Marriage Markets and the Rise of Dowry in India

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Abstract

Dowry payments are an important part of household finances in India, typically exceeding a year of earnings. This paper uses a large historical data set to document new facts on the emergence of dowry. We show that the proportion of Indian marriages with dowry nearly tripled between 1930 and 1975, with a similar expansion in the size of dowry payments. We test numerous prominent theoretical models of dowry, and find that most cannot explain the observed changes. The rise of dowry in India is best explained by shifts in the earnings distribution of grooms in a search model of marriage markets.

1 Introduction

One of the most significant financial transactions for Indian households occurs at the time of marriage. Dowry, transfers from the household of a bride to that of her groom, are nearly universal in contemporary India and typically exceed a year of household earnings. The Indian government considers the payment of dowry to be a major social ill, but its legislative efforts to ban dowry have proven ineffective. Previous studies have documented the negative consequences of dowry, such as encouraging sex-selective behavior (Alfano, 2017; Bhalotra et al., 2018; Borker et al., 2017) and violence against women (Bloch and Rao, 2002; Sekhri and Storeygard, 2014). Despite this
evidence on the consequences of dowry, there are many conflicting theories on why dowry exists and what factors determine the dowry payments. Understanding which theory best explains dowry is important for designing policy responses to mitigate its negative consequences.

In this paper, we use data on over 70,000 marriages across India to document new facts about the evolution of marriage practices in India over the twentieth century. Some practices have not changed: for example, marriages are almost entirely arranged by the parents of the couple, marriage markets remain concentrated within small geographical areas, and 94% of marriages occur between individuals from the same jati (sub-caste). While those customs have not changed, there have been large shifts in dowry practices. Dowry transfers typically include both cash payments and gifts of physical items, such as jewelry or kitchen utensils. In the 1920s, dowry was paid in around 37.5% of marriages, but between 1940 and 1975, dowry was rapidly adopted across all of India; dowries have remained almost universal since then. To the best of our knowledge, this is the first quantitative evidence on the scale, timing, and geography of adoption of dowry across India.

In the post-1945 period, the size of dowry payments began to rise, a phenomenon termed “dowry inflation” (Caldwell et al., 1983; Rao, 1993b). While there is a common perception that the magnitude of dowry payments have continued to increase through the present day (Deolalikar and Rao, 1995; Anderson, 2003, 2007a; Bhaskar, 2016), the data instead indicate that the real value of dowry payments actually fell in the post-1975 period. The richness of the data permits decomposition of changes across the full distribution of dowry payments. In the pre-1975 period, the increase in dowry is initially driven by a shift in the right tail of the dowry payment distribution, followed by increases throughout the distribution. There is then a decline in the upper percentiles of dowry payments in the post-1975 period, with little movement in other parts of the distribution.

These patterns motivate the second portion of the paper, which investigates the root causes of the rise of dowry. We test five prominent theoretical models of dowry, many of which have never been empirically scrutinized, to determine if they can explain the observed patterns. First, one of

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1The 1994 Survey of Women and Fertility (SWAF) asks directly about whether particular items were given as gifts as part of dowry. These gifts rarely included transfers of land (1.2% of marriages), and at the time of the survey, also rarely included large consumer goods such as cars or motorcycles (1.2%), TV/VCRs (2.5%), or refrigerators (2.1%). On the other hand, nearly all weddings featured gifts of jewelry (91%), kitchen utensils (94.5%), and clothing (95%). Other relatively common dowry items include furniture (49%), radios (33%), bicycles (32%) and livestock (20% in Uttar Pradesh). Over the 1965-1993 period, the fraction of marriages in which each of these are given is roughly constant, with decreases in the frequency of livestock transfers and increases in the frequency of consumer goods such as bicycles, furniture and radios.
the most prominent theoretical debates around dowry is whether it stems from a parental desire
to bequeath resources to their daughters (e.g. Botticini and Siow 2003) or is a market clearing
payment for grooms in a competitive marriage market (e.g. Becker, 1973). The data broadly
support the latter model – theories of bequest cannot rationalize the rapid and massive increase in
dowry. Such an increase would have to come either from increases in family wealth, which are small
over this time period, or the desire to provide daughters with a greater share of the inheritance,
which is inconsistent with other family investment decisions.

Second, another well-known explanation for increases in the prevalence of dowry is the Sanskritization hypothesis of Srinivas (1984). This theory proposes that dowry was always practiced among the upper castes and spread as lower castes began to emulate upper caste practices. This emulation is attributed to low caste groups attempting to increase their social status (“Sanskritize”) by emulating practices of upper caste groups. We show that this theory cannot explain the rise of dowry since both low and high caste groups began wide-scale adoption of dowry at around the same time, with only slightly higher initial rates of dowry payment among upper castes.

Third, a number of papers rationalize changes in dowry as the result of population growth affecting sex ratios on the marriage market (e.g. Rao 1993b; Billig 1991, 1992; Dalmia and Lawrence 2005; Sautmann 2011). Men marry at older ages than women, so when there is population growth, this generates a surplus of women on the marriage market. In the resulting “marriage squeeze”, competition over scarce grooms could cause an increase in dowry. Previous research has documented associations between surpluses of women on the marriage market and increases in dowry using small data sets of fewer than 200 individuals (Rao, 1993b), but with some debate over whether such associations exist (Edlund, 2000). Using our larger data set, we find that sex ratio in the marriage market is not related to increases in the prevalence or size of dowry. Instead, the “squeeze” is relieved by a shrinking in the age gap between men and women at the time of marriage, as proposed theoretically in Anderson (2007b). Thus population growth cannot explain the historical rise of dowry.

Fourth, Anderson (2003) proposes a matching model in which dowry inflation results from the process of modernization in a caste-based society. In this model, dowry is an equilibrium payment from a bride to match with a groom of a particular market value. Brides prefer to marry wealthier and higher caste men, while men only care about the dowry they will receive. As modernization
leads to increased dispersion in wealth, there is a corresponding increase in the spread of dowry values. Dowry inflation occurs because of the pressure placed on dowry payments within a particular caste grouping by brides from lower castes. We empirically test one of the key predictions of this model, that increased dispersion in groom quality among lower castes will lead to dowry inflation among higher castes. We do not find evidence of this type of cross-caste competition, likely since households actually prefer marrying within their own caste group rather than with those of higher caste status (Banerjee et al., 2013). As a result, this also cannot explain the rise of dowry.

In contrast, we show that shifts in the distribution of groom characteristics over this period can explain the rise of dowry. Starting in the 1930s and 1940s, primary education became more widely accessible, with a class of higher earning becoming available to Indian men (Srinivas, 1984). If higher earning grooms command higher dowries, then as their numbers increase, this could cause dowry values to rise. Using variation in dowry payments between immediate family members on the marriage market within the same five-year period, we establish that the quality of a groom is a significant determinant of dowry. Taking advantage of caste-based segmentation in marriage markets, we demonstrate that this is not due to the groom’s “rank” relative to other grooms in their state-caste group (quality relative to other caste group members), which would not lead to dowry inflation. Instead, the return to quality is based on absolute level of quality (in this case, years of education). Thus dowry inflation will occur as the pool of high quality grooms expands.

One remaining question is why there is a decline in dowry payments in the post-1975 period. We create and test a search model of marriage markets to explain this phenomenon, building on the matching model of Anderson and Bidner (2015). In our model, potential grooms and brides are matched and bargain over dowry. If the potential bride and groom agree on a dowry, they marry; if not, they rematch with other partners. Higher quality grooms receive higher dowries because brides have a higher utility from matching with them, and so brides prefer to marry them at higher value dowries rather than re-match to a new potential groom. However, as the proportion of higher quality grooms increases, there is a higher probability of a bride meeting a high-quality groom if the bride rematches. As a result, the dowries commanded by higher quality grooms go down, consistent with the observed decline in higher value dowries. We find this exact pattern in the data: as the pool of educated grooms in an area increases, this decreases the dowry premium that more educated grooms receive. While the model of Anderson and Bidner (2015) points to
groom quality shifts as contributing to dowry inflation, the competitive pressure across grooms in the search model can better explain the full trajectory of dowry payments over the past century.\footnote{In the main text of the paper, we omit discussion of a few other theories of dowry inflation for the sake of brevity. For example, dowry sizes might rise with changes in the price of commodities typically given as part of dowry, such as gold (given in over 90\% of marriages with dowry). Bhalotra et al. (2018) show that increases in the price of gold leads to increases in the size of dowry payments, but gold prices were almost completely stable between 1945 and 1967, increasing only in the post-1970 period (World Gold Council, 2019). As a result, the price of gold could not have been a major influence on the main rise of dowry in the 1950s and 1960s. See F.1 in the online appendix on the authors’ websites for further discussion of this and some less prominent theories.}

Our paper makes a number of contributions to the literature. First, we provide a thorough characterization of Indian marriage markets throughout the twentieth century and document novel facts on how dowry has evolved over time. These contrast with and augment the small empirical literature on dowry in India, which has been based on data sets that are either relatively small or do not span all of India (Rao, 1993b; Edlund, 2006; Arunachalam and Naidu, 2008; Sautmann, 2011). Dowry has been shown to affect a wide range of economic activities and behaviors (Alfano, 2017; Bhalotra et al., 2018; Bloch and Rao, 2002; Borker et al., 2017; Sekhri and Storeygard, 2014; Anukriti et al., 2019), and so better understanding of how dowry evolves can help explain historical shifts in practices such as sex-selection. It also may explain other economic phenomena for which there has been less empirical work on the direct role of dowry, such as investments in female and male children.

Second, due to a lack of comprehensive, large scale data on dowry payments and marriage patterns, the literature on the causes of dowry in India has been primarily theoretical (Anderson, 2003, 2007b; Anderson and Bidner, 2015; Becker, 1973; Bhaskar, 2016; Botticini and Siow, 2003; Choo and Siow, 2006). Our paper applies data to identify which theories actually explain dowry. We find that while the matching model of Anderson and Bidner (2015) can explain part of the changes in dowry observed in the data, use of a search model provides relevant additional insight. Understanding the theoretical underpinnings of dowry matters for the design of anti-dowry policies: for example, if we had found that dowry emerged for social signaling reasons (Sanskritization), then the policy recommendation might be for anti-dowry campaigns to focus on changing norms among higher status individuals. Instead, the economic logic of dowry as groom price suggests that campaigns to change norms are likely to be ineffective in reducing dowry prevalence. Other approaches, such as increasing female labor force participation in skilled sectors, are likely to be more effective.
The remainder of the paper is organized as follows. Section 2 discusses the data used in the paper, while section 3 uses that data to document stylized facts on the nature and evolution of marriage markets in India since 1930. Section 4 provides tests of existing theories of dowry, as well as constructing and testing a search model of Indian marriage markets. Section 5 concludes.

2 Data

The analysis in this paper is primarily based on data from the Additional Rural Incomes Survey/Rural Economic and Demographic Survey (REDS), a detailed panel survey of rural households conducted by the National Council of Applied Economic Research (NCAER) across the 17 most populous states in India.\(^3\) The 1999 and 2008 rounds of the survey collected detailed information on the marriages of the household head, their parents, their brothers and sisters, and their sons and daughters, which we combine for a data set of over 74,000 marriages. The data include the monetary value of transfers made from the household of the bride to that of the groom in each marriage, as well as from the household of the groom to that of the bride. For reasons described below, we primarily use data from the 1999 wave of the REDS survey, but also use data from the 2008 round in robustness checks.

