Bargaining over Marriage Payments: Theory, Evidence, and Policy Implications

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Abstract

This article delves into a conservative marriage tradition in Chinese society that involves bidirectional wealth transfers: bride price and dowry, and the broad implication of a pro-women marriage law amendment in a society with high gender inequality. In spite of marital transfers being a tradition derived from history with unequal gender roles, this article first probes the economic rationales behind the two transfers from the groom's family to the bride's family (bride price) and from the bride's family to the couple (dowry). Secondly, I provide evidence on how dowry impacts the intrahousehold bargaining power within the new conjugal households. Lastly, I utilize the 2001 marriage law amendment as a natural experiment to discuss how a one-sided targeting policy can lead to a Pareto improvement for all sides. To answer these questions, I construct a theoretical model that involves the bargaining process on both parents and children's sides. I provide empirical evidence with reduced-form and structural model estimation methods to test the theoretical models' predictions. The empirical results show significant support for the predictions from the models.

Key words

Marriage Payments, Gender Inequality, Intrahousehold Bargaining

JEL Classification codes

J12, D13, J16, D15

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1. Introduction

In Chinese society, a bidirectional payment of both bride price and dowry is widely observed as a marriage custom. Traditional theories of marriage payments provide insights into the existence of a bride price or dowry but not their coexistence. This limits the discussion of the implications of the special institution observed in China. This article researches this conservative tradition with respect to the bargaining process of wealth transfers between the natal families on the two sides and between parents and their children. I answer three questions in this article. First, how do patrilocality and altruism work as the rationale behind the equilibrium of wealth transfers from the groom's family to the bride's family named bride price and from the bride's family to the couple named dowry? Secondly, as a behavior of altruism towards the daughter, what are the impacts of the dowry on shifting the bargaining power in the new conjugal household? Lastly, based on the conclusions from the first two questions, how would a pro-women property-ownership-related marriage law amendment working as a positive shock to the wife's bargaining power affect the willingness for the two marriage payments in a society with high gender inequality?

The marriage payment tradition is performed in such an order: after the betrothal and before the wedding, the bride's family signals to the groom's family how much they want as the bride price. As in modern China, the offer is typically a "take-it-or-leave-it" offer. The groom's family usually does not negotiate the price with the bride's family. If the groom's family chooses to pay the bride price to the bride's parents, the bride's parents will transfer part of their wealth to their daughter and let her bring it to the new family as her dowry[1]. The flowchart below shows the process:

[Insert Figure 1 here]

The first unique feature of this article is the unique institution that I look into involves payments of both bride price and dowry. Bride price and dowry have been prevalent in many societies throughout history, especially where women's social statuses are lower (Anderson, 2003). These traditions remain popular in many developing countries, notably East and South Asia and Sub-Saharan Africa (Anderson, 2007). Typically, a single society only sees one direction in the payments (i.e., either from the groom's side to the bride's side—bride price or from the bride's side to the groom's side—dowry),

[1]Different formats and timelines might be observed in different regions. In this article, I only discuss the one regarded as the mainstream.

and the direction heavily depends on the historical female role in agricultural activity (Corno et al., 2020). Nevertheless, Greater China appears to be the only large society that sees both bride price and dowry in marriages[2] (Anderson, 2007; Brown, 2009). Traditional literature explains the occurrence and roles of marriage payments from different perspectives. Becker (1991) attributes them to the inflexibility in the division of joint products within the marriage. An upfront payment would arise to compensate for the loss of efficiency in the production of one side due to the marriage. Anthropological explanations claim that they function as the kind of property relations within the society (e.g., Goody (1973) and Schlegel & Eloul (1988)), where bride price develops in a society's lack of social stratification and dowry is connected with social stratification[3]. However, both theories have limitations in discussing the scenario of bidirectional transfers.

In order to understand the coherence of the unique institution in Chinese society and answer the three questions raised above, I propose a three-agent model that involves the bride's and the groom's families and the new conjugal household. The model takes two main factors into account: patrilocality and altruism. The parents' utility is altruistic and consists of three parts: the utility from their own and children's consumption and the loss or gain of a fixed value due to their children's marriage. Considering the fact of the prevalence of patrilocality in marriages in China, the leave of their daughter induces the assumption of loss of utility in the bride's family, and the groom's family sees a positive gain. The marriage market equilibrium is based on a maximization problem of the bride's family. Because dowry occurs after the bride price is received, the bride's family has to decide the rule of dowry given any bride price and the consequent bride price amount that maximizes their utility. In addition, the maximization process has constraints from both sides in terms of marriage decisions: the two marital transfers should satisfy the condition that the children getting married is better than any outside options for both sides of the parents.

On the grounds that modern marital transfers still happen not because of the gender roles in agricultural activities but as a tradition kept, the first step of this article focuses on the rationale of how the equilibrium of the two prices is formed for families with different characteristics based on patrilocality and altruism. I prove economically, under the assumption of utility maximization, why the two

[2]Muslim countries in the Indian Subcontinent traditionally require a payment from the groom to the bride named *mahr*, and under the rule of the British Raj, dowry also became very popular. However, *mahr* serves a different religious purpose and should not be treated the same as the bride price.

[3]The social stratification defined in their work is mainly associated with the economic status of women where strong social stratification restrains women from economic activities outside housework.

payments more commonly occur in these two specific directions. In other words, why a negative or zero "bride price" (wealth transfer from the bride's family to the groom's family) would hardly happen, and how it makes the marriage unattractive to the bride's family? Meanwhile, even though less common, the situation of a positive bride price payment but no dowry is observed sometimes with an impecunious bride's family.

The second question is how dowries shift the bargaining power within households in a society that traditionally sees high disparities in social and economic statuses of different genders. Dowry has been proved to have a significant role in raising a wife's bargaining power (e.g., Zhang & Chan (1999); Brown (2009); Anderson & Bidner (2015)). Thus, after knowing the marriage payments in equilibrium, I further extend the model to examine the impacts of dowries on the Pareto weights on the spouses. This discussion serves two purposes. Firstly, it provides an understanding of the scale of intrahousehold inequality in China. Secondly, it reflects on which kind of scale the dowry helps to alleviate the inequality. Both structural model and reduced-form estimation are adopted to research this issue. In the structural model, I introduce the heterogeneity of the bargaining power across different households by incorporating the dowry payment into the Pareto weights. The estimation indicates that, on average, a woman enjoys a much lower Pareto weight within the household than a man. Meanwhile, a higher dowry or dowry-to-bride price ratio significantly shifts up the wife's bargaining power. From the empirical strategy, I use wives' and husbands' time spent on chores as proxies for the spouses' intrahousehold bargaining power. A higher dowry is shown to result in a reduction in wifes' time spent on chores and helps to reduce the gap of time on chores between husbands and wives.

After incorporating the results of intrahousehold bargaining into the equilibrium of the three-agent model, the third question probes how would an external shock on the bargaining power change the willingness to pay of the two families. This article takes advantage of a marriage law amendment that was introduced in the year 2001. The amendment is generally considered pro-women in the wake of the opening-up of society and rising divorce rates. The amendment clarifies the ownership of property obtained by individuals before the marriage and allows the spouses more flexibility to claim the ownership of post-wedding property. Considering that dowry is usually in the form of goods, this law amendment provides a wife the advantage should a divorce happen. On the one hand, the external shock enlarges the value of the dowry, which lessens the need for the dowry to achieve the same level of bargaining power for the bride. On the other hand, the increasing marginal benefit of

dowry provides the bride's family a higher incentive to transfer more wealth. We would expect a more interesting effect when the second effect dominates since this would be consistent with the theoretical conclusion of a Pareto improvement under a high level of inequality. Hence, I employ this amendment as a natural experiment to test if there are discontinuities of the two prices when the amendment was introduced and the direction of the change. The finding from the empirical test proves that there are positive discontinuities in both prices, which supplements the theoretical model; from that, we can conclude that even if a policy is set to target to benefit one side, in a society with excessive inequality, a Pareto improvement for all sides can be achieved.

2. Institutional Background

2.1. Marital Transactions in the Chinese Society

Marriage payment tradition has long been existing in China[4]. In a Chinese marriage, part of the prior wedding rituals is the multiple transfers between the natal families. Bride price (*Caili* or *Pinli*) is the payment or a few payments from the groom's family to the bride's family. Dowry (*Jiazhuang*) is the subsequent transfer from the bride's family. The original idea of the bride price was to compensate the leave of the daughter for the bride's family(Zang & Zhao, 2017). The ancient society was dominantly patrilocal so the brides had very few chances to visit their parents after the wedding(McCreery, 1976). Hence, a high bride price was regarded as necessary to conpenstate the loss of productivity of the bride's family. Dowry originated from the idea of the bride's parents' wish for better treatment of their daughter in the new family(Parish & Whyte, 1980; Zang & Zhao, 2017). Due to the disadvantage of women in agricultural production, a wife tended to have a lower economic status(Wolf & Huang, 1980). A higher value of dowry could help to relieve the situation and balance the bargaining power.

The amount of bride price is usually signaled by the bride's family after the betrothal and before the wedding. During the ancient time, arranged marriages were common and there were matchmakers working as intermediaries who also helped to negotiate bride prices(Ebrey, 1991). However, with the increasing pervasiveness of self-arrangement of marriages[5] and the forbiddance of marriage ar-

[4]Thatcher (1991) finds that the tradition can be dated back to the periods of the Spring and Autumn and the Warring States (770–256 BC). The *Classic of Poetry* (also *Shijing*, 11th to 7th centuries BC), which is the oldest existing collection of Chinese poetry already documented the prevalence of the tradition.

[5]see Zang & Zhao (2017).

rangement[6] as well as more information exchange between the two families before the wedding, it is easier for the bride's family to know more about the characteristics of the groom's family and make a rational and reasonable offer to the groom's family. Even though "marriage by pruchase" has been strongly and consistently disencouraged by the government of the People's Republic of China, no law has been seen to prohibit all betrothal exchange but only "the exaction of money in connection with marriage"(Ocko, 1991). The groom's side usually does not negotiate about the price in order to avoid leaving a bad impression(Zang & Zhao, 2017). Thus, the groom's family would either accept the offer or give up the marriage. The bride price is usually paid in the form of cash but the process can go through one or several installments over the course of the engagement(Ocko, 1991; Brown, 2009).

