E C O N O M I C S B U L L E T I N

A game model of dowry determination in an arranged marriage context

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Abstract

In many arranged marriage contexts, a mediator assists the bride and the groom's families in determining the actual amount of the dowry. Although social scientists in general and economists in particular have studied many aspects of dowries, to the best of our knowledge, the nature of the interaction between a mediator and the two concerned parties has not been analyzed previously in the literature. Therefore, the purpose of this paper is to analyze a simple game model of dowry determination. Specifically, we first solve for the Nash equilibrium pair of final dowry offers from the two concerned parties. Next, we show how the equilibrium dowry offers optimally trade off the desire to make an assertive offer with the likelihood that this offer will be selected by the mediator.

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1. Introduction

The word "dowry" refers to a practice in Hindu society in which payments in cash and/or kind are made by the family of the bride to the family of the groom at the time of marriage. Because most marriages in Hindu society in a country like India are arranged, the practice of dowry has a fundamental connection with the custom of arranging marriages for one's children.[1] Sheel (1999) has noted that the origins of the phenomenon of dowry can be traced back to Vedic times in which expensive clothes, jewelry, and other items were frequently given voluntarily to both the bride and to the groom's families during the so called *kanyadan* or "giving the daughter away" ceremony. As such, the original purpose of dowry was to sanctify material wealth and also to augment one's status at the time of marriage.

In contemporary times however, the practice of dowry has changed substantially. In a disproportionate number of arranged marriages in India and elsewhere, dowry payments are anything but voluntary. In addition, Leslie (1998) and other have pointed out that such payments are now often used by the groom's family to impoverish the bride's family by extracting large amounts of cash and/or material resources as a precondition for marriage. The groom's family is able to do this because women tend to occupy an inferior position in India's patrilineal kinship and family system.

The actual amount of the dowry that is demanded in any particular instance is closely related to the economic and to the social status of the groom's family. In this regard, Sheel (1999, p. 18) tells us that the higher the socioeconomic status of the groom's family, the higher is generally the demand for dowry. This state of affairs naturally gives rise to two questions: First, how do the concerned parties come to an agreement over the actual amount of the dowry payment? Second, if a mediator is used, what is the nature of the interaction between this mediator and the bride and the groom's families?

Extant research by social scientists in general and economists in particular provides a clear answer to the first question and this answer is twofold.[2] We learn that in some arranged marriage settings, the bride and the groom's families directly negotiate with each other to determine the amount of the dowry. However, Jaggi (2001) and Reddy (2002) have clearly noted that in many other arranged marriage settings, the two concerned parties conduct the negotiations with the help of a *mediator*. This leads us to the second question of the previous paragraph. Although there now exists a large literature in the social sciences on dowries and economists themselves have contributed to

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The reader should note that even though our discussion of dowry is in the context of arranged marriages in Hindu society in a country like India, the phenomenon of dowry is also prevalent in the context of arranged marriages in other religions and in other nations. For good general accounts of the phenomenon of dowry, the reader should consult Bumiller (1990), Menski (1998), and Sheel (1999). For more on decision making in arranged marriages, see Batabyal (1998, 2004) and Batabyal and Beladi (2003).

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For a more detailed discussion of this point, see Sharma (1993), Rao (1993), Agnihotri (2003), and Dalmia (2004).

increasing our understanding of alternate aspects of dowries,[3] to the best of our knowledge, there is no research—either by economists or by other social scientists—on the nature of the interaction between a mediator and the bride and the groom's families.

Given this state of affairs, the purpose of this paper is to construct and analyze a simple game-theoretic model of dowry determination in which the interests of the two concerned parties and those of the mediator are explicitly accounted for. Specifically, in section 2.1, we describe our game theoretic model of the dowry determination problem. Section 2.2 sets up and then solves the bride and the groom's optimization problems. Section 2.3 uses an example to illustrate the working of our model. Section 3 concludes and offers suggestions for future research on the subject of this paper.

2. The Game Theoretic Model

2.1. Preliminaries

It should be clear to the reader that in general, there are a variety of ways in which a mediator can interact with the bride's family and the groom's family to determine the amount of the dowry payment. Therefore, rather than model all the different kinds of mediation, for concreteness, in the rest of this paper we shall think of the mediator as an arbitrator. Our game model of dowry determination is based on Farber (1980) and the game itself is a static game of complete information.[4] There are three players. First, there is a representative from the bride's family who we shall refer to as the *bride* b. Second, there is a representative from the groom's family who we shall refer to as the *groom* g. Finally, there is a mediator who we shall designate with the letter m.