[insert table 1 here]

The REDS data has substantial advantages relative to data sources used in earlier empirical work on dowry in India. The most widely cited empirical articles on marriage in India have been based on data collected in 1983 by the International Crops Research Institute for Semi-arid Tropics (e.g. Behrman et al. 1999; Deolalikar and Rao 1995; Edlund 2000, 2006; Rao 1993b; Rosenzweig and Stark 1989). These data only contain 127 observations on dowry between 1923 and 1978 from six villages across three districts in South India (see Edlund (2006) for descriptive statistics). These may not be representative of larger trends across the country, particularly given India’s cultural and regional heterogeneity. Due to the small sample size, we do not use the ICRISAT data in this

\(^{3}\)Data was collected in 1969-1971, 1982, 1999 and 2008. The 2008 wave is sometimes referred to as the 2006 round of the ARIS/REDS survey, but 84% of responses are from 2008, so we refer to it as the 2008 round in this paper. Jammu and Kashmir was surveyed in the earlier waves of the REDS survey, but not in 1999 due to an ongoing local insurgency. Even with Jammu and Kashmir excluded in the 1999 data, the 16 surveyed states contain roughly 96% of the population of India.
The REDS records data on the nominal value of the gifts and cash transfers from the household of the bride to that of the groom at the time of marriage, as well as from the household of the groom to that of the bride. We define the value of dowry as the net value of gifts/payments made to the household of the groom at the time of marriage minus those made to the household of the bride (as opposed to the gross transfer from the household of the bride to that of the groom), as this is the standard definition in the literature (e.g. Rao (1993b); Edlund (2006)). Using either gross dowry or net dowry has little effect on the results since the value of transfers from the groom’s household are much smaller than those from the bride to the groom. We use the wholesale price index to translate these into real values and study the evolution of the real value of dowry over time.\footnote{Another source of data was collected by the National Council of Applied Economics Research in 1995 from two states in India (Anderson, 2007a; Dalmia, 2004; Dalmia and Lawrence, 2005; Sautmann, 2011). We also do not use this data since it cannot be used to document all-India patterns and lacks significant coverage of the pre-1970 period, when most of the changes in dowry practices occur.}

The REDS data contains information on marriages even for family members who have died, avoiding mortality-related attrition.

In five states (Andhra Pradesh, Gujarat, Maharashtra, Orissa and Tamil Nadu), there were inconsistencies in how the REDS surveyors administered questions related to dowry (see appendix section C.1 for details). In those states, we can observe whether dowry was paid, but do not consistently observe the amount of the payment. We thus use data from these states when examining whether dowry was paid in a marriage, but drop these states in any analysis on the amount of dowry payments. While this means that the data on dowry payment amounts is not fully representative of India, it does cover a large majority (69%) of the population. However, given that the trends in whether dowry was paid are similar for these five states and the rest of India (figure A2), the analysis on dowry amount most likely also applies to these five states.

We combine the REDS data with two other data sources that measure demographic factors that may be relevant to marriage markets. The first of these is the Census of India, a survey of...
all Indian households conducted every 10 years by the Government of India. In our analysis on
how sex ratios affect dowry, we construct sex ratios using the district-level population counts of
men and women in different age groups from the Census rounds between 1961 and 1991. Each
census round has tables giving the current population of men and women in five-year age bins in
each district at the time of each census (e.g. males and females aged 0-5, 5-10, 10-15, etc. in West
Godavari district). In a robustness check, we also use data from the 1991 Census that contains the
number of men and women in one-year age bins in each district.

The second data set is the National Sample Survey (NSS), a large, repeated cross-sectional
survey also administered by the Government of India. We use the NSS data to estimate the
sex ratios and educational attainment of men and women on the marriage market. We pool five
NSS rounds that collect information on every member of a surveyed households, including state
of residence, broad caste grouping (divided into general caste, other backwards classes (OBC),
scheduled castes (SC), and scheduled tribes(ST)), religion, gender, education and birth year. This
generates a data set with 2.4 million observations. We use this data to estimate the distribution
of educational attainment for brides and grooms on the marriage market within a particular year,
state, religion, and caste group (e.g. Hindu Scheduled Caste grooms and brides in Uttar Pradesh
on the marriage market in 1975). The pool of men and women defined to be “on the marriage
market” in a given year is women between the ages of 13 to 20, and men between the ages of 18
to 25. On average, data from 1368 men and 1422 women is used to estimate the distribution of
educational attainment in a particular state-religion-caste-marriage year.

We use three additional sources of data for descriptive information on Indian marriage mar-
kets: (i) the Indian Human Development Survey (IHDS); (ii) the National Family Health Surveys
(NFHS); and (iii) the Survey of Women and Fertility (SWAF, Smith et al. (2000)). The first two
are multi-round, representative surveys conducted across India. Researchers from the University of

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7We re-weight according to the weighting file to produce representative figures for the entire population.
8In cases where the NSS data contains fewer than 100 men or 100 women in a particular state-religion-caste-
marriage year, we do not calculate the distribution of educational attainment due to concerns about the accuracy of
the estimates. In practice, results are nearly identical if we do calculate the distribution of education attainment in
these cases, since this restriction only affects approximately 1500 observations in the REDS data.
9See http://ihds.info/
10See http://rchiips.org/nfhs/
11See http://swaf.pop.upenn.edu/ for data and details. This data has also been used by Arunachalam and Logan
Maryland and the National Council on Applied Economics (NCAER) administer the IHDS, which interviews a panel of approximately 41,000 households over two waves (2005 and 2011).\textsuperscript{12} India’s Ministry of Health and Family Welfare coordinates the NFHS, which has completed three publicly released waves of data collection: 1992-93, 1998-99, and 2005-06. In each round of the survey, around 90,000 married women were surveyed about their marriage and family. This is an excellent source of information on age of marriage and fertility, but is limited in scope since it contains no information on dowry payments. The SWAF was collected between 1993 and 1994 in two districts in Tamil Nadu (1,551 households) and two districts in Uttar Pradesh (895 households). It contains retrospective information on selecting a bride/groom, marriage practices, and the dowry and gifts exchanged at the time of marriage. However, it does not contain information on the total value of dowry payments made. Nearly all of the SWAF data is from marriages after 1975, so it is not useful for detecting historical patterns. Broadly, we use these three sources to describe changes in Indian matrimonial markets over time and for robustness checks.

Given the lack of extant historical data on dowry, we use retrospective data on dowry payments in the REDS. One concern is that respondents may be unable to properly recall dowry transactions, but there are a numerous reasons to think that recall should be relatively good. First, given the importance of marriage, events around the time of marriage will be particularly salient to households. Second, the sheer scope of dowry payments makes it likely that respondents will recall them, similar to asking a home owner in the developed world what they had paid for their house years prior. Appendix C.2 discusses possible biases and tests the quality of the retrospective dowry data. Our first test takes advantage of the panel nature of the REDS survey: since respondents were interviewed in 1999 and 2008 and asked similar questions about dowry payments, a systematic recall bias (or any temporal bias) would lead to differences in responses to the 1999 and 2008 waves of the survey. We find that responses are quite similar and cannot reject that they are the same on average.

As a second check, we use data from the SWAF. The SWAF conducts separate interviews with husbands and wives, but asks a series of identical questions about whether particular items were

\textsuperscript{12}While the IHDS data have been used in other papers on dowry, this survey only collects respondent’s perceptions of the average dowry payments at the time of the survey (2005 and 2011), rather than actual payments made. Given the lack of either historical data or data on real dowry payments, it cannot be used for the main analysis in this paper.
given as part of the dowry in their marriage.\textsuperscript{13} If recall were poor, then we would expect that the answers of the two to be poorly aligned. Instead, responses are identical in 87.8% of cases. It is particularly notable that there is nearly no decline in the match rate between couples whose marriages occurred well before the survey and whose marriages were just a year before the survey (online appendix figure A4). This increases our confidence in the validity of using retrospective dowry about dowry: while recall might be poor for less significant economic transactions, it does not appear to be so for one as large and important as dowry.

3 Marriage Markets in India: 1930-present

3.1 Marriage Practices

Marriages in India are nearly all monogamous and fewer than 1\% end in divorce (NFHS, 2006). Parents play an important role in choosing the bride/groom – in over 90\% of marriages between 1960 and 2005, parents chose the spouse (IHDS, 2005). Over 90\% of couples live with their husbands' family after marriage (\textit{patrilocal endogamy}) and over 85\% of women marry someone from outside their own village (IHDS, 2005). While brides move outside of their village, they don’t move far: 78.3\% of marriages are within same district (REDS, 1999), with an average travel time of 3 hours from the household of the bride to that of the groom (IHDS, 2005).\textsuperscript{14}

One of the most significant features of the Indian marriage market is caste. Indian society has traditionally divided individuals in different sub-castes (\textit{jatis}), based on the traditional occupation of their ancestors within a village economy (e.g. leather workers, blacksmiths). Individuals have a strong preference for marrying within their own \textit{jati}, or sub-caste group (Dugar et al., 2012; Banerjee et al., 2013), where Banerjee et al. (2013) find that the preference is so strong that a woman would be indifferent between a husband from the same \textit{jati} with no education and a husband from a different \textit{jati} with a master’s degree. In both the REDS and IHDS data, the prevalence of marriages across caste boundaries is incredibly low in rural areas, with only 6\% of

\textsuperscript{13}The items included are land, jewelry, cash, a vehicle such as a car, a TV, furniture, a radio, utensils, a bicycle, livestock and clothing.

\textsuperscript{14}One might think that the advent of information communications technology would expand markets and thus distances over which marriages are made, but we find no changes in the average distance between bride and groom households over time. This is consistent with earlier literature on the role of social connections in screening prospective partners (Rosenzweig and Stark, 1989). See section §F available at the author’s website for figures showing these trends over time.
marriages occurring between individuals from different sub-castes.\textsuperscript{15} There is no change in inter-caste marriage in rural areas between 1930 and 2011, with only a slight increase of 2 percentage points in urban areas (appendix figure A1).

In recent years, there has been interest in assortative matching in marriage markets, with increased positive assortative matching highlighted as a reason for increases in developed country income inequality (e.g. Eika et al. (2019); Greenwood et al. (2014)). In India, female labor force participation is low, so positive assortative matching on education need not have as substantial implications for income inequality. However, it is still useful to note whether the presence of dowry payments reinforces or reduces the assortativity of matching. Matches are positive assortative: a man with no education virtually always marries a woman with no education, whereas those with higher educational attainment tend to marry women with some education. Online appendix F.2 follows the methodology in Eika et al. (2019) and shows that assortativeness of matching has increased over time. In a traditional matching model, the increase in positive assortative matching implies that there has been an increase in the complementarity of male and female education. This may have occurred because children’s education became increasingly important, and so families place a higher value of educated wives to educate children (Behrman et al., 1999).

3.2 Dowry Prevalence and Size

Since the seminal work of sociologist M.N. Srinivas, conventional wisdom has been that dowry payments became more prevalent in India over the twentieth century (Srinivas, 1976, 1984; Rajaraman, 1983; Billig, 1992). Srinivas (1984) states that dowry was initially prevalent among higher caste groups, while low caste groups instead engaged in payments of brideprice (i.e. transfers from the households of grooms to those of brides), an assertion that we will return to in section 4. However, these claims are based on small qualitative studies of particular villages, which may not be representative of all of India; to the best of our knowledge, there is no quantitative evidence on the size of

\textsuperscript{15}The concept of \textit{varna}, which divides caste groupings into five levels (Brahmin, Kshatriya, Vaishya, Shudra, Untouchable), is often used as a method of categorization. Instead of \textit{varna}, we define levels on the caste hierarchy along the ARIS-REDS categories of Brahmin, non-Brahmin upper caste, scheduled caste, scheduled tribe, other backwards class, and non-classified members of the major religious groups (Hindu, Muslim, Sikh), and check what percent of marriages involve couples from different groups. Only 2.4\% of marriages occur between individuals from different broad categories, with no change over time.
and timing of shifts towards dowry in India. Using data from the 1999 wave of the REDS data, we focus on three stylized facts with regard to the evolution of dowry payments in India:

**Fact #1:** On the extensive margin, there was a rapid increase in the prevalence of dowry payment between 1935 and 1975. After 1975, dowry payments were nearly universal.

**Fact #2:** On the intensive margin, dowry payments rose across all parts of the distribution between 1945 and 1975. This is initially driven by an increase in the upper tail of the distribution, followed by a shift in the bottom half of the distribution. Post-1975, there was a decline in mean dowry payments, driven by declines in the prevalence of larger dowry payments. The lower percentiles and the median of the distribution of dowry payments were mostly unchanged.

**Fact #3:** Median dowry payments were around twice average annual income in the 1960s. Payments declined over time as a fraction of income, and were around 1.2 times average annual rural earnings in 1990.