After receiving the bride's price, the bride's family has to decide how much they want to retain and how much to give to their daughter as the dowry. Dowry does not need to be negotiated with the groom or groom's parents and is totally treated as an internal decision of the bride's family(Ocko, 1991; Brown, 2009; Zang & Zhao, 2017). Different from bride price, dowry can be in any form such as furniture, electronics, bedding, vehicles, and clothing[7]. A bride is expected to have the authority of the property she brings into the new conjugal household. However, in reality, the dowry could become a part of the common property when the couple is into the marriage. In addition, before 2001, the law in China provides no protection with respect to the ownership of the dowry that a bride brought into the household[8] because the marriage payments are regarded as a tradition of feudalism (*Fenjian*)(Ocko, 1991; Brown, 2009). Due to the nature of the forms of dowry, many types of property owned before marriage has no official certifications of ownerships. Hence, in practice, dowry is treated as shared resource in usage despite the actual ownership. However, because the wife has the ownership of the dowry, she may have more say in the usage of the property.

[6] Article 1042 of the Civil Law of the People's Republic of China states arrangement, selling and intervention of marriages are illegal in China.

[7] Ocko (1991) documents the change of the forms of dowry in the People's Republic of China era.

[8] Ocko (1991) documents numerous disputes regarding the divison of property owned before marriage prior to the amendment.

2.2. The 2001 Marriage Law Amendment

One of the main revisions reflected in the 2001 amendment[9] to the 1980 PRC marriage law was the clarification of the property ownership of the individuals. The amendment has critical implication regarding the division of property upon divorce. The 1980 version of the marriage law did not specify the division rules primarily due to the extremely low divorce rate[10] and relatively less wealth people owned(Honig & Hershatter, 1988; Yi & Deqing, 2000). The rising divorce rate in the 1980s and 1990s saw the urgency of a clarification.

There were two major aspects with respect to the property ownership clacification. The first part was that an individual would retain the owenership of the property that belonged to them prior to a marriage (Chapter 3, Article 18). The second part was that the amended law gave the spouses more flexibity to declare the ownership of certain property that obtained either before the marriage or during the marriage (Chapter 3, Article 19). In addition to the property owenership, the amendment made it clearer regarding the process of dividing property upon divorce. If a divorce happens and an agreement cannot be reached in the negotiation for the division of property, a court has the ultimate power to decide the division based on the rule that children and the wife should be the priority of the concern (Chapter 4, Article 39). The amendment was a further extension of protection of a wife in a marriage since the relaxation of the legal restrictions on granting divorce in the 1980 marriage law.

3. Theoretical Model and Predictions

3.1. A Three-agent Marriage Market Model

In this part, I propose a three-agent marriage market model that involves three sides: the bride's family, the groom's family, and the new conjugal household if the couple gets married. The model follows the same procedure as in the institutional background and is set as a single period problem. Both bride's and groom's families have to face two choices: get their children married or not. The model follows the order starting with a "take-it-or-leave-it" offer from the bride's side. Only both of

[9]The amendment was officially passed in the Standing Committee of the National People's Congress of the People's Republic of China in April 2001.

[10]The demographic data analysis provided by Yi & Deqing (2000) shows that the divorce rate increased by 42% from 2.01% to 2.86% between 1982 and 1990.

the two families find that getting married is more beneficial than letting their children stay single, can the marriage happen. Otherwise, both children stay single and their consumption depends on their own income. If the couple gets married, a new household is formed and the whole household's utility relies on both husband's and wife's individual utility.

3.1.1. The Setup of Three Agents

This article focuses on the payments instead of the problem of matching and mating. Consequently, we can simply treat the marriage market as the bargaining between a family with a daughter and a family with a son.

For the bride's and groom's families, their utility both consist of three parts: the utility from their own consumption, weighted utility from their children, and a constant gain or loss due to their children's marriage. The bride's and groom's parents' consumption comes entirely from their wealth. The initial wealth for the bride's family is W^F. If the daughter gets married, their wealth gains the retained part of the bride price; otherwise, the wealth stays the same. The daughter's utility derives from her consumption as well. Following Corno et al. (2020), Corno & Voena (2021) and Han et al. (2015) and also considering the fact of the dominance of patrilocality being the form of marriages in China, I assume if their children get married, the groom's family experiences a constant value of utility gain and the bride's family has to bear a value of a constant loss.

Specifically, the bride's family's utility U_m^F[11] if their daughter gets married is:

$$\begin{aligned} U_m^F &= \xi^F \cdot [u_1^F(c_m^{F,P})]^{\delta_1} \cdot [u_2^F(c_m^F)]^{1-\delta_1} \\ &= \xi^F \cdot [u_1^F(W^F + B - D)]^{\delta_1} \cdot [u_2^F(c_m^F)]^{1-\delta_1} \end{aligned} \tag{1}$$

where B and D are the notation for bride price and dowry. $0 < \delta_1 < 1$ is the weight on the utility from their own consumption and $0 < 1 - \delta_1 < 1$ is the weight on the utility from their daughter's consumption. ξ^F represents the loss of utility because of the leave of the daughter. $0 < \xi^F < 1$ is a multiplier of a constant value. However, if they do not accept this marriage, the bride's family's utility U_s^F based on the outside option is in a form of

[11] In this article, a capital letter U defines a compound utility function. A lower-case u stands for an explicit form of utility function. The subscript and superscript are used only to distinguish which individual the utility function reflects.

$$\begin{aligned} U_s^F &= [u_1^F(c_s^{F,P})]^{\delta_1} \cdot [u_2^F(c_s^F)]^{1-\delta_1} \\ &= [u_1^F(W^F)]^{\delta_1} \cdot [u_2^F(c_s^F)]^{1-\delta_1} \end{aligned} \tag{2}$$

where the bride's parents' consumption is in the same value as their wealth and there is no marriage-induced utiltiy gain or loss. Similiar problem faces the groom's family. If their son gets married, his family's utility U_m^M is:

$$\begin{aligned} U_m^M &= \xi^M \cdot [u_1^M(c_m^{M,P})]^{\delta_2} \cdot [u_2^M(c_m^M)]^{1-\delta_2} \\ &= \xi^M \cdot [u_1^M(W^M - B)]^{\delta_2} \cdot [u_2^M(c_m^M)]^{1-\delta_2} \end{aligned} \tag{3}$$

where $0 < \delta_2 < 1$ is the weight on the utility from their own consumption and $0 < 1 - \delta_2 < 1$ is the weight on the utility of their son. ξ^M reflects the gain of utility because of the obtaining of the daughter-in-law. ξ^M is also a constant-value multiplier but larger than one. Groom's family's utiity U_s^M based on the outside option is:

$$\begin{aligned} U_s^M &= [u_1^M(c_s^{M,P})]^{\delta_2} \cdot [u_2^M(c_s^M)]^{1-\delta_2} \\ &= [u_1^M(W^M)]^{\delta_2} \cdot [u_2^M(c_s^M)]^{1-\delta_2} \end{aligned} \tag{4}$$

The third part exists if the first part of the marriage payments (bride price) occurs, which requires getting married is better for both sides:

$$U_m^M \geq U_s^M, \qquad U_m^F \geq U_s^F \tag{5}$$

When the two conditions are satisfied, the second payment (dowry) enters into the new conjugal household's budget constraint. The household utitlity of the married couple is the combine of the weighted utility of the husband and wife.

$$U^H = \max_{c_m^M, c_m^F} [u_2^M(c_m^M)]^{\delta_3(D)} \cdot [u_2^F(c_m^F)]^{1-\delta_3(D)} \tag{6}$$

s.t.

$$c_m = c_m^M + c_m^F = w^M + w^F + D \tag{7}$$

where w^M and w^F are the incomes of the husband and wife. The incomes are set to be exogenous. Thus, individuals' income is not affected by the decision of getting married or not. If the son or daughter stays single, their consumption is entirely from their own income.

The Pareto weigt of the husband as a function of dowry D satisfies the conditions that $\delta_3'(D) < 0$ and $\delta_3''(D) > 0$.

3.1.2. Equilibrium under a basic utility function form

The structure of the three-agent model allows us to look into the equilibrium of the marriage. Both bride price and dowry work as budget constraints for the three agents. In order to search for the equilibrium and conduct the comparative static analysis, I adopt a basic risk-averse utility function form:

$$u = c^\gamma \tag{8}$$

where the degree of relative risk aversion is set as $0 < \gamma < 1$[12].

In the background, the marriage occurs in a process of the bride's family's decision, the groom's family's decision, and the consequent effects on the newly conjugal household if the agreement of marriage payments is reached. However, to solve the equilibrium, we need to look at the problem backward.

3.1.2.1. Intrahousehold Allocations within the New Conjugal Household

In the first step, the new conjugal household maximizes the utility based on the dowry given:

$$log(U^H) = \max_{c_m^F, c_m^M} \gamma\{\delta_3(D) log(c_m^M) + [1 - \delta_3(D)] log(c_m^F)\} \tag{9}$$

[12]This assumption implies moderate risk aversion of individuals. Previous literature suggests an elasticity in a range of $[1, 2]$ is reasonable for CRRA utility function (e.g. Chetty (2006), Morten (2019), and Corno et al. (2020)). The solution of the subsequent model will not largely depend on this assumption.

s.t.

$$c_m = c_m^F + c_m^M = w^M + w^F + D \tag{10}$$

There is also an underlying constraint from the spouses' side that getting married is better for either of them (each individual's consumption is larger). Different from contraints for the parents' side, this assumption is logically easier to meet. First, the spouses will share the endowed dowry. Second, the analysis is based on the fact that the match has happened, which means the couple finds the marriage benefits themselves. As a result, the first-order conditions lead to the solutions for both c_m^M and c_m^F:

$$c_m^M = \delta_3(D) \cdot (w^M + w^F + D) \tag{11}$$

$$c_m^F = [1 - \delta_3(D)] \cdot (w^M + w^F + D) \tag{12}$$

3.1.2.2. Maximization Problem of the Bride's Family

The consumption of the spouses is also the rule of allocations of resources within the newly-formed household. Considering the wages of the wife and husband are exogenous in the model, once the dowry is decided, the consumption of both the wife and husband is decided. Thus, we can take the solutions back to the utility maximization problem of the bride's family. The problem for the bride's family transforms to the maximization of utility with regard to the dowry amount given any bride price.

Theoretically, the value of dowry D is not bounded by any restriction in this tradition. However, it is straightforward to conclude that the optimum is strictly less than the bride's family's wealth plus the bride price under the values of the parameters.