The timing of the game between the bride, the groom, and the mediator is as follows. First, the bride and the groom simultaneously make dowry offers d_b and d_g respectively. Second, the mediator selects one of the above two offers as the final dowry amount that is agreed upon by both the bride and the groom. Because the mediator generally has some knowledge of both the bride and the groom, we suppose that this individual has a preferred dowry amount in mind. Let us denote this preferred amount by d_m. Further, to keep the mathematics from getting unduly complicated, we suppose that after observing the offers d_b and d_g, the mediator simply picks the offer that is closer to his preferred amount d_m.

Clearly, from everything we know about actual dowries, we expect the offer made by the bride to be less than that made by the groom. Mathematically, we expect $d_g > d_b$ in equilibrium and in our subsequent analysis we shall show that this is indeed the case. Given that the above inequality holds in equilibrium, the mediator's choice problem can be described as follows. He chooses d_b if $d_m < (d_b + d_g)/2$ and he chooses d_g if $d_m > (d_b + d_g)/2$.

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3 For more on research by economists on alternate aspects of dowries, see Rao (1993), Bloch and Rao (2002), Anderson (2003), Dalmia (2004), and Dalmia and Lawrence (2005).

4 For more on static games of complete information, see Fudenberg and Tirole (1991, chapter 1) or Gibbons (1992, chapter 1).

The mediator obviously knows d_m but neither the bride nor the groom know the mediator's preferred dowry amount. In other words, from the standpoint of the bride and the groom, d_m is a *random* variable. As such, we suppose that the bride and the groom both believe that the cumulative distribution function of d_m is $H(d_m)$ and that its density function is $h(d_m)$. With this stochastic specification and given our delineation of the mediator's choice problem in the previous paragraph, we can deduce that

$$Prob\{d_b \;\; is \;\; selected\} = Prob\{d_m < \frac{d_b + d_g}{2}\} = H(\frac{d_b + d_g}{2}), \tag{1}$$

and

$$Prob\{d_g \;\; is \;\; selected\} = 1 - H(\frac{d_b + d_g}{2}). \tag{2}$$

Now, combining equations (1) and (2) we can tell that the mediator's expected dowry amount is $d_b \cdot Prob\{d_b \;\; is \;\; selected\} + d_g \cdot Prob\{d_g \;\; is \;\; selected\}$. In turn, this expectation can be written as

$$d_b \cdot H(\frac{d_b + d_g}{2}) + d_g \cdot [1 - H(\frac{d_b + d_g}{2})]. \tag{3}$$

In general, the bride will want the dowry to be as low as possible and, in contrast, the groom will want the dowry to be as high as possible. Therefore, we suppose that the bride wants to *minimize* the mediator's expected dowry amount (given by equation (3)) and that the groom wants to *maximize* this same amount.

2.2. The optimization problems

Formally, the bride solves

$$\min_{\{d_b\}} [d_b \cdot H(\frac{d_b + d_g}{2}) + d_g \cdot [1 - H(\frac{d_b + d_g}{2})]] \tag{4}$$

and the groom solves

$$\max_{\{d_g\}} [d_b \cdot H(\frac{d_b + d_g}{2}) + d_g \cdot [1 - H(\frac{d_b + d_g}{2})]]. \tag{5}$$

Now, using the result that $H^{/}(\cdot)=h(\cdot)$, the first order necessary conditions for an optimum for the above two optimization problems are

$$H(\frac{d_b^*+d_g^*}{2})=\frac{(d_g^*-d_b^*)}{2}\cdot h(\frac{d_b^*+d_g^*}{2}) \tag{6}$$

and

$$1-H(\frac{d_b^*+d_g^*}{2})=\frac{(d_g^*-d_b^*)}{2}\cdot h(\frac{d_b^*+d_g^*}{2}), \tag{7}$$

where d_b^* and d_g^* are the optimizing values of the two control variables in problems (4) and (5) respectively.