Figure 1 shows the prevalence of dowry over time (Fact #1). Before 1930, only 38% of households engaged in the payment of dowry, but this increased to 88.2% by 1970 and has remained relatively steady since then. The timing of adoption is also consistent with ethnographic evidence, such as Srinivas (1976) noting adoption of dowry in the 1940s. This raises one of the central questions of the paper: what drove the sudden rise of dowry in the post-1940 period?

The existing literature on dowry payments in India has focused on the intensive margin of dowry payments, i.e. the size of dowry payments made by those who are paying dowry. It is commonly thought that the size of dowry payments has increased over time (Billig 1991, 1992; Epstein 1973; Rajaraman 1983; Bhaskar 2016; see Anderson (2007a) for a review). Quantitative evidence for this claim comes from Rao (1993b), who finds aggregate increases in dowry size over time, but

16 Arunachalam and Logan (2016) address a similar question on whether the motivation for dowry transfers has shifted from bequest to groom price in Bangladesh, and do find some shifts, but look entirely within among households that paid dowry rather than the entire population. Ambrus et al. (2010) study the emergence of dowry in Bangladesh as the result of legal changes around the mehr, which governs transfers at the time of divorce in Muslim marriages. This legal shift did not occur in India (and most Indians are Hindu, so the institution of mehr is not relevant) and so their analysis cannot be applied to the adoption of dowry in India.

17 Appendix figure A2 shows the geographical heterogeneity in adoption of dowry. Some states, such as Himachal Pradesh and Madhya Pradesh had near universal payment of dowry over most of the sample period, while others, such as West Bengal, had consistently lower rates of dowry payment than the rest of the country.

18 One concern is that the pattern could be produced by poor recall, where individuals have systematically worse recall in earlier periods and hence state they did not pay dowry. The data separates non-payment and non-recall of dowry: the rate of non-recall is quite low and not skewed towards older marriages (see appendix figure A3).
based on a very small sample (the ICRISAT data, i.e. 127 marriages in three districts). We consider dowry size between 1930 and 1999 in the 1999 wave of the REDS data, which has three key advantages over existing research. First, its coverage is much broader. Other research on the evolution of dowry in India is based on either extremely small sample sizes (Edlund, 2000; Rao, 1993b), only has data from a few states (Sautmann, 2011; Arunachalam and Logan, 2014), or only describes the period after which dowry was already universal (Anukriti et al., 2019). Second, all of the existing literature has considered the size of payments made by those paying dowry, but not the extensive margin of dowry payment. Due to the enormous changes on the extensive margin over time, it is important to include these changes. Third, we consider how the overall distribution of dowry payments has changed, rather than just the mean, since focusing only on the central moments masks important patterns.

Figure 2 plots the median real dowry payment (inclusive of payments of zero) as a three year moving average. Dowry size steadily rises in the post-1950 period, but has not consistently grown in real value since around 1970. This is a stark contrast to popular accounts, which suggest more continuous increases in dowry payments over time. This discrepancy may be because individuals think in nominal rather than real terms (Shafir et al., 1997), as there have been large increases in dowry in nominal terms.

![insert figure 2 here]

Figure 3 plots the full probability density function of dowry payments by decade between 1940 and 1999. Between the 1940s and 1950s, the median of the distribution shifts upwards, along with some increase in the upper tail. Between the 1950s and 1960s, the entire distribution of dowry payments shifts outwards, with the largest increase in the upper tail of the distribution. In the 1970s, there is some outwards shift around the 60th to 70th percentile of the payment distribution.

\[\text{[insert figure 2 here]}\]

\[\text{[insert figure 3 here]}\]
with stagnation elsewhere. Following the 1970s, there is a clear decline in dowry in the upper half of the distribution, while among the bottom 35% of payments, there is no shift at all. This decline will be discussed in section 4.5.

Finally, we document trends in dowry payment as a fraction of average annual earnings.\footnote{For average annual earnings, we calculate the average daily rural agricultural wage by state using the National Sample Surveys between 1960 and 1995. The REDS data is entirely rural, so it only makes sense to include rural wages. Since wages in the NSS and dowry in REDS are both recorded in contemporary prices (e.g. rural wage in 1956 is reported in 1956 valued nominal rupees), we divide reported dowry payment by the average daily rural agricultural wage multiplied by 300 (working days per year).} Using a three-year moving average, figure 4 shows that dowry payments have declined as a fraction of average annual earnings. Nonetheless, payments are still substantial, with the median payment at between one to two times annual household income.

## 4 Testing Theories of Dowry

There are many theoretical arguments on the evolution and prevalence of dowry practices, with two broad economic explanations for payments at the time of marriage. The first considers dowry to be a pre-mortem bequest, in which parents use dowry to give their daughters their inheritance. This idea is extended by Botticini and Siow (2003), who note that in developing countries with patrilocal endogamy, male children remain part of household production, but daughters do not. If parents passed on part of earnings to their daughters after death, this would disincentivize effort by male children, so it is more efficient to provide the daughter’s inheritance as dowry at the time of separation from the family. Under the second set of explanations, dowry is a price in a two-sided market where brides pay higher prices to match with higher quality grooms (Becker, 1973).\footnote{Depending on the relative values of brides and grooms, payments could also go in the other direction (bride price), where transfers are made from the groom’s family to the bride’s family; the direction of payments may have implications for investment behavior (Ashraf et al., 2019; Corno et al., 2017; Vogl, 2013).} Past research has noted that these explanations need not contradict one another: both bequest and matching motivations may matter, there may be transitions from bequest to matching motivations over time (Caldwell et al., 1983; Kapadia, 1993; Anderson and Bidner, 2015), and there may be
heterogeneity in dowry motives across different families (Arunachalam and Logan, 2016).\textsuperscript{23}

### 4.1 Sanskritization

One of the most widely cited theories in Indian sociology is that of Sanskritization, first proposed by Srinivas (1956) when observing Indian rural villages in the late 1940s and 1950s. The theory states that Brahmins, the priestly caste, traditionally carried out a number of practices that reinforced their elevated caste status, such as payment of dowry, vegetarianism and particular forms of dress (e.g. wearing the “sacred thread”). Srinivas argues that lower castes began to emulate these practices, including dowry, in order to increase their ranking in the caste hierarchy. Other authors have disputed this explanation for dowry. Rao (1993a) argues that the increase in status conferred by dowry could not possibly justify the enormous dowry payments made by households. Caldwell et al. (1983) points out that demands for dowry are typically viewed in a negative light and thus are unlikely to confer higher caste status. However, to the best of our knowledge, no papers have quantitatively tested this hypothesis.

Sanskritization has two main testable predictions with regards to dowry. First, if Sanskritization is to explain widespread adoption of dowry, it must be the case that dowry payments were relatively rare in lower caste marriages and common in upper caste marriages. Figure 5 reports the proportion of marriages with dowry payments over time across four caste groupings in the REDS data. Even in the early time period, upper caste marriages had rates of dowry payments that were only slightly higher than those of lower caste marriages. Table A1 formally tests by regressing an indicator for whether a marriage included dowry payments on a binary indicator for caste grouping, as well as district and time fixed effects. Although upper caste marriages are indeed more likely to involve dowry in the pre-1930 period than lower caste marriages (column (2) of Table A1), the difference is relatively small (5.2%); the difference between Brahmin and non-Brahmin marriages is not statistically significant. All of these facts contrast with the notion of dowry as an exclusively upper caste institution.

A second testable prediction of Sanskritization is that the widespread adoption of dowry across

\textsuperscript{23} Related concepts are used to categorize the components of dowry in India: \textit{stridhana}, gifts from parents to the bride that remain her property (often jewelry or gold) and pure groom price, cash payments that are the property of the groom and his family. Over time, the latter category is speculated to have become increasingly dominant (Anderson and Bidner, 2015). While \textit{stridhana} payments are clearly bequests, payments that appear as groom price may also be bequests, where the family purchases a higher quality groom as their daughter’s inheritance.
India comes from increases in the prevalence of dowry in lower caste marriages. Figure 5 shows graphically that all caste groupings adopt dowry at relatively similar rates, until jointly peaking at near universal adoption of dowry around 1975. Based on Table A1, we cannot reject that the difference in dowry prevalence across lower and upper caste marriages is the same in the 1930s-1940s (2.0 percentage points) as it is in the 1970s-1990s (1.5 percentage points), which is inconsistent with the rise of dowry coming from low castes emulating upper caste practices. These results do not invalidate Sanskritization generally, since it may be that lower caste individuals began to emulate upper caste practices other than dowry. However, Sanskritization cannot explain the broad adoption of dowry practices over the past century.  

[insert figure 5 here]

4.2 Bequest Motives

Under a bequest motive, the dowry given to a daughter equals the amount that parents wish to bequeath to her. It is difficult for such motives to rationalize the sudden and massive increase in dowry between 1945 and 1970. This increase would have to originate from either: (i) an increase in families’ expectation of their future earnings; (ii) an increased desire to bequeath resources to daughters rather than sons; or (iii) a change in how families make bequests to daughters, such as shifting from another type of transfer towards dowry. The first reason is inconsistent with the limited income growth over this period. The Green Revolution in India began in the 1960s and was not anticipated in the 1950s, when much of the increase in dowry began. The second and third explanations imply observable changes in the allocation of family resources. However, any adjustments on these margins would have to be huge to be able to compensate for the large increase in dowry during this period. Male education levels did increase at a faster rate than female education levels over this time period, but the relative costs of school and low baseline rate of women getting any schooling make this explanation unlikely to explain this rise.

Furthermore, if dowry were an inheritance for the daughter, we would expect that she would

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24 One concern is that this finding could be due to recall bias, with upper caste or Brahmins individuals failing to recall dowry payments. However, recall bias would not produce these patterns unless Brahmins were systematically more forgetful (and thus less likely to report historical dowry payments) than other caste groups. If anything, higher rates of education among Brahmins should point in the opposite direction. It is also inconsistent with the slightly lower prevalence of missing responses to questions about dowry among Brahmins relative to other caste groups in the REDS data.
control the dowry transfers. However, the Survey of Women and Fertility data finds that only 9% of wives control the cash component of dowry, where control is mostly split between the husband and/or his family. Data from Behrman et al. (1999) also points to non-bequest motives for dowry. Household heads were asked about the dowries they had paid at the time of marriage of their daughter and the principal reason why the dowries of particular daughters deviated from the average dowry payment. The primary reasons were schooling differences across the daughters (34.1%) and the wealth of the groom (32.7%). It was not common to state bequest explanations for differences in dowry payments, such as favoring one child over another or changes in household finances between the time of each marriage. Even if bequest motives were once the driving factor behind dowry, this may have shifted over time in response to economic forces, as in the model of Anderson and Bidner (2015). While we do not provide a rigorous test of bequest motives, bequest does not appear able to explain the broad adoption of dowry in India.

4.3 Modernization in Caste-Based Societies

Anderson (2003) develops a novel theoretical framework to explain why dowry disappears during modernization in some societies but increases during modernization in others (i.e. India). In this section, we provide a high-level overview of the theory, but mostly focus on testing its empirical predictions. In this model, there are some societies in which individuals are divided into caste groups, where caste is an inherited, hierarchical characteristic, with a universally agreed upon ranking of caste groups. Brides on the marriage market are characterized by their caste and the wealth of their parents, while grooms are characterized by their caste and quality (which is equivalent to their wealth). Matches form between brides and grooms, where a bride makes a dowry transfers to a groom of a particular type in order to match with him. The model assumes that women prefer marrying men of higher caste status and quality, where these characteristics are substitutable with one another. Men are assumed to only care about the dowry they can receive, and so are indifferent to the caste status of their potential brides. In equilibrium, matches are positive assortative on wealth, and the size of dowry transfers are such that a bride married to a particular groom is indifferent between marrying him and the next best groom.