After knowing dowry D is a function of bride price B, the control variable in the bride's family's maximization problem becomes B:

$$log(U_m^F) = \max_B log(\xi^F) + \gamma\{\delta_1 \cdot log(W^F + B - D(B)) + (1 - \delta_1) \cdot log(c_m^F)\} \tag{13}$$

Hence, the bride's family wants the bride price as high as possible. The derivative of the utility function of the bride's family with respect to the bride price is always in a positive value (see the proof in Appendix A.). This means that the bride's family will want the bride price as high as possible as long as the groom's family accepts.

3.1.2.3. Marriage Payments under Equilibrium

The Upper Limit of the Bride Price for the Groom's Family: The maximization problem presents a result that the bride's family's utility is monotonically positively correlated with the bride price received. However, they cannot ask for an unlimited amount of bride price due to the constraint that the groom's family would choose to stay single if the bride price required is too high. Thus, the utility of getting married for the groom's family must satisfy being no smaller than staying single:

$$\xi^M \cdot [u_1^M(W^M - B)]^{\delta_2} \cdot [u_2^M(c_m^M)]^{1-\delta_2} \geq [u_1^M(W^M)]^{\delta_2} \cdot [u_2^M(c_s^M)]^{1-\delta_2} \tag{14}$$

The upper limit of the bride price is achieved when the LHS equals the RHS.

The Reservation Bride Price for the Bride's Family: Once the bride's family knows the upper limit of the bride price and the distribution of the resources for the couple given any value D, they also need to consider their own constraint that their daughter getting married is better than staying single:

$$\xi^F \cdot [u_1^F(W^F + B - D)]^{\delta_1} \cdot [u_2^F(c_m^F)]^{1-\delta_1} \geq [u_1^F(W^F)]^{\delta_1} \cdot [u_2^F(w^F)]^{1-\delta_1} \tag{15}$$

When the equal sign is achieved, the bride price is the minimum value for the bride's family to agree on the marriage. Meanwhile, if the inequality holds, the difference between the LHS and RHS: $U_m^F - U_s^F$ is the surplus the bride's family will get from their daughter's marriage.

In other words, we can treat the rule deciding bride price as a bargaining process where the weight on the groom's side is zero. This would leave no surplus to the groom's family and the upper limit will be the exact bride price the bride's family would ask for if the reservation price condition is met.

In addition, a comparative static analysis on how family characteristics influence the equilbrium of the two prices is also provided in Appendix A.

3.1.3. Implications of Model under Equilibrium

Since we have derived the forms of the marriage payments, it allows us to further investigate the directions and scales of the two prices. There are two transfers between the two natal families, and between the parents and children. Under the assumption of patrilocality and altruism in the model, this part provides some logical evidence that in a general case, marital transfers occur in the direction that the groom's family pays to the bride's family in a positive amount and the bride's family transfers a positive amount to the couple. In other words, it would be a rare case where the bride's family transfers a positive amount of money to the groom's family or the bride's family transfer no money to the couple.

LEMMA 1: The dowry rule $D(B)$ indicates a positive relationship between the dowry and the bride price given other family characteristics: $\partial D/\partial B > 0$.

Proof: *see Appendix A*.

Given a fixed set of family characteristics, both the bride price and the dowry will be decided. In addition, when all other exogenous factors are also decided, for every single value of the bride price, it is corresponding to a single value of the dowry. In other words, any outside factors leading to an increased dowry would be observed with a higher bride price paid even though the relationship might not be linear.

PROPOSITION 1: The bride price always occurs in a direction from the groom's family to the bride's family.

Proof: *see Appendix A*.

A transfer from the groom's family to the bride's family is easier to occur because of the positive gain of utility for the groom's family. Since the transfer from the bride's family to the groom's side does not bring direct utility gain to the prior, the marriage would not be attractive to the bride's family unless the gain of their daughter's utility is larger enough to compensate for the loss of utility due to the leave of the daughter and the payment of the "bride price". Additionally, this means the groom brings much more income to the household than the bride, which makes his consumption less than before the marriage and contradicts the presumption. Thus, intuitively, this combination is hard to achieve, unless the marriage is arranged in which the groom's family "sells" their son for their own

benefits as there are no constraints on the groom's individual utility before and after the wedding.

In addition, given a non-negative boundary constraint for the bride price ($B \geq 0$), a zero payment of the bride price ($B = 0$) is still unusual if we also impose a non-negative constraint for the dowry amount ($D \geq 0$). The groom's family does not pay the bride price because their son is much wealthier than the bride so the bride benefits much more from the marriage. This is the same situation facing us for a "negative bride price". Meanwhile, given the fact of receiving no bride price, the only reason the bride's family would want to transfer wealth to the couple is that the spouses are relatively poor and they are wealthy enough. Thus, the two conditions contradict each other.

Proof: *see Appendix A.*

In conclustion, since the situation leads to a worse off situation for the groom because of the marriage, intuitively, the matching of the two spouses would be rare to occur in the first place.

PROPOSITION 2: A zero transfer of dowry ($D = 0$ and $B > 0$) may occur when W^F is small and w^M and w^F are large.

Proof: *see Appendix A.*

Intuitively, being compensated with the bride price but no need to transfer wealth makes the marriage attractive to the bride's family. The only reason the bride's family does not want to transfer wealth to the couple is that the bride's family is relatively poor so they cannot afford to give away any money to their daughter (high marginal cost) meanwhile their daughter earns enough. This situation appears to be less common considering the combination.

PROPOSITION 3: Dowry exceeds the bride price ($D > B$) when the bride's side is wealthier and the couple has low income

Proof: *see Appendix A.*

When the groom's family is not as wealthy as the bride's family, low payment of bride price would be observed. This leads to relatively higher payment of dowry from the bride's family. Intuitively, the bride's family can take advantage of this situation to harvest more bargaining power for their daughter. We have to pay attention that Propostion four and one refelct two different aspects and do not contradict each other. Given any family characteristics, a higher bride price is always linked to a

higher dowry. However, when the bride price is low, it is possible that the dowry amount can exceed the bride price.

PROPOSITION 4: A higher patrilocal gain for the groom's family increases their willingness to pay

In addition to the family characteristics, patrilocality plays a role as an exogenous factor shifting the bride price. The higher patrilocality gained (ξ^M) as a result of the marriage for the groom's family, the higher willingness they have to pay a high bride price. The previous analysis is about how the marriage payments are correlated with family characteristics based on fixed utility gain or loss due to patrilocality. The next analysis instead focuses on how would the bride price change when there are different levels of gain due to the patrilocal tradition given the fixed family and individual wealth.

Proof: *see Appendix A.*

This is a general rule that applies to all cases regardless of family characteristics. At the same time, even though the patrilocal gain means a loss to the bride's family, the loss does not directly affect the rule of deciding the amount of bride price or dowry. However, the increase of the bride price due to the patrilocal gain for the groom's family would naturally increase the dowry amount. On the other hand, even though the model does not reflect how the patrilocal tradition impacts the intrahousehold bargaining power directly, the intuitive explanation for the increase in dowry attributes to the fact that the more the bride contributes to the groom's family, the less connection she may have kept with her natal family. In that case, her parents would want to give her more protection by transferring more wealth to her.

3.2. Dowry and Intrahousehold Bargaining Power

In the second part, I delve into another question what are the impacts of the marriage payments on the new conjugal household. In the analysis of the factors affecting the bargaining of the two payments, the major focus is on the parents' side. Nevertheless, we know that the transfer of the dowry to the couple originates from the incentives of the bride's parents wishing for more bargaining power for their daughter. It is necessary to further look at how can the marriage payments shape the bargaining power of the individuals. Due to the cultural background that only dowry will enter into the couple's budget constraint as a part of the endowment but the bride price works as a role to compensate for

the loss of a daughter for the bride's family, we only need to consider the role of dowry in shifting bargaining power.

In the previous setting, a person's bargaining power is reflected in the individual's Pareto weight in the whole household's utility. This is achieved by introducing the heterogeneity of the bargaining power across different households where the Pareto weight is a function of dowry. In addition to this, I also revisit the form of the utility function by incorporating home production and leisure time. The purpose of doing so is to inspect the allocations of different resources between the spouses, which reflect the weights of each individual in the household.

The framework of the following model is built upon the literature of collective models with a process of intrahousehold allocations such as Chiappori et al. (2002), Chiappori & Mazzocco (2017) and Lise & Yamada (2019). Within the newly-formed household, an individual's utility consists of consumption of final goods c_m^G and home production q_m^G, and leisure ℓ^G ($G = M$ or F):

$$U^H = \max_{c_m^M, c_m^F, q_m^M, q_m^F, \ell^M, \ell^F} [u_2^M(c_m^M, q_m^M, \ell^M)]^{\delta_3(D)} [u_2^F(c_m^F, q_m^F, \ell^F)]^{1-\delta_3(D)} \tag{16}$$

Both wife's and husband's time are divided into three parts: work, home production, and leisure. The final goods do not require a home production process. However, to consume home-produced goods, an individual has to spend time on home production. Home production involves individuals' time spent on home production h^G and an input of the intermediate goods g:

$$q_m^G = q_m^G(g, h^G) \tag{17}$$

Thus, the control variables in the maximization problem in fact are each individual's consumption of final goods, their time spent on home production and leisure, and expenditure on intermediate goods. The household budget constraint is subject to:

$$c_m^M + c_m^F + g = \omega^M \cdot t^M + \omega^F \cdot t^F + D \tag{18}$$

where ω^M and ω^F are the husband's and wife's total incomes divided by their annual working hours: t^M and t^F. For the convenience of analysis, I normalize the total time as 1 for each individual:

$$t^M + h^M + \ell^M = 1, \qquad t^F + h^F + \ell^F = 1 \tag{19}$$

3.3. External Shock on Bargaining Power and the Marriage Payments

This part discusses when there is any exernal shock that changes the bargaining power of the spouses, how the marriage payments would change following that. I consider the case when the external shock positively increases the wife's bargaining power since we will be using the marriage law amendment as a natural experiment. With the amendment, dowry becomes more valuable in shifting power to the wife's side. This can be achieved by a constant gain in the Pareto weight (because the bride's family now has the belief that their property will be better protected by law after getting into the marriage) or a higher marginal benefits from dowry (the impact of every single *yuan* becomes larger). These two channels result in the same results in terms of the changing direction of the marriage payments.