Inspecting equations (6) and (7) we see that the RHSs of these two equations are equal. Therefore, setting the LHSs of these two equations equal, we get

$$H(\frac{d_b^*+d_g^*}{2})=\frac{1}{2}. \tag{8}$$

In words, equation (8) tells us that in equilibrium, the *mean* of the two dowry offers from the bride and the groom must equal the *median* of the mediator's preferred dowry amount. Now substituting the result from equation (8) into either equation (6) or equation (7), we get

$$[h(\frac{d_b^*+d_g^*}{2})]^{-1}=d_g^*-d_b^*. \tag{9}$$

Equation (9) tells us that the gap between the two dowry offers made by the groom and the bride (the RHS) must equal the reciprocal of the value of the density function at the median of the mediator's preferred dowry amount (the LHS). Now, in order to proceed further with the analysis, it will be helpful to make an assumption about the distribution of our mediator's preferred dowry amount d_m. Therefore, we suppose that d_m is normally distributed with mean μ and variance σ^2. This supposition means that $h(d_m)=\{1/\sqrt{(2\pi\sigma^2)}\}\exp[-\{1/(2\sigma^2)\}(d_m-\mu)^2]$.

2.3. An example

It is well known that the normal distribution is symmetric about its mean and hence the mean μ equals the median for this distribution. In our case, this means that equations (8) and (9) can be rewritten as

$$\frac{d_b^* + d_g^*}{2} = \mu \text{ and } d_g^* - d_b^* = \frac{1}{h(\mu)} = \sqrt{(2\pi\sigma^2)}. \tag{10}$$

Solving the two equations in (10) simultaneously gives us the bride and the groom's Nash equilibrium dowry offers. Mathematically, we have

$$d_b^* = \mu - \sqrt{(\frac{\pi\sigma^2}{2})} \text{ and } d_g^* = \mu + \sqrt{(\frac{\pi\sigma^2}{2})}. \tag{11}$$

In words, equation (11) tells us two things. First, the equilibrium dowry offers made by the bride and the groom are centered around the mean of the mediator's preferred dowry amount (μ). Second, the difference between these two offers is essentially a function of the bride and the groom's uncertainty about the mediator's preferred dowry amount (σ^2). Specifically, as σ^2 increases (decreases), this difference between the two equilibrium dowry offers also increases (decreases).

The equilibrium described by equations (10) and (11) makes perfect economic sense and it is also consistent with what we know to be true about real world dowries. To see this clearly, note that when presenting their dowry offers, the bride and the groom face a very basic tradeoff. A very low offer by the bride or a very high offer by the groom results in a better reward if this offer is selected by the mediator. However, a very low or a very high offer also makes it less likely that this offer will, in fact, be chosen by the mediator. Therefore, when there is a great deal of uncertainty about the mediator's preferred dowry amount, i.e., when σ^2 is high, the bride and the groom can afford to make more assertive offers because these more assertive offers are unlikely to be completely at odds with the mediator's preferred dowry amount. In contrast, when there is little or no uncertainty, i.e., when σ^2 is equal to or close to zero, neither the bride nor the groom can afford to make "very assertive" offers because the mediator is more likely to accept the dowry offer that is close to his preferred mean amount (μ).

We close this section by pointing out that the above kind of analysis—with the normal distribution—can also be conducted for other distribution functions. For instance, consider the case in which the mediator's preferred dowry amount d_m follows a beta distribution. In this case $h(d_m) = [\Gamma(\alpha+\beta)/\{\Gamma(\alpha)\Gamma(\beta)\}] d_m^{\alpha-1}(1-d_m)^{\beta-1}$, $\alpha>0$, $\beta>0$, and $\Gamma(\cdot)$ is the gamma function. When the parameters α and β are equal to each other, $h(d_m)$ is symmetric about ½, the mean, and hence the mean equals the median. With some additional clutter, the analysis for this beta distribution case would proceed exactly as indicated earlier in this section.

3. Conclusions

In this paper, we analyzed a simple game model of dowry determination. In particular, we first solved for the Nash equilibrium dowry offers from both the bride and the groom. Then, with the help of an example, we showed how the equilibrium dowry offers optimally trade off the desire—on the part of both the bride and the groom—to make an assertive offer with the likelihood that this assertive offer will, in fact, be selected by the mediator.

The analysis in this paper can be extended in a number of directions and in what follows, we suggest two potential extensions. First, it would be useful to extend the static game analysis of this paper to a dynamic game analysis in which the three players do not interact once and for all but, instead, interact over several time periods. Second, it would be instructive to examine the case in which the bride and the groom have heterogeneous beliefs about how the mediator's preferred dowry amount (d_m) is distributed. Studies that analyze these aspects of the problem will increase our understanding of the properties of mediated dowry determination in arranged marriage contexts.

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