Modernization has two components in the model: increasing average wealth and increasing income dispersion within caste groups, where dispersion is the key driver of dowry inflation. The
highest caste groups are the first to experience modernization/wealth dispersion, and over time, castes of progressively lower ranks also experience modernization. The broad result is that in a caste-based society, the increase in within-caste wealth dispersion leads to inflation in the size of dowry payments. Intuitively, this occurs because of how lower caste brides value upper caste grooms. For the lowest quality grooms within a given caste group of rank \( i \), as part of the wealth dispersion from modernization, their quality/wealth may be lower than that of the lowest quality groom of rank \( i \) in the previous period. However, as a result of the competition over them by brides from the caste group of rank \( (i - 1) \), the dowry they receive does not decline by as much as it otherwise would have.\(^{25}\) This cross-caste competition causes further inflation as increased dispersion in the quality of lower caste grooms will further increase the dowries paid to higher caste grooms.

Fundamentally, the model revolves on the presence of cross-caste competition among brides over grooms. This is manifested in one of the model’s key empirical predictions: dowry values in a caste of rank \( i \) will increase as there is increased dispersion in groom quality/wealth among the castes ranked \( \{1, \ldots, i - 1\} \) in the caste hierarchy below them (Proposition 4(b) in the paper). This occurs because the increased dispersion leads to dowry inflation among the lower caste groups. To maintain incentive compatibility and marriage within caste groups, dowry payments in caste \( i \) will rise in response. We estimate equation 1 to test whether increased dispersion in the groom quality among castes lower in the caste hierarchy affects dowry payments in a given caste group. We use a two-way fixed effects specification with year (\( \delta_t \)) and state-caste (\( \phi_{sc} \)) fixed effects included to account for unobserved heterogeneity over time and space:

\[
y_{msct} = X_{msct} \beta + \alpha Dispersion_{s(c-1)t} + \delta_t + \phi_{sc} + \epsilon_{mdt}
\]

where \( y_{msct} \) is the outcome variable for marriage \( m \) in state \( s \) and caste group \( c \) in time \( t \). We regress this on a measure of dispersion (\( Dispersion_{s(c-1)t} \)) in the caste ranked directly below caste \( c \) in the caste hierarchy, including controls for groom and bride education in marriage \( m \) in \( X_{msct} \).

Panel A of Table 2 uses educational attainment as a measure of groom quality since section 4.5

\(^{25}\)This is the result of two assumptions: brides of lower castes are less sensitive to income differences among higher caste grooms than higher caste brides are; and as part of a concavity assumption on the utility function of brides, the loss to a bride from marrying a groom one rank lower in the caste hierarchy is larger in absolute value than the gain to “marrying up” one rank.
shows a tight link between the level of educational attainment of a groom and the dowry they receive. We use the NSS data to estimate the distribution of educational attainment among men of a particular state-religion-caste group whose age would place them on the marriage market within a particular five year period (1935-1939, 1940-1944, 1945-1949, etc.). We then calculate the mean and standard deviation of that distribution. For general caste grooms, we take the mean and standard deviation of the OBC educational distribution within the same state and five year time period, whereas for OBC grooms, we take the same statistics from the scheduled caste distribution. Scheduled caste and tribes are omitted since there are not identify groups lower in the caste hierarchy than them. We find no relationship between shifts in the mean or standard deviation of the educational distribution among the caste group of rank (c-1) and either the likelihood of dowry being paid or the size of dowry payments for an individual in caste c.

[insert Table 2 here]

Even though groom educational attainment is a strong predictor of dowry amount, one might worry that it does not adequately capture dispersion in groom quality. Panel B conducts an even more direct test, using the distribution of dowry payments among lower caste groups. If the theory in Anderson (2003) is correct, then larger or more dispersed dowry payments in a given caste group should translate into increases in dowry payments among the castes ranked above them in the caste hierarchy. On the other hand, if there is not cross-caste competition for grooms, then dowry payments in a given caste group should not be affected by dowry payments in the castes above or below them. Following a similar process to panel A, we determine the distribution of dowry payments among marriages of each state-religion-caste group over a five year period. We then regress dowry on the median and standard deviation of the dowry distribution among the next lowest state-religion-caste group (e.g. OBC for general caste) in the contemporary period, following equation (1). In addition to controlling for male and female education levels, we also control for the median or standard deviation of dowry payments within the marriage’s own state-religion-caste group in the prior five year period to deal with past common shocks such as economic growth in

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26 We use the REDS to generate the distribution of dowry payments in a particular state-religion-caste group. Since the REDS has significantly fewer observations than the NSS, we estimate the distribution of dowry payments in a given state-religion-caste groups within five year periods; state-religion-caste groups within fewer than 30 dowry payments over a five year period are dropped so that the standard deviation of the dowry payment distribution is calculated reliably.
the state. As in panel A, changes among contemporary lower caste dowries does not affect dowry payments for higher castes, inconsistent with this cross-caste competition mechanism.

More generally, the pattern of dowry inflation observed in India does not match the theory's predictions of how dowry inflation comes to pass. Figure 6 plots the 25\textsuperscript{th}, 50\textsuperscript{th}, and 75\textsuperscript{th} percentiles of the dowry distribution for each year across upper caste (Brahmin and non-Brahmin general caste) and lower caste (OBC, SC, ST) grooms. If the theory is correct, then higher quality grooms within a caste group receive larger dowries: in figure 6, the 75\textsuperscript{th} percentile represents the dowry payments made to higher quality grooms, while the 25\textsuperscript{th} percentile represents the payments made to lower quality grooms. If the theory were correct, then low quality, upper caste grooms should experience dowry inflation that outpaces high quality, lower caste grooms. Instead, we observe that dowry inflation is substantial among high quality, lower caste grooms throughout the time period, whereas for low quality, upper caste grooms (25 percentile of the dowry payment distribution), the rate of dowry inflation is much lower.

While Anderson (2003) provides an elegant and internally consistent theory of how dowry practices might evolve over time, it does not appear to fit the Indian context. The likely reason for this discrepancy is the assumption that female preferences over the caste of their groom are vertical, i.e. they prefer to marry higher caste men, which leads to cross-caste competition over grooms. Banerjee et al. (2013) directly test this assumption, using data from responses to matrimonial advertisements to estimate underlying preferences over prospective partners. This estimation allows for both vertical and within-caste preferences over caste, and finds that Indian households have a strong preference for marrying within their own caste group. The lack of interest in marrying outside of caste precludes cross-caste competition over grooms, meaning that this theory cannot explain dowry inflation in India.

4.4 Marriage Squeeze Hypothesis

A prominent strand of the dowry literature attributes changes in Indian dowry practices to a “marriage squeeze”. This theory, initially proposed by Caldwell et al. (1983), notes that in India, as in many other developing countries, women typically marry at younger ages than men. As a result, if the population of the country is growing, the cohort of men who are on the marriage

\footnote{This need not be true if inter-caste marriage becomes more prevalent, but figure A1 shows that it does not.}
market will be smaller than the cohort of women. This could lead to increased competition over a limited pool of men and result in increases in dowry size. Appendix Figure 7 plots the marriage market sex ratio (number of women aged 10-25 divided by the number of men aged 15-30) and aggregate population sex ratio (number of women divided by number of men) across all of India and by state. Although the aggregate sex ratio is relatively steady over time, the number of marriage age women increases relative to men prior to 1970, and then decreases. This pattern is potentially consistent with the timing of increases and decreases in dowry amounts.

On the other hand, there are theoretical reasons why dowry size may not respond to population growth and sex ratio imbalances. Anderson (2007b) argues theoretically that the marriage squeeze will not cause dowry inflation, but instead shift the age at which individuals marry. If there is a relative scarcity of men at typical ages of marriage, women may marry later or men marry earlier to restore balance on the marriage market instead of dowry size increasing. Bhaskar (2016) extends the Anderson (2007b) model in a dynamic setting to examine the impact of permanent and transitory shocks to cohort sizes on the equilibrium age gap and size of dowry. Under a standard transferable utility framework, he shows that the age gap will be immune to systematic growth in cohort sizes, while there will be an increase (decrease) in dowry paid with positive (negative) growth of cohort size. The paper argues that a transitory shock to cohort size could affect both age gaps and dowry sizes of the nearby cohorts, and the dynamic adjustment will depend on how sensitive cohorts are to age considerations. It is unclear which type of shock is empirically relevant in this context since individuals may not know whether changes in population growth are transitory or permanent.

Rao (1993b) provided the first empirical support for the marriage squeeze theory in India, showing a positive relationship between the marriage market sex ratio and dowry size in the ICRISAT data. In contrast, Edlund (2000) finds no relationship between sex ratio and dowry size with the same data, and points out that the limited sample size of the ICRISAT data makes it difficult to draw definitive conclusions. We use a two-way fixed effects empirical strategy similar to Rao (1993b), with year ($\delta_t$) and district ($\phi_d$) fixed effects to account for unobserved heterogeneity over time and space,

$$y_{mdt} = X_{mdt}\beta + \gamma SexRatio_{dt} + \delta_t + \phi_d + \epsilon_{mdt}$$  \hspace{1cm} (2)
where \( y_{mdt} \) is the outcome variable for marriage \( m \). \( X_{mdt} \) is a vector including the education levels and \( jati \) of the bride and groom in case there are compositional differences in the types of individuals getting married in a particular time year. Sex ratio is estimated using four rounds of data from the Census of India (1961, 1971, 1981, 1991), which provides the total number of men and women in a district within 5 year age bands (e.g. in the district of Agra, the total number of women and women aged 0-4 years, 5-9 years, etc.). In the REDS data, 90% of women married between the ages of 11 and 25, while 90% of men married between the ages of 15 and 31. We group the marriages into five year bins (1950-1954, 1955-1959, etc.) and define the marriage market sex ratio as the number of women aged 10 to 25 in the district divided by the number of men aged 15 to 30 in the same district in that period.

[insert table 3 here]

Table 3 offers little support for the marriage squeeze hypothesis, as there is no statistically significant relationship between marriage market sex ratios and either whether dowry is paid or dowry amount. Anderson (2007b) suggests that the sex ratio pressures will be relieved through changes in the age of marriage. In the REDS survey, the age at marriage is recorded for the household head and their spouse. Columns (3) and (4) of the table use the same specification as in (2), but with the outcome as age at marriage and the marriage age gap (defined as the age of the groom age minus the age of the bride). Results are consistent with Anderson (2007b): as there is an increase in the number of marriage age women relative to men, the gap in bride and groom age decreases. Interestingly, the smaller gap comes from an increase in female age of marriage, suggesting that sex ratio may be responsible for some aggregate increases in marriage age among women over time.\(^{28}\)

The identifying variation for this empirical strategy comes from differential changes in marriage market sex ratios across districts over time. One concern is that these changes may be due to shifts in preferences that affect both gender-specific mortality rates (e.g. sex selective abortion, neglect of

\(^{28}\) Outside of India, other papers have found that imbalanced sex ratios can lead to changes in the ages at which men and women marry, including Bergstrom and Lam (1994) in Sweden, Brandt et al. (2016) in China, Edlund (1999) in cross-country regressions, and Foster and Khan (2000) in Pakistan. However, aside from Rao (1993b), none of these have examined the effect of imbalanced sex ratios on dowry.
female children) and dowry payments. We can directly observe changes in gender-specific mortality by using the contemporaneous sex ratio in a given marriage year, which we define as the ratio of women between the ages of 15 to 20 to men between the ages of 15 to 20. If there were a decrease in the ratio of women relative to men, this would indicate that the survival rate for female children has decreased relative to the survival rate for male children. Results are the same after controlling for contemporaneous sex ratio (table A2). 29

Ideally, sex ratio would be measured using women and men from the same jati and district as the individual in their exact year of marriage. Unfortunately, there are no data sets of sufficient granularity for that measure, so we rely on approaches that approximate this sex ratio. Appendix section D discusses five desirable criteria for constructing marriage market sex ratios and two other data sets that can be used to estimate sex ratios in this context. We carry out robustness checks in which we recalculate the sex ratio based on the other two data sets: the first allows us to construct the age bins at a finer gradation, while the second allows us to construct the sex ratios within broad caste groupings at the state level. Each approach has strengths and weaknesses, but all three yield the same result: no relationship between sex ratio and dowry, and a consistent relationship between sex ratio and age of marriage.