The impact of the amendment on dowry are in two different directions since dowry enters into both consumption and the bargaining power of the spouses. First, regarding the dowry rule, given the same amount of the bride price, the bride's family now only needs to transfer less wealth to maintain the same level of bargaining power for their daughter. This is directly reflected on the dowry rule. With the new dowry rule, the groom's family will also adjust the bride price. On the other hand, because dowry becomes more valuable (higher marginal benefits), the bride's family will find it is more attractive to transfer a little more to their daughter. Hence, with the positive shock on dowry, theoretically, the change of the amounts fo the two prices is uncertain.

Depending on the parameters, the change of the two prices could only occur in the two directions presented below:

		Bride price	
		Increase	Decrease
Dowry	Increase	✓	✗*
	Decrease	✗	✓

*May be true when initially there is no dowry May be true when initially there is no dowry May be true when initially there is no dowry

Proof: *see Appendix A.*

When both prices increase, it indicates the marginal benefits of dowry on the consumption exceed the impact on the bargaining power. Hence, both families are more willing to transfer more wealth to their children since they both can get more utiltiy from the altruistic part. On the other hand, when

both of the two prices decrease after the amendment, on the contrary, shows the increased marginal benefits from the daughter for the bride's family is comparatively small. We can notice that the first case is more interesting since it will be a Pareto improvement. Both spouses' consuption will increase. For the bride's maiden family, not only will they get higher utility from the altruistic part, but they also obtain it through higher consumption. Since the groom's family always gets the outside option level, they are not hurt by the amendment. Nevertheless, for the case of both decreasing prices, even though we know the groom will have less consumption, the change on the bride is uncertain.

4. The Empirical Analysis

This part presents empirical evidence to test the solidarity of the models raised in the previous section. The three major questions I intend to answer in this part are whether the directions of the impacts of the family characteristics on the marriage payments are correct, the magnitude of the influence of dowry on a wife's bargaining power, and the impacts of the marriage law amendment on the dowry amount. The analysis comprises two methodologies: the first part introduces the estimation strategies for the structural model raised previously in examining intrahousehold bargaining power; the second part conducts reduced-formed regressions to provide fundamental evidence on the relationships between marriage payments and family characteristics, the relationships between dowry payment and the wife's bargaining power as well as whether there is a discontinuity in the year when the amendment of marriage law was passed.

4.1. Data and Summary Statistics

Estimation requires marriage payments from both sides, the family characteristic information for both brides and grooms as well as their parents, and the allocations of resources and time for the married couple. A unique dataset that meets these requirements is the 2018 China Labor force Dynamics Surveys (CLDS)[13].

[13]CLDS data is a panel dataset that was conducted in 2011, 2012, 2014, 2016, and 2018. However, only the 2018 one has full information on the marriage payments. Previous surveys only asked about the total expenditures from the grooms' parents (bride prices). The 2018 survey asked not only both the groom and bride about their betrothal payments from their parents (bride price and dowry, respectively) but also their spouse's parents' marriage payments (dowry and bride price, respectively), which helps us to have a double-check on whether the payments are consistent between the spouses.

4.1.1. Description of CLDS data

The surveys cover 29 provinces (or equivalents) in total and the data includes three parts: community, household, and individual surveys[14]. As the name suggests, the surveys involve only potential labor force aged between 15 and 64 (whether they actually work or not). The household and individual data can be linked with the household ID of each individual. Due to the purpose of my research, I only select the households of married (or engaged) couples and one of the couples is regarded as the household head.

For the individual-level data, the surveys ask the individuals' information as well as their parents. For the main variables of interest, the marriage payments questions are:

- Marriage Payments
  - How much did your family spend for your first marriage (such as betrothal gifts and bride price or dowry) _____$yuan$?
  - How much did your spouse's family spent _____$yuan$?

We can access the answers from both sides and drop the observations whose payment amounts are not consistent[15]. Other information at the individual level includes their demographic information, *hukou* status[16], wedding years, education levels, occupations, incomes, allocations of time on working and chores, and migration history. For parental information, an individual is asked about their demographic information, *hukou* statuses, education levels, and occupations if they are still in the labor force. However, the flaw is that the surveys do not ask about individuals' parents' wealth or income.

The household part mainly surveys the household member structures, living conditions, income, and expenditures. Every household has a one-member registered as the household head in *hukou*. This helps to select the sample for the analysis. The main variables we are interested in are the expenditure

[14] The community part mainly surveys the development of the villages or neighborhoods so that I will not focus on this part.

[15] I allow a tolerance of a 10% difference.

[16] *Hukou* or household registration system is a national segregation policy in China. This system categorizes Chinese citizens either with "rural" or "urban" *hukou*. *Hukou* is associated with the welfare, benefits, and opportunities provided by the government. Local governments make all the decisions on what benefits residents with local *hukou* and migrants can enjoy. The public service and welfare are attached to a person's *hukou* status instead of their physical location. Typically, residents without local *hukou* can enjoy no or very limited resources provided by the local government.

or consumption-related ones, which reflect the allocations of the resources. The surveys ask not only about the total consumption but also the subcategories. Combined with individuals' time allocation information, this helps to construct home production information.

4.1.2. Summary Statistics

After dropping single-member families, the observations of two-spouse households with complete individual-level data are $1,196$, among which 651 have complete household-level information. Table 1 presents the summary statistics of the main variables at the individual level (Panel A) and household level (Panel B).

[Insert Table 1 here]

The average ages for female and male samples are 46.16 and 47.77 years old. Among these married couples, the percentages of couples married in the 1980s, 1990s and after 2000s are 31.4%, 37.6% and 31.0%. Due to the relaxation of *hukou* obtention laws in the 1990s that people can choose to switch to their spouses' *hukou* and the ages of the sample after selection, over 95% of the couples hold the same types of *hukou*[17]. The surveys cover both rural and urban areas. Among the sample, around 17% of the households hold urban *hukou*.

Both men and women in the sample see high labor force participation rates, which are consistent with the continuing trend of comparatively high labor force participation rates among Chinese women (Maurer-Fazio et al., 2011). At the same time, only 3.5% of men are out of the labor force while the rate is proximately 18% for women. On average, a man works as twice as long as a woman in the labor market. However, as for chore participation, a much lower rate can be observed among husbands. Only 2.2% women do not do any chores but the rate reaches 32% among men. In addition, a woman spends 15 hours weekly on chores on average but these hours are just 4 among husbands.

Due to the limitation of data of the wealth of the parents on both sides, I adopt two proxies for the two variables: the *hukou* statuses and education levels. An urban *hukou* and higher education levels are typically associated with higher wealth. A person's father's *hukou* status is chosen as the measurement considering that 98% of the parents have the same types of *hukou*. For the bride's side,

[17]The rules of *hukou* obtention through marriage vary differently from places to places. Larger and wealthier cities see tighter rules on the obtention. For instance, megacities such as Beijing and Shanghai require at least 10 years of marriage and applicants' ages over 40 years old. Smaller cities, towns, or villages may approve right after the marriage registries.

13.80% of their parents hold urban *hukou*. A higher percentage of 17.00% is observed among the grooms'. For education levels, I distinguish by whether they have finished high school. No large difference can be noticed between the bride's and groom's sides, where 12% is around the average rate for both of them.

For the household level, the average bride price and dowry for the sample are $9,867$ and $5,234$ *yuan*[18]. We have to keep in mind that the majority of the sample got married 30 or 40 year prior to the surveys when China was at the beginning of the economic reform and transitioning from a planned economy to a market economy. These two values should be treated as considerable at that time.

4.2. Structural Model Estimation

This part follows the second section in the theoretical model part to estimate the impacts of dowry on individuals' bargaining power. The theoretical model introduces the heterogeneity in Pareto weights by assuming that a higher dowry raises the wife's weight. Thus, if we know the actual allocations of resources within a household, the maximization problem focuses on the adoption of the weights on spouses to maximize the whole utility of the family.

The previous model presents the utility function as an egoistic form, where an individual only cares about their own consumption and leisure. However, in reality, it is difficult to observe the divisions of consumption among household members. The surveys that I adopt in the analysis only provide the total expenditures on consumption and its subcategories. Nevertheless, it is more practical to obtain individuals' information on their time spent on work, home production, and leisure, which is accessible from the surveys. Thus in order to tackle this issue, I revisit the original household utility maximization problem in the form below:

$$V^H = \max_{c_m^H, q_m^H, \ell^M, \ell^F} [u_2^M(c_m^H, q_m^H, \ell^M)]^{\sigma_3(D)} [u_2^F(c_m^H, q_m^H, \ell^F)]^{1-\sigma_3(D)} \tag{20}$$

where V^H is the revised household utility. The individual utility is in a form of:

$$u^G = (c_m^H)^{\tau_1^G} (q_m^H)^{\tau_2^G} (\ell^G)^{\tau_3^G}, \qquad \tau_1^G + \tau_2^G + \tau_3^G = 1, G = M \text{ or } F \tag{21}$$

I replace the consumption of final goods and home production of individuals with the total con-

[18] All prices involved in this paper are CPI adjusted to the 2000 values in each province.

sumptions: c_m^H and q_m^H. Home production involves the input of both husband's and wife's time on chores and intermediate goods. The production function is below:

$$q_m^H = (h^M)^{\rho_1} \cdot (h^F)^{\rho_2} \cdot (g)^{(1-\rho_1-\rho_2)} \tag{22}$$

The budget constraint becomes:

$$c_m^H + g = \omega^M \cdot t^M + \omega^F \cdot t^F + D \tag{23}$$

To reflect the role of dowry in influencing a wife's bargaining power, I parametrize the heterogeneity in Pareto weights δ_3 and $1 - \delta_3$ in terms of the dowry payment D. For the convinience of structural estimation, I adopt the exponential form of the Pareto weights considering the nature of the data. The weight on the husband's utility is:

$$\delta_3(D) = \frac{exp(\nu_0 + \nu_1 D)}{1 + exp(\nu_0 + \nu_1 D)} \tag{24}$$

The specification normalizes the sum of the weights of the husband and wife to 1. For the dowry payment variable, I adopt two indicators: the actual value of dowry and the dowry-to-bride price ratio. Even though the bargaining of marriage payments between the two families shows the uncertainty of the directions of the dowry-to-bride price ratio, it should not affect our analysis of its role in impacting intrahousehold bargaining power between the married couple. In addition to the evident role that we have already seen in the first part that the dowry works as an endowment in the couple's budget constraint, the dowry amount also shows the bride's parents' support for her bargaining power in the new conjugal household. Table 2 below presents the estimation results:

[Insert Table 2 here]

The estimation of Pareto weight is based on the sample average. Overall, the husbands see much higher bargaining power than the wives with a weight of 0.73. In addition, for a woman who brings the mean value of dowry, a $1,000$ *yuan* increase in dowry results in a 0.37% percentage point increase in her bargaining power. When measured with the dowry-to-bride price ratio, a woman whose family retains the mean value of the ratio sees 0.4% percentage point higher bargaining power if the ratio increases by 1 percentage point.

