, this paper attempts to investigate the basis for the observed rise in the real value of dowries in South Asia. A hedonic dowry function is estimated with a small sample of marriages in South Central India. The empirical results support the hypothesis that population growth, and the consequent increase in the size of younger cohorts, resulted in a surplus of women in the marriage market, which played a significant part in the increase in dowries.

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[12] The reduction in the ratio of unmarried widowers to unmarried widows could also have been caused by decreases in the number of widowers relative to the number of widows, but this is unlikely. The declines in the age difference between spouses, in fact, should have increased the number of widowed men relative to the number of widowed women.

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