4.5 Shifts in the Distribution of Groom Quality

Finally, we test whether changes in dowry may result from changes in the earnings distribution of grooms, as was initially hypothesized by a number of sociologists (Srinivas, 1984; Caplan, 1984). Prior to the 1930s, the vast majority of rural India was composed of uneducated farmers and agricultural labor. During the 1930s and 1940s, the number of other types of jobs, such as those in the public sector, began to grow. Men in those occupations tend to earn higher and more stable wages, making them more desirable on the marriage market. As a result, competition over these differentiated grooms leads to them receiving larger dowries, and may lead to aggregate dowry inflation.

29 Another concern is that pre-marital investments may respond to sex ratios (Lafortune, 2013), and that dowry in turn responds to those investments. We do not observe a relationship between education and sex ratios when groom education is the dependent variable in the two-way fixed effects specification of (2), indicating that this cannot explain the observed relationship (table OA1). This is likely because it will take time for rural households to recognize shifts in sex ratios (as they will not have access to census data, and only directly observe a small segment of the population in their village) and adjust pre-marital investments accordingly, whereas our empirical strategy relies on short-run fluctuations in sex ratios on the marriage market.
The two-sided matching market model of Anderson and Bidner (2015) is based around this mechanism. In the model, brides and grooms have a single dimensional measure of quality, and dowry transfers are made at the time of marriage. Households can invest in the quality of their offspring prior to entry on the marriage market or instead dedicate those resources towards payments to the other side of the market. In equilibrium, matches are stable, meaning that dowry payments are such that no groom and bride prefer to leave their partners and rematch with one another. The dowry payment to the lowest quality groom depends on a potential bride’s return to marrying them relative remaining single. Dowry payments to higher quality grooms depend on the return to marrying them relative to lower quality grooms. Since an increase in the fraction of more educated potential grooms does not change the outside option value of remaining single or the value of low quality grooms, high quality grooms continue to command a premium even as their numbers grow. As the fraction of grooms who are high quality increase, the average dowry payment will also increase, producing overall dowry inflation.\footnote{Anderson and Bidner (2015) provide additional insight on patterns of pre-marital investments, but that is not the focus of our paper.}

We test this hypothesis indirectly by examining whether there are real returns to groom quality on the marriage market and whether these returns are about absolute or relative level of quality (i.e. marriage market returns to groom quality are due to the groom’s relative position in the distribution of groom quality, or the absolute quality of the groom, such as earnings).\footnote{A direct test of this hypothesis would examine how changes in the fraction of educated grooms are related to dowry size. For this test to be valid, the fraction of educated grooms in an area could not independently be related to economic outcomes in ways that might affect dowry, which is unlikely to be true.} It may be the case that a potential bride only values a groom’s ranking in the distribution of potential grooms (e.g. 95th percentile of educational attainment among men on the marriage market) rather than absolute attainment (e.g. completed university). This would be true if grooms are conspicuous consumption for the bride’s family, where getting a more educated groom matters only for signaling their status. In this case, a shift in the distribution of groom quality need not have an aggregate effect on dowry size. For example, if the educational distribution of men on the marriage market changes so that an man at the 80\textsuperscript{th} percentile has 10 years of education instead of 6 years, the man at the 80\textsuperscript{th} percentile would still receive the same amount of dowry. On the other hand, it is plausible that there are absolute returns to a bride marrying a more educated groom. In a matching model, the premium commanded by a groom depends on the returns to marrying them relative
to outside options. If a groom is able to earn more due to his education, then the bride will gain utility relative to her outside option, and be willing to pay more. If there remains a mass of grooms at the lowest quality rung (landless, illiterate laborers) but an increasing number of high quality quality, there will be aggregate inflation in dowry.

We first examine whether higher quality grooms in fact receive larger dowries. As we do not directly observe the best of measure of groom quality (earnings) in the REDS data, we use education as a proxy measure. For a marriage \( m \) of a groom in household \( h \) of district \( d \) at time \( t \) within the five-year band \( f \), we regress:

\[
y_{mhdt} = \beta_1 e_{mhdt} + \phi_{hf} + \delta_t + \epsilon_{mhdt}
\]

where \( y_{mhdt} \) is the dowry payment (in real terms), \( e_{mhdt} \) is the years of education of the groom, and \( \delta_t \) and \( \delta_{hf} \) are marriage year and household-five year fixed effects respectively. Marriage year fixed effects account for changes in aggregate dowry payments over time. Household fixed effects would remove time invariant differences in dowry payments related to household wealth or tastes over dowry that could be related to groom quality. However, household wealth and attitudes are not static, where a household may be relatively poor and have poorly educated grooms in the 1940s, but become wealthier and educate its grooms in the 1960s. To account for these changes, we include time-varying household-five year fixed effects: i.e. one fixed effect for marriages in that household between 1940 and 1944, another for marriages between 1945 and 1949, and so forth. Under this relatively stringent set of fixed effects, identification is based on whether differences in dowry between brothers married within the same five-year window are related to differences in their education. \( \beta_1 \) is not a causal estimate of the effect of education, since there may be omitted qualities of a groom related to education that allow them to command a higher dowry. But since those omitted characteristics are additional measure of quality that are presumably positively related to education, that is still part of the quality we seek to measure.

The key identifying assumption is that there are not other within-household changes over that five year span that are simultaneously related to dowry and quality of the groom. That is plausible given that education is completed prior to marriage for 97.4% of males in our sample, so any wealth shocks that affected the education of one brother will either have dissipated or, if persistent, affect
both when they later are on the marriage market. Table 4 indicates a substantial premium paid to higher quality grooms, where each additional year of a groom’s education is associated with an increase in dowry of over Rs. 1000 (approximately 4% of the median dowry payment).

There is a large premium for higher quality grooms, but this does not necessarily mean that changes in the groom quality distribution will cause dowry inflation. Taking advantage of the segmented nature of Indian marriage markets, it is possible to separately identify whether dowry is affected by the absolute or relative quality of grooms. We estimate:

\[
y_{mhdt} = \beta_1 \bar{e}_{mhdt} + \beta_2 \tilde{e}_{mhdt} + \phi_{hf} + \delta_t + \epsilon_{mhdt}
\]

where \( \bar{e}_{mhdt} \) is the groom’s percentile rank in the educational distribution of men in his marriage market in the year of his marriage. This is calculated by combining multiple rounds of the National Sample Survey, which contains individual-level data on the age, gender, education, state, and broad identity grouping (caste and religion). Using the NSS data on the education distribution of grooms on the same market as this groom in his year of marriage, we calculate his relative position (e.g. for a scheduled caste Hindu groom who was married in 1984 in Rajasthan, this will be his position in the distribution of education for scheduled caste Hindu males in Rajasthan aged 18-25 in 1984). As before, we include household-five year fixed effects \( \delta_{hf} \), which remove time-varying characteristics of the family that might be related to groom quality.

We are able to separately identify \( \beta_1 \) and \( \beta_2 \) due to the segmentation of marriage markets within identity groups. Suppose that there are two sets of brothers from identity groups A and B. In both sets, the first brother has 8 years of education and the second has 10 years of education. If their percentile ranking were defined with respect to the aggregate educational distribution in the country, then years of education would be almost fully collinear with percentile ranking of educational attainment. However, since they are in different marriage markets, they face different distributions of educational attainment. It might be the case that the brothers from group A are in the 30\(^{th}\) and 50\(^{th}\) percentile of their distribution, while those from group B are in the 70\(^{th}\) and 80\(^{th}\) percentile of their distribution. Intuitively, \( \beta_1 \) and \( \beta_2 \) are derived from taking the difference in
dowry between the two brothers and seeing if that is related to either the difference in their years of education (2 years) or their relative ranking in the educational distribution (20 percent and 10 percent). Table 4 shows that it is the absolute return to education that motivates dowry. Relative rank is individually a strong predictor of dowry size, but once the two are placed in a horse-race, relative rank becomes an insignificant predictor of dowry payments. The dominance of absolute levels of quality as a determinant of dowry will lead to dowry inflation occurring as educational attainment rises (assuming that there remain some fraction of low quality groom, as empirically is the case).

One remaining question is why there is a decline in the fraction of large dowry payments in the post-1975 period, especially given the relative stability in the bottom 40% of the distribution of dowry payments (see figure 3). One possible reason for this pattern is that marriage markets are better characterized by a search model, in which potential grooms are matched to a potential bride in every time period. The pair bargains, and if they are able to agree on a dowry payment, the match is made. If not, then they rematch with another possible partner in the next period and repeat the process. Since brides receive a higher surplus from marrying a more educated groom, these grooms are able to command higher dowries; brides prefer to match with them at higher dowries rather than re-enter the market. As the fraction of educated grooms in the population increases, there are more grooms getting larger dowries (even if the size of the dowry that the individual receives decreases as the number of high quality grooms increases), potentially causing average dowry size to increase. However, there is eventually an inflection point – the premium that high quality grooms command on the market will eventually decrease sufficiently that average dowry begins to decrease. That is because there is now a higher probability of a bride meeting a high quality groom if she rematches, and so the groom has to give up more of his surplus to convince her to match with him. Such a model is consistent with the decline in high-end dowries observed in the data: these high quality men can no longer command large sums because there are more of them around. Appendix E provides a theoretical model that illustrates this dynamic and provides some testable comparative statics.32

For each marriage in the REDS data, we use the NSS data to estimate the fraction of grooms

32Beauchamp et al. (2017), Sautmann (2011), and Vogl (2013) also provide search models of Indian marriage markets, but do not discuss the role of shifts in the quality distribution of grooms on dowry, focusing on different aspects of marital partner quality (e.g. age of prospective partner).
with twelve or more years of education in the same state-religion-caste group as the groom during the five-year period of that marriage. We estimate the relationship:

\[ y_{mhsct} = \beta_1 e_{mhsct} + \beta_2 e_{mhsct} \times (educated\_frac)_{scf} + \phi_{hf} + \delta_t + \epsilon_{mdt} \] (5)

where \( y_{mhsct} \) is the dowry payment (in real terms), \( e_{mhsct} \) is the years of education of the groom, \( (educated\_frac)_{scf} \) is the fraction of prospective grooms within this state-religion-caste over this five year period that have attained twelve or more years of education, and \( \delta_t \) and \( \delta_{hf} \) are marriage year and household-five year fixed effects respectively. The non-interacted term \( (educated\_frac)_{scf} \) is not included since it drops out due to the presence of household-five year fixed effects. We are interested in the sign of \( \beta_2 \), which can be interpreted as how the educational level of other grooms on the marriage market affect the returns to additional education in terms of dowry payments. If \( \beta_2 \) were negative, then this would imply that a higher fraction of educated grooms on the marriage market reduces the dowry premium earned by more educated grooms, as a search model would predict.

In practice, we specify equation (5) using two different definitions of \( e_{mhsct} \): in columns (3) and (4) of table table 5, education is defined as years of education of the groom, while in columns (5) and (6), it is defined as a binary variable for whether the groom has more than the median level of education in the sample. The returns to education decline as an increasing fraction of educated grooms enter the marriage market, although the estimate in one of the four regressions (column 5) is not statistically significant at conventional levels \( (p=0.13) \).

The principal concern with equation 5 is that areas with an increasing fraction of educated grooms may be changing in other ways that affects the returns to education for grooms on the marriage market. For one, groom education is an endogenous choice, where high returns to education on the marriage market may cause a higher fraction of households to invest in groom education. This reverse causality would bias the estimate of \( \beta_2 \) in a positive direction, and so cannot explain the consistently negative estimates of \( \beta_2 \). Areas with faster growth in groom education may also have faster economic growth, which could increase the size of dowries by increasing household wealth or raising the labor market returns to education (Rosenzweig, 2010). Again, the bias in the estimate
of $\beta_2$ would be in the opposite direction of what we observe.\footnote{A final possibility is that the increase in proportion of educated grooms depresses the economic returns to education on the job market (Khanna, 2015), which lowers the marriage market value of educated grooms. Given that this explanation is broadly similar to the search model of marriage markets, we do not seek to disentangle the two.}

Another possibility is that areas with a higher fraction of educated grooms are also areas where the fraction of educated brides has increased. If female education is valued on the marriage market, then a higher proportion of educated brides could depress dowry payments. As a robustness check, we use the NSS data to estimate the fraction of highly educated brides in the same state-religion-caste group during the five-year period in which the marriage occurs. Appendix table A3 adds the interaction between this variable and $e_{mhsct}$ to the regression. One of the $\beta_2$ coefficients is no longer statistically significant (column (1) of appendix table A3), possibly due to the collinearity between the fraction of educated men and women, but the interaction between the fraction of educated women and $e_{mhsct}$ is not statistically significant in any of the specifications. We interpret this as evidence that the observed decline in returns to education are primarily due to the increase in proportion of educated grooms.