4.3. Reduced-form Evidence

This part examines the two major conclusions raised in the previous part with reduced-form methods. In addition, the empirical evidence on testing the comparative static analysis on how family characteristics influence the equilbrium of the two prices is provided in Appendix B.

4.3.1. Dowry and Intrahousehold Bargaining Power

This part provides empirical evidence to answer the question: what are the outcomes of higher dowries? To answer this question, we need to find an indicator to reflect the bargaining power of an individual within the family. Following the strategy in Zhang & Chan (1999), I look into individuals' participation in chores at home. As mentioned in the data summary part, the disparity between chore participation and time investment between the two genders is substantial. Considering that almost all of the women in the sample participate in chores regardless of their incomes or education levels but a third of men do not engage in any housework, I test whether there is a positive relationship between dowry amount and an individual's chore participation. The specification is below:

$$Chores_{i,k} = \boldsymbol{X}_{i,k}\boldsymbol{\beta}_6 + \kappa_k + \varepsilon_{i,k} \tag{25}$$

The measure chore participation, I construct three indicators: a wife's time spent on chores, the ratio of time spent on chores and time on working for working women, and the time difference between the husband and the wife on chores. The main explanatory variable is the amount of dowry. Different from Zhang & Chan (1999), I do not incorporate the bride price because the data from their surveys show dowry is significantly higher than bride price in Taiwanese society[19], which is a different situation to the surveys that I use to some extent. Table 3 presents the estimation results:

[Insert Table 3 here]

We can notice that dowry has significant impacts on all three indicators and the results direct to less time on chores for women and more participation of husbands. First, a 1% increase in dowry leads to $9-10\%$ reduction in the wife's time spent on chores. The conclusions still hold when individuals' *hukou* and education levels are taken into account and provincial fixed effects are controlled. Sec-

[19] In addition, their research finds only dowry has impacts on husbands' participation in chores while bride price sees minor and insignificant coefficients.

ondly, for those working women, dowry also has a significant role in shifting their time scheduling. A 1% increase in dowry is associated with $8-10$ percentage points decrease in the weekly chore-to-work ratio for working women when the provincial fixed effects are not controlled. Furthermore, when we take husbands into account, a higher dowry helps to reduce the deficit of time on chores of husbands and wives, where nearly 9% is lessened with a 1% increase in dowry. However, the deduction of the deficit is mainly from the power gaining of the wives presumably because of the already low participation rate of the husbands.

4.3.2. The Impacts of the Marriage Law Amendment on Dowry

In this part, I test whether the agent marriage law amendment would lead to a discontinuity of the marriage payment with empirical data. The theoretical part suggests two directions of change may occur under different situations. Thus, if the theory is valid that dowry occurs as a behavior of altruism of parents towards children, under the case of a less euqual family, the protection of property ownership prompted by the law amendment should induce higher incentives for the bride's family to transfer wealth to the couple as well as a higher bride price paid. Hence, we should be able to observe a positive discontinuity of dowry payment in the year when the amendment was introduced. First, I examine the graphic evidence of the discontinuity by looking into the time trends of two prices. For the part of dowry, I also calculate the ratio of dowry to the bride's income. The two scatterplots in Figure 4 and Figure 5 present the average bride price, and dowry and the average dowry-to-bride's income ratios through the sample years.

[Insert Figure 4 here]

[Insert Figure 5 here]

For both amounts of marriage payments, there is an upward trend due to society getting wealthier. However, there is a clear discontinuity in the year of the amendment, where an upsurge can be observed. The interesting phenomenon about the dowry-to-bride's income ratios is that before the introduction of the amendment, the flat regression line is consistent with the dowry being relative to the income per capita. After the year of amendment, not only do we notice a jump in the ratio but also a continuously increasing trend afterward.

In order to test the magnitude of the discontinuity due to the law amendment, I adopt a Regres-

sion Discontinuity Design(RDD) strategy to analyze the scale of dowry being influenced. The basic specification is below:

$$Price_{i,t} = \boldsymbol{\beta}_7 + \boldsymbol{\beta}_8 D_i + \boldsymbol{\beta}_9 T_{i,t} + \boldsymbol{\beta}_{10} D_i \cdot T_{i,t} + \varepsilon_{i,t} \tag{26}$$

$Price_{i,t}$ is either bride price or the dowry indicators. D_i is a dummy variable that indicates whether the year when the couple got married was after the amendment (1 if after 2001 and 0 if before 2001). $T_{i,t}$ stands for the wedding year, which captures the time trend. The specification also includes the interaction term of the dummy variable and the time trend term, and the error term. Hence, the estimand $\boldsymbol{\beta}_8$ reflects the discontinuity: $\boldsymbol{\beta}_8 = \lim_{T \uparrow A^*} E[Price_{i,t}|T_{i,t} = Amendment] - \lim_{T \downarrow A^*} E[Price_{i,t}|T_{i,t} = Amendment]$. In addition, considering that the term of bride's income used in calculating the dowry-to-bride's income ratios is the current income, I further include the control variable of the age of the bride at which she got married. Table 4 presents the estimation results:

[Insert Table 4 here]

The first four columns test the effect on the bride price and dowry where both the actual currency values $(1-2)$ and values after IHS conversion $(3-4)$ are presented, The last column presents the dowry-to-income ratio results. The estimation shows that the increase of dowry amount to the dowry-to-income ratio at the timing cutoff is consistently significant at the 10-percent level or higher. The increase of the exact bride price and dowry values amount to $2,243$ and $1,214$ *yuan*, respectively. The average dowry before the law amendment was $12,483$ *yuan*; thus, this amendment amounts to a 9.93% increase. The average dowry-to-income ratio prior to the amendment was 1.04; thus, the amendment helped to raise the ratio considerably to 1.68.

4.3.3. Robustness Tests on the Impacts of the Marriage Law Amendment

4.3.3.1 Impacts of the Marriage Law Amendment on Samples with Different Level of Inequality

The first robustness test focuses on one of the conclusions from the theoretical part regarding the changing direction of the marriage payments when there is a positive shock to the wife's bargaining power. When the household is more unequal, we should expect more pronounced impacts from the the marriage law amendement. Borrowing the evidence from the intrahouse bargaining power part, I

test wheter the impact of the marriage law amendment will be different on samples showing different bargaining power. In order to do so, I adopt the first measurement: the time the wife spends on chores from the last part and divide the sample into two groups depending on if their time is higher than the average (lower bargaining power for the wife and a less equal household) or lower than the average (high bargaining power for the wife and a more equal household). We need to keep in mind that the high or low bargaining power is a comparison between wivies from different families. Generally the society observes women hold lower bargaining power than man, which we will further see in the next part. The comparison between the restults for the two groups are presented in Table 5 below:

[Insert Table 5 here]

For the group in which the wives have lower bargaining power, we can notice not only does the amendment show higher sigfincance in the estimation among the low bargaining power group, but it also displays higher magnitudes in both prices. The amendment leads to twice and three times as much impact on the bride price and dowry for the less equal households than the group with more equal power. However, we can notice both groups show positive increments in the cutoff year. This is due to the reason mentioned above that wives overall have less bargaining power and it is rare to observe samples with equal or wives holding more power.

4.3.3.2 Manipulation of the Law Amendment around the Year of Implementation

This part examines the general concern of testing the implementaion of any policies that a manipulation may occur around the year when a policy is introduced. The concern regarding this specific amendment is refelcted in two parts both before and after the year of implementation. Since the hearing of the amendment was held one year ahead of the implementaion in October 2000 and the release of the information could even be earlier, some people would have expection for the implementaion. Thus, for them, if they chose to get married one or two years ahead of the amendment, they may choose to set the prices according the new information. On the other hand, for those who are less sensitive to political news, it might take sometime for them to apprehend the new law. Thus they may still set the prices according to the old law. In addition to the the marriage price part, another aspect with regard to the manipulation is the decision of timing of getting married. Because this amendment is more pro-woman, the couple, especially the bride's side, would want to wait to see how the pol-

icy would be implemented if they were initially planning to register around those years. Though we cannot directly test the first case, it is possible to conduct a McCrary density test to examine whether there was an abnormality around the year of implementation. Following Cattaneo et al. (2020, 2021), I conduct a hypothesis test about whether the density near the cutoff to is discontinuous. Table 5 below presents the result:

[Insert Table 5 here]

The test clearly indicates there is a manipulation around the year of the implementation of the amendment. It indicates some couples adopted a "wait to see" strategy. Thus, in order to avoid the interference of the lag and lead effects, I employ the donut RDD method. Table 6 below shows the results with one and two years excluded on each side.

[Insert Table 6 here]

We can notice that the magnitudes of all five indicators of both new samples are larger than the original test. In addition, higher sigifcant levels can also be observed in the new estimation. The differnce is especially noticable in the sample with two years on each side excluded where the discontinuity of the bride price is almost doubled and the dowry estimation sees a nearly 50% increase. The donut RDD regression results further strengthen our findings respecting the impacts of external shocks on the marriage payments.

5. Conclusions

I have constructed a simple equilibrium model of the marriage market to explore the bargaining process of the families on two sides regarding a bidirectional marriage payment tradition in Chinese society: bride price and dowry. I also investigate the consequential impacts of the marriage payments on spouses' intrahousehold bargaining power by adopting a collective model. By taking advantage of a pro-women property-ownership-related law amendment, I examine how the amendment increases both families' willingness to transfer more wealth. The result leads to a Pareto improvement for all sides in a society with high gender inequality. My research helps to understand the importance of gender roles in a traditionally conservative society with reference to one of the most important events in people's life: marriage.