## 5 Conclusion

Despite repeated legislative attempts, the Indian government has proven unsuccessful in banning dowry. If policymakers are serious about the elimination of dowry, alternative approaches are clearly needed. Understanding the underlying drivers of dowry payments matters for how such policies should be designed. For example, if dowry emerges because payment of dowry increases social status (Sanskritization), anti-dowry strategy focused on changing norms among high status individuals will be most effective at reducing dowry payments. On the other hand, if sex ratio is a major determinant of dowry, then we might expect that the skewed sex ratios generated by sex selective abortion to lead to the decline and eventual disappearance of dowry. However, this will not be true if marriage markets adjust to sex ratio imbalances through the age at which men and women marry. Finally, if the earnings distributions of brides and grooms determine dowry, then encouraging female labor force participation is a promising strategy for reducing the size of dowry payments.

This paper parses these contrasting theories of dowry. The paper begins by characterizing
how marriage practices have evolved in India over the twentieth century. While many practices have remained static, there were large-scale changes in dowry beginning in the 1940s. Within thirty years, dowry had become nearly universal in marriages across India, and the average size of dowry payments had tripled. While previous work has noted that dowry payments have become more common over time, the REDS data allow us to estimate the magnitude of the phenomenon. Widescale adoption of dowry was not based on lower caste adoption of a higher caste practice of dowry (Srinivas, 1956), but was adopted across different states and caste groups at relatively similar rates. Following the period of dowry inflation, average dowry sizes actually began to fall through the 1980s and 1990s, in contrast with the conventional wisdom of a consistent escalation of dowry values over time in India (e.g. Anderson, 2007a; Bhaskar, 2016). These decreases are concentrated among the upper end of the dowry payments, and as we show, are most consistent with a search model of marriage markets in which grooms are differentiated by quality (as opposed to more standard matching models, e.g. Anderson and Bidner, 2015). Many of the other prominent theories of dowry in India do not match the patterns in the data, though it may be that there are settings outside of India in which they are applicable.

While this paper has addressed a number of the open empirical questions on dowry in India, many others remain open. We have focused on the male side of the marriage market, but it would be helpful to understand how changes on the bridal side of the market affect dowry. Existing evidence points in different directions: for example, Beauchamp et al. (2017) find that higher levels of education for women reduces their value on the marriage market, while Behrman et al. (1999) conclude the opposite. Future research could consider collecting data on dowry payments and marriage market outcomes as part of experiments related to female education, empowerment, or labor force participation to better understand these relationships. Such data would also be informative in documenting whether the observed trends in dowry payments have persisted since the REDS data was collected and extending tests of theoretical models of dowry to the modern era.

34 The main reason for our choice to ignore the female side of the market is the low rate of female labor force participation in India and our sample over this time period. That limits the economic returns to education for women and thus potentially the marriage market returns.

35 To the best of our knowledge, Borker et al. (2017) is the only paper with systematic data on dowry payments since the 2008 round of the REDS data. However, their data comes from a single district in Tamil Nadu, so can’t be used to study nationwide trends.
Given the economic foundations of dowry as groom price, our findings suggest that norms-based approaches to eliminating dowry are likely to be ineffective. Grooms have a strong economic incentive to take dowry, particularly if their family has to pay out dowry for the marriages of female household members (which they could put the received dowry payment towards) or wants to recoup investments in the groom’s education. Families who refuse to pay dowry for their daughters will be left to match with lower quality grooms. Under the current marriage market equilibrium, both brides and grooms have economic motivations to perpetuate the institution of dowry. Future campaigns to eliminate dowry must acknowledge these factors and either successfully shift preferences over dowry on both sides of the market, or address the underlying economic factors that perpetuate dowry (e.g. low labor force participation of women).

References


6 Figures

Figure 1: Prevalence of Dowry from 1930-1995

Figure 2: Dowry Payment By Year of Marriage
Figure 3: Dowry Payment Distribution

(a) Dowry payments 1940-1979

(b) Dowry payments 1970-2008

Figure 4: Income and Dowry Payments
Figure 5: Prevalence of dowry by decade across caste groups

Figure 6: Dowry Payment By Caste and Year of Marriage
Figure 7: Sex Ratio Over Time (Census)
Note: There was no census in 1981 in Assam due to an ongoing insurgency.
### 7 Tables

<table>
<thead>
<tr>
<th>Decade</th>
<th>Pre-1930s</th>
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<th>1940s</th>
<th>1950s</th>
<th>1960s</th>
<th>1970s</th>
<th>1980s</th>
<th>1990s</th>
<th>Total</th>
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<td>3,198</td>
<td>5,586</td>
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<td>15,141</td>
<td>16,559</td>
<td>11,573</td>
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Table 1: Number of Marriages in the 1999 ARIS-REDS data by decade of marriage

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<th>Dowry (=1)</th>
<th>Dowry Value</th>
<th>Dowry Value</th>
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<td>(4)</td>
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#### Panel A: Lower Caste Groom Educational Distribution

<table>
<thead>
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<th>-0.007</th>
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<td>(0.042)</td>
<td>(8.010)</td>
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<th>1.861</th>
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</thead>
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<td>(0.040)</td>
<td>(12.832)</td>
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<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
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</thead>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
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<td>54831</td>
<td>36417</td>
<td>36417</td>
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#### Panel B: Lower Caste Dowry Distribution

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<th>0.252</th>
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<td>(0.001)</td>
<td>(0.290)</td>
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</table>

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<th>0.102</th>
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<tr>
<td>(0.001)</td>
<td>(0.068)</td>
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Standard errors are clustered at the state-caste group level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 

39
<table>
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<tr>
<th></th>
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<th>(4)</th>
<th>(5)</th>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Dowry Value</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age Gap</td>
<td></td>
<td></td>
<td>-3.178**</td>
<td>1.249</td>
<td>4.469***</td>
</tr>
<tr>
<td>Age of Marriage (Male)</td>
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<td>1.938</td>
<td>(1.938)</td>
<td>(1.572)</td>
</tr>
<tr>
<td>Age of Marriage (Female)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>61.13</td>
<td>(0.0931)</td>
<td>(44.40)</td>
<td>(1.565)</td>
</tr>
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<td></td>
<td></td>
<td>(1.565)</td>
<td>(1.572)</td>
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<td>Yes</td>
<td>Yes</td>
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<td>District FE</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year FE</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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</table>

Standard errors are clustered at the district level.

* p<0.10, ** p<0.05, *** p<0.01

Table 3: Sex Ratios and Dowry

<table>
<thead>
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<th></th>
<th>(1)</th>
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<tbody>
<tr>
<td>Groom Education (Years)</td>
<td>1.206**</td>
<td>(0.446)</td>
<td>1.026**</td>
</tr>
<tr>
<td>Groom Education Percentile</td>
<td>14.63**</td>
<td>(6.090)</td>
<td>0.360</td>
</tr>
<tr>
<td>Observations</td>
<td>30923</td>
<td>24760</td>
<td>24574</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Village FE</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Household-5 year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Birth Order FE</td>
<td>Yes</td>
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Standard errors clustered at the district level

Table 4: Education and Dowry
Table 5: Education and dowry within a search model of marriage markets

<table>
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<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
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<tbody>
<tr>
<td>Groom Education (Years)</td>
<td>0.00291***</td>
<td>1.008***</td>
<td>0.00620***</td>
<td>2.128***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.000808)</td>
<td>(0.248)</td>
<td>(0.00188)</td>
<td>(0.634)</td>
<td></td>
<td></td>
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<tr>
<td>Groom Education (Years) X Highly Educated Frac</td>
<td>-0.0160**</td>
<td>-5.318*</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(0.00693)</td>
<td>(2.712)</td>
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<td>Above Median Education (=1)</td>
<td></td>
<td>0.0400***</td>
<td>15.85***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0133)</td>
<td>(3.931)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Above Median Education (=1) X Highly Educated Frac</td>
<td></td>
<td>-0.0751</td>
<td>-41.49***</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>(0.0543)</td>
<td>(15.28)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Standard errors clustered at the district level. All regressions include controls for bride’s education.
A Appendix Figures

Figure A1: Prevalence of Inter-jati Marriage from 1930-1999 (REDS)

The figure gives the percentage of marriages occurring in the five period that are between a bride and groom of the same sub-caste. The rural REDS data has slightly lower rates of within caste marriage than the IHDS rural sample. This is likely because the IHDS explicitly asks individuals whether they married within their caste group (yes/no), whereas the REDS asks about the caste of the bride and groom and we analyze if that is the same. If REDS surveyors made a mistake in even 1% of cases when noting the jati of individuals, this would fully account for the difference between IHDS and REDS. Respondents may also be more likely to respond to the IHDS question framing in the affirmative if inter-caste marriage is socially undesirable.
Figure A2: Prevalence of Dowry Across States
# B Appendix Tables

Table A1: Proportion of Marriages with Dowry (by Caste)

<table>
<thead>
<tr>
<th></th>
<th>Pre-1930s</th>
<th>1930s-1940s</th>
<th>1950s-1960s</th>
<th>1970s-1990s</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
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<td>(4)</td>
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**Panel A: Dowry Prevalence in Brahmin and non-Brahmin Marriages**

<table>
<thead>
<tr>
<th></th>
<th>Brahmin (=1)</th>
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<tbody>
<tr>
<td></td>
<td>0.043</td>
<td>0.016</td>
<td>0.026**</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>(0.031)</td>
<td>(0.018)</td>
<td>(0.011)</td>
<td>(0.006)</td>
</tr>
</tbody>
</table>

Observations: 2260 8770 19962 43766

**Panel B: Dowry Prevalence in General Caste and Lower Caste Marriages**

<table>
<thead>
<tr>
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<th>Upper Caste (=1)</th>
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<tr>
<td></td>
<td>0.052***</td>
<td>0.020*</td>
<td>0.024***</td>
<td>0.015***</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.011)</td>
<td>(0.006)</td>
<td>(0.003)</td>
</tr>
</tbody>
</table>

District FE: Yes Yes Yes Yes
Year FE: Yes Yes Yes Yes
Dependent mean: .38 .53 .77 .87
Observations: 2260 8770 19962 43766

Standard errors are clustered at the district level. Upper caste includes Brahmins and other general caste groups. * p < 0.10, ** p < 0.05, *** p < 0.01.

Table A2: Sex Ratios and Dowry (with Controls for Contemporaneous Sex Ratio)

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
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<th>(4)</th>
<th>(5)</th>
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</thead>
<tbody>
<tr>
<td>Dowry (=1)</td>
<td>-0.0838</td>
<td>30.34</td>
<td>-2.900*</td>
<td>0.574</td>
<td>3.567**</td>
</tr>
<tr>
<td>Dowry Value</td>
<td>(0.100)</td>
<td>(42.50)</td>
<td>(1.535)</td>
<td>(1.946)</td>
<td>(1.764)</td>
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Observations: 51044 34833 5026 5097 5028
Controls: Yes Yes Yes Yes Yes
District FE: Yes Yes Yes Yes Yes
Year FE: Yes Yes Yes Yes Yes

Standard errors are clustered at the district level. * p<0.10, ** p<0.05, *** p<0.01
<table>
<thead>
<tr>
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<td>Dowry Value</td>
<td>Dowry Value</td>
<td>Dowry Value</td>
</tr>
<tr>
<td>Dowry (=1)</td>
<td>0.00592***</td>
<td>2.246***</td>
<td>2.246***</td>
<td>2.246***</td>
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<td>(Years)</td>
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<td>(0.669)</td>
<td>(0.669)</td>
<td>(0.669)</td>
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<td>(Years) X Highly Educated Fraction</td>
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<td>(4.071)</td>
<td>(4.071)</td>
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<td>5.677</td>
<td>5.677</td>
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<td>9.978</td>
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<td>Education X Highly Educated Fraction (Women)</td>
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<td>(33.42)</td>
<td>(33.42)</td>
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<td>42877</td>
<td>29613</td>
</tr>
<tr>
<td>Year FE</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Household-5 year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Birth Order FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Standard errors clustered at the district level. All regressions include controls for bride’s education.

Table A3: Education and dowry within a search model of marriage markets (including control for Female education)
C Data Details

C.1 Data Construction

This appendix describes the issues in the administration of the REDS survey questions on dowry in a few states and how we have dealt with this. On the REDS survey, respondents were asked to give the value of dowry for each of the recorded marriages. We divides these responses into three categories: either the data records that the dowry transfer had a value of zero (i.e. no dowry was given), dowry had a non-zero value, or the dowry value is missing (which is meant to indicate that the respondent did not tell the surveyor the value of the dowry payment). Figure A3 plots the proportion of marriages in each of these categories by state over time. This helps us to identify problems in administration of the survey in each state. We can divide states into 4 categories:

1. Correctly administered: In cases where the survey was fully correctly administered, there should be a low and relatively constant proportion of missing data. That is the case in Bihar, Haryana, Himachal Pradesh, Kerala, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh, West Bengal, and Assam, which jointly account for approximately 69% of the population of India (2011 Census of India).

2. Surveyors correctly recorded whether dowry was paid, but did not ask about the value of dowry in cases when dowry was paid: This is only the case in Maharashtra. Surveyors correctly recorded if dowry was not paid (value of zero), but in nearly all cases where it was paid, they did not record the value. As a result, they recorded a missing value for the dowry payment field in that situation. This pattern is relatively clear in figure A3, as well as when we compare to the 2008 wave of the REDS survey, in which surveyors did record the dowry payment amounts.

3. Significant time trends in missing data over time: the last category contains three states with significant trends in missing data over time: Gujarat, Orissa and Tamil Nadu. In these states, the proportion of missing values is initially low, but then rises sharply over time. This is a less extreme version of what happened in Maharashtra, in which surveyors successfully found that respondents had paid dowry, but were unable to elicit the precise amount; however, there are some cases in which they did record the dowry amount (unlike in
Maharashtra). That interpretation is again supported by comparisons with the 2008 wave of the data from those states.

4. **Surveyors recorded zero dowry payments as missing values:** This occurred in the state of Karnataka, where the data contains missing values in those cases where the respondents did not pay dowry. This can easily be seen in the graph, where no respondents were ever recorded as not paying dowry.

![Figure A3: Missing Dowry Information by State](image)

For analysis on whether dowry was paid, we code missing values in Maharashtra, Gujarat, Orissa, and Tamil Nadu as having paid dowry, and missing values in Karnataka as having not paid dowry. In an online appendix on the authors’ websites, figure OA11 plots the proportion of marriages with dowry over time with data from these five states either dropped or included in the manner described. Patterns of dowry adoption are virtually the same across both sets of estimates. For the analysis on size of dowry, we drop data from Maharashtra, Gujarat, Orissa, and Tamil Nadu due to the inconsistent recording. We code missing values in Karnataka as a payment of zero. In an online appendix on the author’s websites (section F.5), we re-run the main tables, but instead drop all of the dowry data from these five states. The results are nearly identical, indicating that
these coding decisions do not affect our main results.

C.2 Recall Bias

Given the lack of extant historical data on dowry, it is necessary to use retrospective data. However, it is possible that respondents are unable to properly recall dowry transactions, particularly given that many occurred well before the time of the survey. In this context, there are a number of reasons to think that recall will not be a major problem. Marriage is one of the main focuses of life in rural India, and events around that time are likely to be particularly salient. Given the scope of dowry payments, it is likely that respondents will be able to recall them; it would be like asking a home owner in the US what they paid for their house, a number likely to be remembered with ease.

Another issue is that death of potential respondents could bias the estimates. This would be a particular problem if poorer households died at an earlier age, and so the sample of households in the earlier data were systematically different from the households in later data. Fortunately, households are asked about all relevant marriages, even if those individuals have died, and so we have information on the full sample. For the majority of our time period of interest, there is a living member of the couple. Even for marriages occurring between 1940 and 1950, 47% of the relatives on whom the respondent is reporting are still alive, while that figure is 72% for marriages between 1950 and 1960, and 89% for marriages between 1960 and 1970.

We run a number of direct tests of recall bias. The first test takes advantage of the panel nature of the REDS survey. Respondents were interviewed in 1999 and 2008, and asked similar questions about dowry payments at the time of marriage. If there were a systematic bias that emerges over time, we would expect it to emerge in comparisons between the 1999 and 2008 waves of the survey due to the gap in survey administration timings. Ideally, we would compare the recall for a particular marriage within the 1999 and 2006 waves, but it is not possible to match exact marriages across waves of the REDS. We instead take the full distribution of nominal dowry size for each state within five year bands for each wave of the survey (e.g. the distribution of dowry payments in Bihar between 1960-64 in both the 1999 and 2006 waves). We calculate five percentiles of that distribution ($20^{th}$, $35^{th}$, $50^{th}$, $65^{th}$, $80^{th}$) for each state in each five year period and regress the 1999 wave percentiles of the distribution on the 2008 percentiles (e.g. $20^{th}$ percentile of the
dowry distribution in Bihar in 1960-1964 in the 1999 data as compared to the 20th percentile of the dowry distribution in Bihar in 1960-1964 in the 2006 data). This is a relatively stringent test, in which we do not only focus on the central moments, but also other parts of the distribution. Table A4 finds that we cannot reject the null hypothesis that the values of the percentiles of the dowry distribution are on average the same between the two waves.

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.049***</td>
<td>(0.0322)</td>
</tr>
</tbody>
</table>

Observations: 1050
State FE: Yes
Five Year FE: Yes

Table A4: Dowry Payments by State-Year across the REDS rounds

As second check of the validity of retrospective dowry data, we turn to the SWAF. It conducts separate interviews with husbands and wives, but asks a series of identical questions about whether particular items were given as part of the dowry in their marriage. If recall is poor, then we would expect that the answers of the two parties would be poorly aligned: in the extreme where they were guessing on each response, they would match 50% of the time. Instead, their responses are nearly identical, matching in 87.8% of cases. We can also check whether recall of dowry transactions declines over time by checking how match rate varies depending on time elapsed since the marriage. Figure A4 plots the match rate at five year intervals after 1960. It is particularly notable that there is nearly no decline in recall matches between couples whose marriages occurred between 1970-1975 and those whose marriages were within a year of the survey, for whom the mismatch presumably does not stem from memory issues. There is a small decline for marriages occurring between 1965-1970, but the match rate remains exceptional. This increases our confidence in the validity of using retrospective dowry about dowry: while recall might be poor for less significant economic transactions, it does not appear to be so for one as important as dowry.

36 The items included are land, jewelry, cash, a vehicle such as a car, a TV, furniture, a radio, utensils, a bicycle, livestock and clothing
Figure A4: Dowry Recall in the SWAF
D Sex ratio and Dowry

In this paper, we attempt to measure the sex ratio as experienced by a respondent when they participated in the marriage market, and determine if this is related to dowry payments. In an ideal world, we would use data to construct sex ratio that satisfies all of these criterion:

1) **Non-Retrospective Data:** When measuring the population of men and women who were part of the same marriage market as a given individual, we use those within a certain age of the individual. It is strongly preferable to measure these populations at a time close to, or even prior to, the age of marriage, rather than based on the population of men and women within that age band at a much later date (e.g. measuring the population of 35-50 year old men and 30-45 year old women in 1980 and inferring sex ratio in the marriage market in 1960 based on that). The first reason for this is differential mortality by gender between the time of the marriage market and measurement. In particular, India has historically had relatively high rates of maternal mortality in childbirth, and so the number of women aged 35-45 in 1980 might be reduced from the population of women aged 15-25 in 1960.

The second reason is that introduces additional noise into the measurement. It is quite common for individuals in India, particularly in rural areas, to not know the exact year in which they were born. For those under the age of 20, this presents less of a challenge, since it is straightforward to figure out approximate age (e.g. spacing between siblings and age of most recent birth). For older individuals, this is more of a challenge, leading to clustering of ages. For example, it is much more common to observe individuals stating that their age is a quantity ending in 0 or 5 (e.g. 40, 45, 50, etc) at higher ages. By averaging over a range of years (since we consider the marriage market to be the range of years over which an individual of a given gender tends to marry), we partially mitigate the problem, but it is better to use more accurate measurements from younger individuals.

The third reason is that individuals may migrate between the time of marriage and later measurement. Fortunately, long-term migration in India is relatively low relatively to temporary migration, and individuals often migrate within a district or state (such as to a larger metropolitan entity). Nonetheless, if this migration is differential by gender across areas (e.g. one district sends many male economic migrants to Delhi, while another does not), this can skew the measurement of population and sex ratio.
(2) Full Census: In one of our approaches, we combine multiple rounds of nationally representative surveys to estimate sex ratios. These are relatively large samples (in the hundreds of thousands of individuals), but still are derived from less than 1% of the population. On the other hand, the Census of India measures all individuals within a given geographical boundary and age. By using a sample rather than the full population, this can introduce noise into the measurement of sex ratios, particularly given that sex ratios vary within a relatively narrow range.

(3) Jati or Caste-Level Data: As shown in the paper, marriage markets in India are at the jati-level: individuals rarely marry outside their jati and may face significant social sanction for doing so. It would thus be ideal to measure the sex ratio at the jati level. Unfortunately, that is not possible in any of these data sets. The Indian Census no longer collects information at the jati level, or anything more detailed than whether an individual is from a scheduled caste or tribe. While there are some nationally representative surveys with information on jati (e.g. National Family Health Surveys), their samples are too small for reliable inference on sex ratio at the jati-level. Nationally representative surveys such as the National Sample Survey collect information on the broad caste group to which an individual belongs (general caste, other backwards class, scheduled caste, scheduled tribe) and religious affiliation, but that combines a large number of heterogeneous jati groups. Nonetheless, this is likely to be more strongly correlated with jati-level sex ratios than the overall population.

(4) Yearly Data One possible advantage for a data set is that it contains the number of individuals born in a given year, rather than in broader five year bins. This makes it more straightforward to determine the total number of men and women who would have been on the marriage market at the same time as a given individual.

(5) District-level data: As we show in the paper, marriage markets are concentrated within the district: 78.3% of marriages are within the district, and the average distance between the household of brides and grooms is less than 15 miles. It is thus advantageous to measure population at the district-level, rather than state or higher, since there is substantial variation in sex ratio across districts within a state.

Unfortunately, there are no data sets that satisfy all of these criteria, and so we must rely on data sets that approximate the sex ratio. We apply three different approaches to measuring sex ratios, and rerun our analysis with each to check the robustness of our findings.
Method 1: Historical Census Tables (1911-1991) The first method is to use district-level data from the Census of India rounds between 1961 and 1991, as in the text of the paper (table 3). Each census round has tables giving the current population of men and women in five-year age bins in each district at the time of each census (e.g. males and females aged 0-5, 5-10, 10-15, etc. in West Godavari district). With this data, we can construct the sex ratio among marriage aged individuals in a given five period and district.

Method 2: Census Age Tables (1991 Census) Our second method uses data from the 1991 round of the Indian Census. In this data, we observe the full age distribution of individuals by gender at the district level. For example, in West Godavari district of Andhra Pradesh, we observe that living in the district, there are a total of 37,120 men and 36,260 women who were born in 1975, 40,850 men and 36,240 women born in 1976, 35,474 men and 35,170 women born in 1977, etc. This data does not identify population by caste or religion. It is based on a 10% sample of individuals in major states and an 100% sample in smaller states for a total of 108.4 million records, or approximately 250,000 individuals per district. While technically not a complete census, it is a sufficiently large sample to get precise estimates of the population by age group. With this data, we construct the sex ratio for marriages in a given year and district as the number of women aged 13-20 divided by the number of men aged 18-25 in that year; this more precisely measures the pool of individuals who are most likely to be on the marriage market.