The first bargaining regarding the payments of bride price and dowry is based on a maximization problem of the bride's family, where the parents' utility comprises both their own and daughter's consumption as well as the utility loss from the daughter's marriage due to the patrilocal tradition. The constraints derive from the factual tradition of the immense cost of the bride price to a family and a reservation price from the bride's family's side by reason of their desire for higher welfare for their daughter. The second part is built upon a collective model that involves intrahousehold bargaining between the spouses. I introduce the heterogeneity into the Pareto weight of each individual by incorporating the dowry payment. By observing the allocations of resources and time in each family, I estimate how dowry shifts a wife's bargaining power. Meanwhile, it also helps us to understand the disparity between the genders in society. Lastly, I provide evidence on how a positive external shock that increases the value of dowries can lead to a Pareto improvement for all sides.

This article provides empirical evidence to test the predictions of the theoretical models with both structural model estimation and reduced-form methods. A unique dataset that includes both marriage payment information and family characteristics is adopted. The RDD estimation regarding the impacts of the marriage law amendment indicates positive increments in both marriage payments. The marriage law amendment resulted in positive changes in both bride price and dowry payment, where a 26.26% increase in the bride price and a 9.93% increase in the dowry or 61.5% increase in the dowry-to-income ratio can be observed. The robustness test implies that the improvements are more significant in households with higher inequality.

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Figures

Figure 1: The Process of Payments in A Marriage

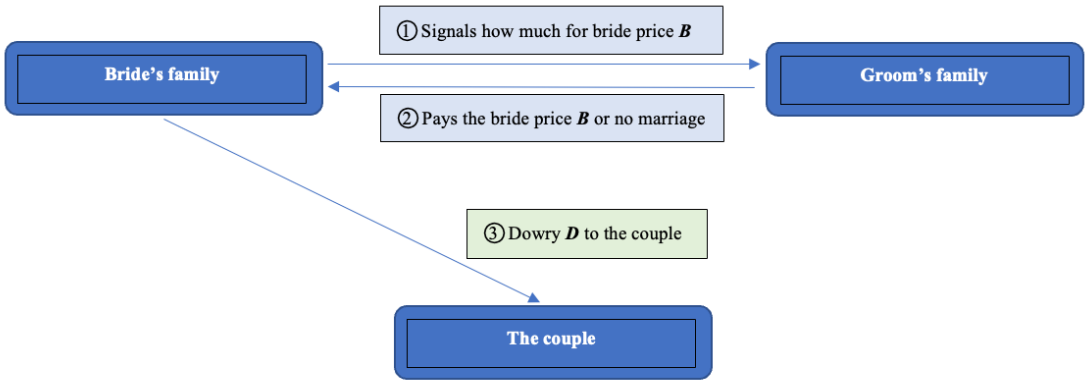


Figure 2: Relationship between wedding year and bride price

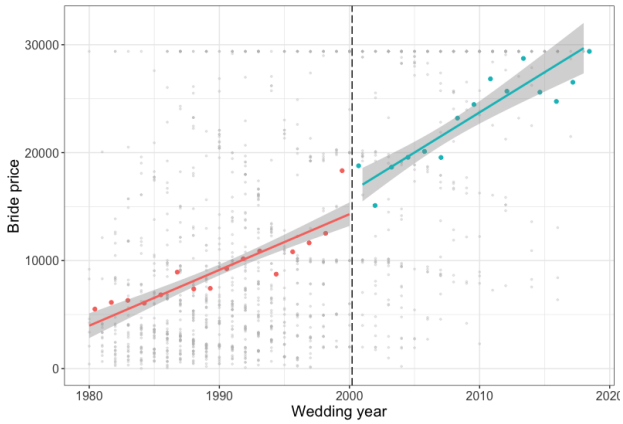
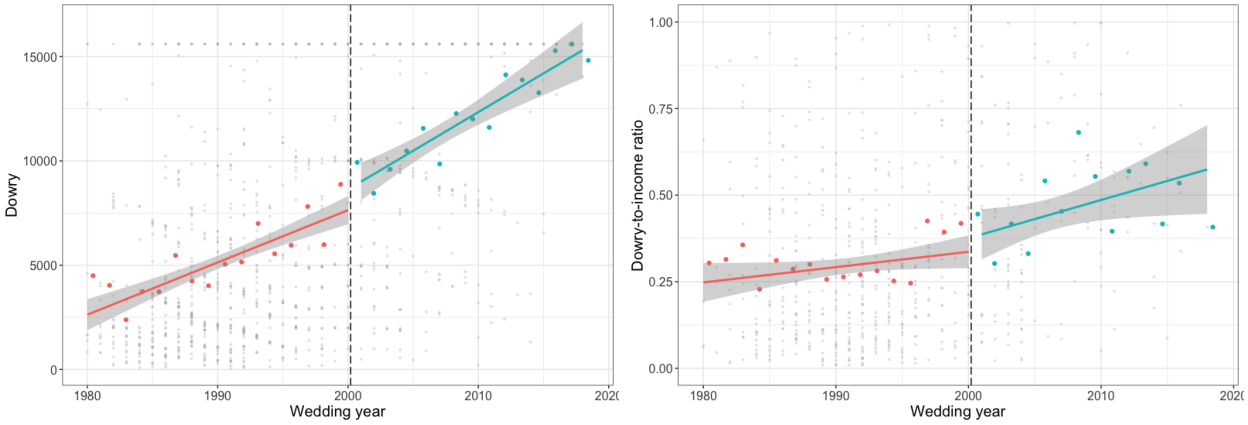


Figure 3: Relationship between wedding year and the ratio of dowry to bride's income



Tables

Table 1: Summary Statistics

Panel A: Individual Data		
	Bride	Groom
Age (years)	46.16	47.77
Urban *Hukou* Percentage	16.70%	17.50%
High School Education Percentage	22.00%	30.60%
Income (*yuan*)	1,9445	3,4416
Labor Force Participation Rate	82.14%	96.46%
Average Working Hours (weekly)	18.08	32.01
Chore Participation Rate	97.80%	68.00%
Average Hours on Chores (weekly)	15.10	4.14
Father Urban *Hukou* Percentage	13.80%	17.00%
At Least One Parent High School Education	12.19%	11.60%
Panel B: Household Data		
	Household	
Bride Price	9,867	
Dowry	5,234	
Dowry-to-bride price Ratio	80%	
Total Consumption (annually)	26,635	
Food Consumption (annually)	6,728	
Number of Observations	1,196	

Notes: The results use the sample from the 2018 China Labor force Dynamics Surveys (CLDS). All prices are in 2000 value in each province (or equivalents).

Table 2: Structural estimation: Dowry, Preferences and Bargaining Power

	(1)		(2)	
Pareto Weight Parameters				
σ_3 (sample average)	0.764***		0.820**	
	(0.269)		(0.405)	
Dowry	-1.249***			
	(0.320)			
Dowry Ratio			-1.151**	
			(0.484)	
Individual Preference Parameters				
	Groom	Bride	Groom	Bride
Final Goods	0.254***	0.301***	0.296***	0.338***
	(0.061)	(0.052)	(0.051)	(0.045)
Home Production	0.397***	0.417***	0.452***	0.443***
	(0.085)	(0.065)	(0.050)	(0.043)
Home Production Parameters				
ρ_1	0.164***		0.174***	
	(0.002)		(0.002)	
ρ_2	0.204***		0.204***	
	(0.002)		(0.002)	
Observations	471		471	

Note: Standard errors in brackets and errors are clustered at the household level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. Both final and intermediate goods values are transformed with the Inverse Hyperbolic Sine (IHS) function. The Pareto weight parameter estimation is based on the sample average values of the dowry amount and the dowry-to-bride price ratio.

Table 3: Reduced-form Evidence: Relatiobship between Dowry and Chore Participation

	Dependent variable:								
	Wife's time on chores			Time on chores / Time on work (Wife)			Husband's - Wife's time on chores		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dowry	-0.115***	-0.091***	-0.086***	-0.100***	-0.082***	-0.046*	0.121***	0.089***	0.080**
	(0.017)	(0.018)	(0.020)	(0.021)	(0.024)	(0.028)	(0.029)	(0.032)	(0.035)
Dependent Variable Mean	3.698	3.537	3.650	1.405	1.283	0.927	-2.327	-2.127	-1.853
Spouses' *Hukou* Statuses		X	X		X	X		X	X
Spouses' Eduaction		X	X		X	X		X	X
Province Fixed Effects			X			X			X
Observations	1,190	1,183	1,183	729	725	725	1,185	1,179	1,179
R^2	0.038	0.055	0.087	0.029	0.036	0.087	0.015	0.024	0.085

Note: Standard errors in brackets and errors are clustered at the household level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. The dependent vairiable of time on chores, and the explanatory variable of the dowry amount are all transformed with the Inverse Hyperbolic Sine (IHS) function. Both spouses' education and *hukou* variables are dummy variables. For education, the variable is 1 if the individual has finished high school and 0 if they have never. For *hukou*, the variable is 1 if they hold an urban *hukou* and 0 if they do not.

Table 4: Reduced-form Evidence: Effect of The agent Marriage Law Amendment on Marriage Payments

	Dependent variable:				
	Bride price (log)	Bride price	Dowry (log)	Dowry	Dowry-to-income ratio
	(1)	(2)	(3)	(4)	(5)
RDD estimand	0.203*	2,242.983**	0.232*	1,213.899**	1.074***
	(0.122)	(971.448)	(0.138)	(583.456)	(0.393)
Observations	1,461	1,461	1,207	1,207	804
R^2	0.335	0.343	0.292	0.299	0.031

Note: Standard errors in brackets. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. The dependent variables in columns 1 and 3 are the bride price and dowry transformed with the Inverse Hyperbolic Sine (IHS) function. The dependent variables in columns 2 and 4 are the actual amounts of the bride price and dowry. The dependent variable in column 5 is the ratio of dowry to the income of the bride (CPI adjusted),. All three columns utilize local linear regression and triangular kernel. The Bandwidth type is chosen based on the method proposed by Imbens & Kalyanaraman (2012).

Table 5: Robustness Test on the Effect of The agent Marriage Law Amendment on Marriage Payments: Different Bargaining Power

	Household sample group:			
	High bargaining power wife		Low bargaining power wife	
	Bride price	Dowry	Bride price	Dowry
	(1)	(2)	(3)	(4)
RDD estimand	1,371.572	448.322	2,214.231*	1,528.255**
	(1,648.480)	(973.313)	(1,216.821)	(733.639)
Observations	448	372	1,005	829
R^2	0.400	0.353	0.297	0.249

Note: Standard errors in brackets. * significant at the 10% level; ** significant at the 5% level. The dependent variables are the actual amounts of the bride price and dowry. All four columns utilize local linear regression and triangular kernel. The Bandwidth type is chosen based on the method proposed by Imbens & Kalyanaraman (2012).

Table 6: Policy Manipulation Test

***Variables*:**		
Number of observations	1,461	
Cutoff = 0	Left of Cutoff	Right of Cutoff
Number of observations	1,076	385
Order est. (p)	2	2
Order bias (q)	3	3
Method	T	$P > \|T\|$
Robust	3.8378	1e-04

Note: The test is based on the local polynomial density estimator proposed in Cattaneo et al. (2020, 2021). The kernel used in the test is triangular. The VCE method is jackknife.

Table 7: Robustness Test on the Effect of The agent Marriage Law Amendment on Marriage Payments: Donut RDD

	Dependent variable:				
	Bride price (log)	Bride price	Dowry (log)	Dowry	Dowry-to-income ratio
	(1)	(2)	(3)	(4)	(5)
	Sample: One year on each side excludeded				
RDD estimand	0.251*	3,048.888***	0.273*	1,291.790**	1.153***
	(0.137)	(1,070.960)	(0.156)	(653.684)	(0.447)
Observations	1,395	1,395	1,148	1,148	759
R^2	0.339	0.353	0.296	0.305	0.033
	Sample: Two years on each side excludeded				
RDD estimand	0.365**	4,237.120***	0.323*	1,760.606**	1.226**
	(0.153)	(1,182.938)	(0.175)	(728.923)	(0.512)
Observations	1,339	1,339	1,097	1,097	722
R^2	0.346	0.367	0.302	0.315	0.033

Note: Standard errors in brackets. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. The dependent variables in columns 1 and 3 are the bride price and dowry transformed with the Inverse Hyperbolic Sine (IHS) function. The dependent variables in columns 2 and 4 are the actual amounts of the bride price and dowry. The dependent variable in column 5 is the ratio of dowry to the income of the bride (CPI adjusted),. All five columns utilize local linear regression and triangular kernel. The Bandwidth type is chosen based on the method proposed by Imbens & Kalyanaraman (2012).

Appendix

Appendix A: Theoretical Appendix

A.1. The Relationbship between Bride Price and Bride's Family's Utility

$$\frac{\partial log(U_m^F)}{\partial B} = \gamma\Bigg\{\delta_1 \frac{1}{W^F + B - D}\big(1 - \frac{\partial D}{\partial B}\big) + (1-\delta_1)\frac{1}{c_m^F}\big[-\delta_3' \frac{\partial D}{\partial B}(w^M + w^F + D) + (1-\delta_3)\frac{\partial D}{\partial B}\big]\Bigg\} \tag{A1}$$

Since $-\delta_1 \frac{1}{W^F+B-D} + (1-\delta_1)\frac{1}{c_m^F}\big[-\delta_3'(w^M + w^F + D) + (1-\delta_3)\big] = 0$
and $\frac{\partial log(U_m^F)}{\partial B} = \gamma\delta_1 \frac{1}{W^F+B-D} > 0$,
$\frac{\partial log(U_m^F)}{\partial B} > 0$

A.2. Implication of the Three-agent Model under Equilibirum

This part provides the detailed solutions to the discussions of the implications of the equilibrium of the three-agent models.

The rule deciding the dowry amount given any bride price can also be written as:

$$-\frac{\delta_1}{W^F + B - D} - \frac{(1-\delta_1)\delta_3'}{1-\delta_3} + \frac{1-\delta_1}{w^M + w^F + D} = 0 \tag{A2}$$

Take partial differential with respect to the bride price (D is a funtion of B):

$$\frac{\delta_1}{(W^F + B - D)^2} = \Bigg\{\frac{\delta_1}{(W^F + B - D)^2} + (1-\delta_1)\big[\frac{\delta_3''(1-\delta_3) + (\delta_3')^2}{(1-\delta_3)^2}\big] + \frac{1-\delta_1}{(w^M + w^F + D)^2}\Bigg\}\frac{\partial D}{\partial B} \tag{A3}$$

$\frac{\partial D}{\partial B} > 0$. This indicates that given the exogenous variables set, a higher bride price means also a high dowry payment.

I assign a detailed function form to the bargaining weight δ_3. Notice that the specification does not deliver an explicit function form of dowry but helps to simplify the analysis. The function form also meets the first and second -order

$$\delta_3 = \frac{1}{1 + \alpha_0 + \alpha_1 D} \qquad \alpha_0, \alpha_1 > 0 \tag{A4}$$

$$\delta_3' = -\frac{\alpha_1}{(1+\alpha_0+\alpha_1 D)^2} < 0 \tag{A5}$$

$$\delta_3'' = \frac{2\alpha_1^2}{(1+\alpha_0+\alpha_1 D)^3} > 0 \tag{A6}$$

This results in a detailed dowry rule as below.

$$-\frac{\delta_1}{W^F + B - D} + \frac{(1-\delta_1)\alpha_1}{(\alpha_0+\alpha_1 D)(1+\alpha_0+\alpha_1 D)} + \frac{1-\delta_1}{w^M + w^F + D} = 0 \tag{A7}$$

We can notice the LHS's value is monotonically increasing with the increase of B. This indicates that given the exogenous variables W^F, w^M and w^M, a D is corresponding to a single B value.

The following subsections are corresponding to the proofs of the four propositions where I list the opposite situations and prove that they only occur under rare conditions.

A.2.1.1. A negative bride price $\mathbf{B < 0}$

Intuitively, the patrilocality means the groom's family gains from getting a daughter-in-law. Thus, a negative value of "bride price" could further make the marraige more attrative ot them. However, for the bride's family, a negative value of "bride price" means they will further lose wealth after the leave of their daughter. This will make the condition difficult to hold.

From the view of the bride's family's utility, transferring wealth (negative "bride price") does not benefit either their own or their daughter's consumption. The spouses' consumption is not influenced by the bride price but only dowry. Thus we have no change on the bride's consumption regardless of the bride price amount. The inequation below holds when the "bride price" is negative:

$$log(\xi^F) + \gamma[\delta_1 log(W^F - D) + (1-\delta_1) log(c_m^F)] \geq log(\xi^F) + \gamma[\delta_1 log(W^F + B - D) + (1-\delta_1) log(c_m^F)] \quad \text{when } B < 0 \tag{A8}$$

Hence, the only reason why the bride's family could possibly pay to the groom's family is that the outside option for the groom's family is larger than getting their son married.

$$log(\xi^M)+\gamma\{\delta_2 log(W^M-B)+(1-\delta_2)log[\delta_3(w^M+w^F+D)]\} < \gamma[\delta_2 log(W^M)+(1-\delta_2)log(w^M)] \quad \text{(A9)}$$

This can be rewritten as:

$$\gamma(1-\delta_2)log\left[\frac{w^M}{\delta_3(w^M+w^F+D)}\right] > \gamma\delta_2 log\left(\frac{W^M-B}{W^M}\right)+log(\xi^M) \quad \text{(A10)}$$

Since the RHS is positve, the inequation holds only if the groom's consumption is worse off due to the marriage. This already contradicts the presumption that the marriage benefits both spouses. Even this happens, it means the groom's income is much higher than the bride. The spouses also get only small amount of dowry from the bride's family. This is more possible in an arranged marriage where the bride has a low productivity. In the case of a negative "bride price", the reservation bride price needs to be larger than the outside option:

$$log(\xi^F)+\gamma[\delta_1 log(W^F+B-D)+(1-\delta_1)log(c_m^F)] \geq \gamma[\delta_1 log(W^F)+(1-\delta_1)log(w^F)] \quad \text{(A11)}$$

Suppose $B<0$, $D\geq 0$, and $W^F+B-D>0$. A negative bride price means that the gain for the bride has to justify both the loss of wealth the leave of the daughter:

$$log(c_m^F)-log(w^F) \geq \frac{\delta_1}{1-\delta_1}[log(W^F)-log(W^F+B-D)]-\frac{1}{\gamma(1-\delta_1)}log(\xi^F) \quad \text{(A12)}$$

This can be rewritten as:

$$\frac{\frac{\alpha_0+\alpha_1 D}{1+\alpha_0+\alpha_1 D}\frac{w^M+w^F+D}{w^F}}{\left[\frac{1-\delta_1}{\delta_1}W^F\left(\frac{\alpha_1}{(\alpha_0+\alpha_1 D)(1+\alpha_0+\alpha_1 D)}+\frac{1}{w^M+w^F+D}\right)\right]^{\frac{\delta_1}{1-\delta_1}}} \geq exp\left[-\frac{1}{\gamma(1-\delta_1)}log(\xi^F)\right] \quad \text{(A13)}$$

This inequation condition is met when the spouses, especially the bride, have high income and a high payment of dowry. Considering that these two condition contrdict the conditions just raised, achieving the situation of a negative "bride price" is impratical.

A.2.1.2. No transfers between the natal families $\mathrm{B}=0$ and $\mathrm{D}>0$

If $B=0$:

$$log(\xi^M) + \gamma(1-\delta_2)log(\frac{\delta_3(w^M + w^F + D)}{w^M}) = 0 \tag{A14}$$

since $log(\xi^M) > 0$, if the equation holds, we at least need $\delta_3(w^M + w^F + D) < w^M$, which is the same situation facing us for a negative "bride price" where the consumption of the groom becomes lower after the marriage. Even if the inequation is feasible, this mean the income of the groom is much higher than the bride, and the dowry amount cannot be too high.

Let $g(D) = -\frac{\delta_1}{W^F+B-D} + \frac{(1-\delta_1)\alpha_1}{(\alpha_0+\alpha_1 D)(1+\alpha_0+\alpha_1 D)} + \frac{1-\delta_1}{w^M+w^F+D}$. $g'(D) < 0$. Thus, when B is zero, there exists a postive value of dowry only if $-\frac{\delta_1}{W^F} + \frac{(1-\delta_1)\alpha_1}{\alpha_0(1+\alpha_0)} + \frac{1-\delta_1}{w^M+w^F} > 0$. In other words, we will see a positive value of dowry given a zero bride price only if the bride's family is relatively wealthy and both spouses have low income.