Method 3: Pooling Nationally Representative Surveys The third approach takes multiple rounds of the National Sample Survey (rounds 38 [1983], 43 [1987-88], 50 [1993-4], 55 [1999-2000], 62 [2005-6]) and combines them to estimate the total population of men and women born in a given year. In this data set, we observe the current state, district, caste, gender, religion, education, and birth year of a given individual. We reweight according to the associated weight file to produce population-valid values. Even though pooling the NSS data produces approximately 1.5 million observations, we can only generate estimates of sex ratio at the identity group-state level: doing so at a lower level of aggregation such as district would not have enough observations.37

37This approach is similar to that of Anukriti (2013), which looks at the effect of sex ratio imbalances at birth on age of marriage. She finds, as we do, that more imbalanced sex ratios are related to the age of marriage. However, we use marriage market sex ratios rather than sex ratio imbalances at birth. Changes in sex ratio imbalances at birth can only be explained by changes in sex selection, which is likely to be endogenously related to dowry through shifts.
We divide the data into 11 religion-caste based identity groupings: Hindu-Scheduled Tribe (ST), Hindu-Scheduled Caste (SC), Hindu-Other, Muslim-SC, Muslim-Others, Sikh-SC, Sikh-Others, Christian-ST, Christian-Others, and Other Religions. The Others caste grouping aggregates OBC and General caste individuals, since we don’t observe OBC status in early rounds of the NSS. We then take sex ratio estimates for each identity group at the state-level for any cell in which we have at least 5000 total observations. This ensures that there are enough observations to calculate an accurate measure of sex ratio for that state-identity group level in fine time increments. After doing this, 88% of the identity grouping cells in which we observe sex ratio are either Hindu (any caste) or Muslim-Others. Such a rule allows us to observe identity groupings that may be common in some states but not others: for example, Christian STs are relatively common in the state of Jharkhand. With this data, we construct the sex ratio for marriages in a given year, state, and identity grouping as the number of women aged 13 to 20 divided by the number of men aged 18 to 25 in that year, identity grouping and state.

Table A5 summarizes how each of the approaches matches the ideal criteria. The historical census approach matches the highest number of criteria, so we include that in the text of the paper. Tables A6 and A7 rerun the sex ratio regressions using data from methods 2 and 3. In both tables, sex ratios affect the age at which marriages occur, but are not related to dowry payments on either the intensive or extensive margin. In table A7, the decreased gap in marriage age comes from a decrease in the age at which grooms marry, as opposed to an increase in bridal age (as seen in the text of the paper). Given the smaller sample sizes in the marriage age regressions, it is possible that we are underpowered to detected which side of the marriage market is adjusting, and in fact both bride and groom age adjusts. It is encouraging to see that the main result, a shrinking gap in marriage age between brides and grooms, remains steady across different methods of constructing sex ratio.
### Table A5: Advantages and Disadvantages of Population Data sets

<table>
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<th>Census Age Tables (1991)</th>
<th>Pooled National Surveys</th>
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<td>Caste Grouping-level Data</td>
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<tr>
<td>Yearly Data</td>
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Table A6: Sex Ratio Regressions (1991 Census Age Tables)

<table>
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<tr>
<th></th>
<th>(1) Dowry (=1)</th>
<th>(2) Dowry Value</th>
<th>(3) Age Gap (Male)</th>
<th>(4) Age of Marriage (Male)</th>
<th>(5) Age of Marriage (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex Ratio</td>
<td>-0.000331</td>
<td>15.68</td>
<td>-1.044**</td>
<td>-0.264</td>
<td>0.572</td>
</tr>
<tr>
<td>(0.0254)</td>
<td>(10.66)</td>
<td>(0.444)</td>
<td>(0.564)</td>
<td>(0.485)</td>
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<td>Observations</td>
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<td>5558</td>
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<td>5561</td>
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<tr>
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</tr>
<tr>
<td>District FE</td>
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<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
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</table>

* p<0.10, ** p<0.05, *** p<0.01

Table A7: Sex Ratio Regressions (Pooled National Sample Survey)

<table>
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<tr>
<th></th>
<th>(1) Dowry (=1)</th>
<th>(2) Dowry Value</th>
<th>(3) Age Gap (Male)</th>
<th>(4) Age of Marriage (Male)</th>
<th>(5) Age of Marriage (Female)</th>
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<tbody>
<tr>
<td>Sex Ratio</td>
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<td>11.47</td>
<td>-0.943**</td>
<td>-1.328**</td>
<td>-0.317</td>
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<td>(0.0266)</td>
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<tr>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year FE</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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</tr>
</tbody>
</table>

Standard errors are clustered at the district level.
* p<0.10, ** p<0.05, *** p<0.01
E Theoretical Model

Setup. Consider a simple two-period search model of the marriage market. There are two types of grooms \( j \in \{H, L\} \) where the fraction of \( H \)-type grooms is equal to \( \alpha \). There is no differentiation in the quality of the bride. A groom of type \( j \) has an outside option of remaining single and receiving utility \( v_j \). The outside option of a single bride is normalized to 0. In each period \( t \), brides and grooms costlessly search in the marriage market and randomly meet a potential partner.

If a couple decides to marry, they receive a (present-discounted) lifetime utility of \( y_j > v_j \), which is shared \( \lambda \) and \( (1-\lambda) \) between the bride and groom respectively. Assume \( y_h - v_h > y_l - v_l \) i.e. marital surplus is higher for a \( H \)-type couple than a \( L \)-type couple. In period \( t \), a bride pays dowry \( d_{jt} \) to groom \( j \), where \( d_{jt} \) is determined in equilibrium. There are no separations/divorce after marriage. Given this setup, we find the equilibrium dowry payments using backward induction to solve the model.

**Terminal period \((T)\):** In the last period, a bride matched to a groom of quality \( j \) will marry if the utility from marriage is greater than staying single i.e. \( \lambda y_j - d_{jT} \geq 0 \). This implies that the maximum dowry she is willing to pay is \( d_{jT} \leq \lambda y_j \). Similarly, a groom of type \( j \) will choose to negotiate (and potentially marry) a bride as long as \( (1-\lambda)y_j + d_{jT} \geq v_j \), which implies that \( d_{jT} \geq \lambda y_j - (y_j - v_j) \). Putting it together, any \( d_{jT}^* \in [\lambda y_j - (y_j - v_j), \lambda y_j] \) will result in a match. Let \( \theta \) be the bargaining power of the groom and define \( A_j \equiv y_j - v_j \). Therefore, the optimal dowry paid by a bride to a groom of type \( j \) and hence, the utility of the bride \((U_{jT})\) and groom \((V_{jT})\) can be given by:

\[
\begin{align*}
    d_{jT}^* &= \lambda y_j - (1-\theta) A_j \quad \text{(Equilibrium dowry)} \\
    U_{jT} &= (1-\theta) A_j \quad \text{(Utility of the bride)} \\
    V_{jT} &= v_j + \theta A_j \quad \text{(Utility of the groom)}
\end{align*}
\]

---

38 A two-period model is sufficient to provide the insights on how equilibrium dowry payments evolve as the ‘type’ of grooms change. We later discuss the implications of the model for \( T > 2 \) periods.
**Penultimate period:** In the penultimate period, assume with a probability $\varepsilon$ that negotiations between the bride and groom fail\(^{39}\) so they search in the terminal period. Therefore, a groom of type $j$ will search in the penultimate period as long as

$$\varepsilon V_{jT} + (1 - \varepsilon) \left[(1 - \lambda)y_j + d_{jT-1}\right] \geq V_{jT}. \tag{6}$$

Substituting from 6 and simplifying, we have that a groom will search as long as:

$$d_{jT-1} \geq d_{jT}^* \tag{7}$$

Let $\alpha_T$ be the fraction of $H$-type grooms in period $T$ where $\alpha_T = f(\alpha, \varepsilon)$ and is determined in equilibrium. Given $\alpha_T$, the expected utility of the bride from searching in the last period, is given by:

$$E(U_T) = \alpha_T \times \frac{(1 - \theta)A_h}{=} + (1 - \alpha_T) \times \frac{(1 - \theta)A_l}{=} > 0 \tag{8}$$

Therefore, a bride matched to a groom of type $j$ will negotiate as long as $\varepsilon E(U_T) + (1 - \varepsilon) \left[\lambda y_j - d_{jT-1}\right] \geq E(U_T)$. Using (6) and (8) and simplifying we get:

$$d_{hT-1} \leq d_{hT}^* + (1 - \alpha_T)(1 - \theta) \left[A_h - A_l\right] > 0 \tag{9}$$

$$d_{lT-1} \leq d_{lT}^* - \alpha_T(1 - \theta)(A_h - A_l) \tag{10}$$

From (7) and (10), note that for a bride matched a $L$-type groom, there will be no equilibrium dowry that will be mutually acceptable. This is because a groom can get $d_{lT}^*$ in the terminal period. A bride on the other hand would be willing to pay less than $d_{lT}^*$ because she has a chance of matching with a $H$-type groom in the last period. For a bride matched with a $H$-type groom on the other hand, from equations (7) and (9), the equilibrium dowry will be given by:

\(^{39}\)This can be rationalized by a utility shock either equal to zero or a large negative value, so that marriage will never be acceptable to the couple. In an extension, we generalize $\varepsilon$ to follow a continuous distribution $F(\varepsilon)$. This does not alter the insight of the model.
\[ d_{hT-1}^* = d_{hT}^* + \theta(1 - \theta)(1 - \alpha_T)(A_h - A_l) \] (11)

In equilibrium, \( H \)-type grooms will enjoy a premium over \( d_{hT}^* \) because in the last period, there is a chance that the bride will match with a \( L \)-type groom and enjoy lower marital surplus. Lastly, let \( N_j \) be the number of \( j \)-type grooms. Therefore, in equilibrium since a fraction \( \varepsilon \) of the \( H \)-type grooms match and none of the \( L \)-type grooms match:

\[
\alpha_T = \frac{\varepsilon N_h}{\varepsilon N_h + N_l} = \frac{1}{1 + \frac{1}{\varepsilon} \times \frac{1 - \alpha}{\alpha}}
\]

where \( \partial \alpha_T / \partial \alpha > 0 \) and \( \partial \alpha_T / \partial \varepsilon > 0 \), which are both intuitive.

To summarize, \( L \)-type grooms receive a dowry \( d_{lT}^* \), given in equation (6). However, \( H \)-type grooms receive a dowry greater than \( d_{hT}^* \), where the premium depends (among other parameters) on \( \alpha \). Lastly, the model can be extended to periods \( t < T - 1 \). Intuitively, early in the search (low \( t \)), the premium captured by the \( H \)-type grooms will be lower since the bride has more chances of matching with a \( H \)-type groom in the future. However, as \( t \to T \), this premium will start increasing.

**Impact of an increase in \( \alpha \) on average dowry:** Let us now examine what happens to average dowry as the fraction of \( H \)-type grooms (\( \alpha \)) increase. From the above, the average dowry \( \mathbb{E}(d) \) as a function of parameters \( \{ \alpha, \varepsilon, \theta \} \) can be given by:

\[
\mathbb{E}(d) = \alpha \left[ d_{hT}^* + (1 - \varepsilon)\theta(1 - \theta)(1 - \alpha_T(\alpha, \varepsilon))(A_h - A_l) \right] + (1 - \alpha)d_{lT}^*
\]

Figure A5 plots average dowry as \( \alpha \) increases. There are two forces at play: first, as the proportion of \( H \)-types increases, the average dowry increases since the \( H \)-types get more dowry. On the other hand, the premium commanded by the \( H \)-type is decreasing as \( \alpha \) increases.
Figure A5: Average dowry as $\alpha$ increases

Parameter values: $y_h = 10; y_l = 5; v_h = 2; v_l = 1; \theta = 0.5; \lambda = 0.4; \varepsilon = 0.1.$