Combining the two conditions above, it is difficult to achieve both simutaneously.

A.2.1.3. A positive value of bride price but no dowry $\mathrm{D} = 0$ and $\mathrm{B} > 0$

If $D = 0$:

Similar to the analysis above, we the function of D will satisfy

$$-\frac{\delta_1}{W^F + B} + \frac{(1-\delta_1)\alpha_1}{\alpha_0(1+\alpha_0)} + \frac{1-\delta_1}{w^M + w^F} \leq 0 \tag{A15}$$

This means a relatively impecunious bride's family even after the receive of a bride price, and high-income spouses. To ensure a positive payment of the bride price, the following condition has to be met:

$$log(\xi^M) + \gamma(1-\delta_2)log(\frac{\delta_3(w^M + w^F)}{w^M}) > 0 \tag{A16}$$

Since $log(\xi^M) > 0$, the condition is not impossible to achieve even if the bride's income is low.

A.2.1.4. A higher value of dowry than the bride price $\mathrm{D} > \mathrm{B}$

When $D > B$, we can easily get the inequation below from the rule of dowry decision:

$$\frac{(1-\delta_1)\alpha_1}{(\alpha_0 + \alpha_1 D)(1+\alpha_0+\alpha_1 D)} + \frac{1-\delta_1}{w^M + w^F + D} = \frac{\delta_1}{W^F + B - D} > \frac{\delta_1}{W^F} \tag{A17}$$

The inequation holds when the bride's family is wealthy and the income of the couple is comparatively low. In addition, the groom's family's side derives the ineuqation as below:

$$log(\xi^M)+\gamma\{\delta_2 log(W^M-B)+(1-\delta_2)log[\delta_3(w^M+w^F+B)]\} < \gamma[\delta_2 log(W^M)+(1-\delta_2)log(w^M)] \quad \text{(A18)}$$

This can be rewritten as:

$$log(\xi^M) + \gamma\delta_2 log\left(1 - \frac{B}{W^M}\right) < \gamma(1-\delta_2)log\left[\frac{w^M}{\delta_3(w^M + w^F + B)}\right] \quad \text{(A19)}$$

Combined with the previous results, we know that $D > B$ happens also because a less wealthy groom's family and a low payment of the bride price.

A.2.2. Patrilocality and bride price

The bride price rule with the explicit function form of the Pareto weights is written as:

$$log(\xi^M)+\gamma\{\delta_2 log(W^M-B)+(1-\delta_2)log[\delta_3(w^M+w^F+D)]\} = \gamma[\delta_2 log(W^M)+(1-\delta_2)log(w^M)] \quad \text{(A20)}$$

or:

$$log(\xi^M) + \gamma\delta_2 log\left(1 - \frac{B}{W^M}\right) = \gamma(1-\delta_2)log\left[\frac{w^M}{\delta_3[w^M + w^F + D(B)]}\right] \quad \text{(A21)}$$

The LHS is a function monotonically descreasing with the increase of bride price. Under the assumption, the RHS is normally decreases with the amount of dowry. When either side is weathy enough, the RHS starts to increase after reaching the turning point. However, regardless of the shape of the RHS, higher patrilocality (a larger value of the contant $log(\xi^M)$) would always result in a higher value of bride price.

A.2.3. Dowry and bargaining power

This part presents theoretical evidence of how the bride price and dowry change with an exogenous shock that brings extra value to the dowry. Considering the form of the Pareto weight, we can interpret the exogenous shock at a constant gain (higher α_0) or a higher marginal gain from the dowry (higher α_1). However, either of the change would lead to the same result on the dowry rule that for a fixed amount of bride price, the dowry will decrease. This is due to the fact that the bride's family only needs a smaller amount of wealth transfer to maintain the same level of bargaining power of their daughter.

Next, we can look at the bride price rule again under the updated dowry rule. For the groom's side, the final rule for the groom's family is that they always get the utility the same as the outside option ($\gamma[\delta_2 log(W^M) + (1-\delta_2)log(w^M)]$). However, we can not directly tell the changing direction of the bride price. Consider the bride price rule:

$$log(\xi^M) + \gamma\{\underbrace{\delta_2 log(W^M - B)}_{\text{Part A}} + \underbrace{(1-\delta_2)log[\delta_3(w^M + w^F + D)]}_{\text{Part B}}\} = \underbrace{\gamma[\delta_2 log(W^M) + (1-\delta_2)log(w^M)]}_{\text{Outside option (constant)}} \tag{A22}$$

when the bride price increases, Part A will decrease. However, the amount of dowry and the consequent bargaining power are uncertain, which depend on the values of parameters. Hence, it is possible Part B will increase. In other words, the consumption of the groom: $[\delta_3(w^M + w^F + D) = \frac{w^M + w^F + D}{1+\alpha_0+\alpha_1 D}$ should increase. In this case, the only outcome would be dowry also increase. If D instead decreases, $1 + \alpha_0 + \alpha_1 D$ should also decrease. However, this would contradict the dowry rule. Thus, the only possible case is that the dowry amount also goes higher.

If the bride price goes down, Part A will increase. Meanwhile, from the dowry rule, the dowry will certainly decrease. Thus, it is possible that the bargaining power will also decrease and Part B will decrease. To conclude, there are only two conditions as shown can make the equation above hold that the two prices must change in the same direction.

Even theoretically the two price rules hold in both cases, the parameters decide which direction is more possible to occur in what case. The dowry rule decides that a groom with lower bargaining power (compared with other grooms with higher bargaining power) in an more equal family tends to see dowry changes in a negative direction, and vice versa.

A.3. Comparative Statics of the Marriage Payments

The framework of the marriage payment model allows us to conduct a comparative static analysis of how exogenous variables impact the amounts of marriage payments. There are four exogenous variables that mainly interest us: the wealth of the two families and the income of the spouses. This section delves into how the equilibrium of the two prices changes with the change of the four variables.

The equilibirum involves four exogenous variables: w^M, w^F, W^M, and W^F and four endogenous variables: c_m^M, c_m^F, B, and D. The intrahousehold allocation rules present two equations regarding the consumption of the spouses. In addition, the utility maximization problem of the bride's family and the indifference condition

of the groom's family provide another two equations.

$$\begin{cases} c_m^M - \delta_3(w^M + w^F + D) & = 0 \\ c_m^F - (1-\delta_3)(w^M + w^F + D) & = 0 \\ \gamma\Big\{ -\delta_1 \dfrac{1}{W^F + B - D} + (1-\delta_1)\dfrac{1}{c_m^F}[-\delta_3'(w^M + w^F + D) + (1-\delta_3)] \Big\} & = 0 \\ log(\xi^M) + \gamma[\delta_2 log(W^M - B) + (1-\delta_2) log(c_m^M)] - \gamma[\delta_2 log(W^M) + (1-\delta_2) log(w^M)] & = 0 \end{cases} \tag{A23}$$

In order to conduct comparative static analysis, we need take derivative regarding all endogenous and exogenous variables.

$$\begin{cases} dc_m^M - [\delta_3'(w^M + w^F + D) + \delta_3]dD - \delta_3 dw^M - \delta_3 dw^F & = 0 \\ dc_m^F - [-\delta_3'(w^M + w^F + D) + (1-\delta_3)]dD - (1-\delta_3)dw^M - (1-\delta_3)dw^F & = 0 \\ -\dfrac{(1-\delta_1)[-\delta_3'(w^M + w^F + D) + (1-\delta_3)]}{(c_m^F)^2} dc_m^F + \dfrac{\delta_1}{(W^F + B - D)^2} dB & \\ + \Big\{ -\dfrac{\delta_1}{(W^F + B - D)^2} + \dfrac{1-\delta_1}{c_m^F}[-\delta_3''(w^M + w^F + D) - 2\delta_3'] \Big\} dD & \\ -\dfrac{1-\delta_1}{c_m^F}\delta_3' dw^M - \dfrac{1-\delta_1}{c_m^F}\delta_3' dw^F + \dfrac{\delta_1}{(W^F + B - D)^2} dW^F & = 0 \\ \dfrac{1-\delta_2}{c_m^M} dc_m^M - \dfrac{\delta_2}{W^M - B} dB - \dfrac{1-\delta_2}{w^M} dw^M + \delta_2\big(\dfrac{1}{W^M - B} - \dfrac{1}{W^M}\big) dW^M & = 0 \end{cases} \tag{A24}$$

The four differential equations can be written as a matrix form

$$\begin{bmatrix} 1 & 0 & 0 & K_1 \\ 0 & 1 & 0 & -1 - K_1 \\ 0 & K_2 & K_3 & K_4 \\ K_5 & 0 & K_6 & 0 \end{bmatrix} \begin{bmatrix} dc_m^M \\ dc_m^F \\ dB \\ dD \end{bmatrix} = \begin{bmatrix} \delta_3 & \delta_3 & 0 & 0 \\ (1-\delta_3) & (1-\delta_3) & 0 & 0 \\ K_7 & K_7 & 0 & -K_3 \\ K_8 & 0 & K_9 & 0 \end{bmatrix} \begin{bmatrix} dw^M \\ dw^F \\ dW^M \\ dW^F \end{bmatrix} \tag{A25}$$

where

$$
\begin{cases}
K_1 = -[\delta_3'(w^M + w^F + D) + \delta_3] \\
K_2 = -\dfrac{(1-\delta_1)[-\delta_3'(w^M + w^F + D) + (1-\delta_3)]}{(c_m^F)^2} \\
K_3 = \dfrac{\delta_1}{(W^F + B - D)^2} \\
K_4 = -\dfrac{\delta_1}{(W^F + B - D)^2} + \dfrac{1-\delta_1}{c_m^F}[-\delta_3''(w^M + w^F + D) - 2\delta_3'] \\
K_5 = \dfrac{1-\delta_2}{c_m^M} \\
K_6 = -\dfrac{\delta_2}{W^M - B} \\
K_7 = \dfrac{1-\delta_1}{c_m^F}\delta_3' \\
K_8 = \dfrac{1-\delta_2}{w^M} \\
K_9 = -\delta_2\big(\dfrac{1}{W^M - B} - \dfrac{1}{W^M}\big)
\end{cases}
\tag{A26}
$$

Three assumptions:

Assumption 1: Generally, $\partial c_m^M/\partial D > 0$. However, when w^M or w^F is large, $\partial c_m^M/\partial D < 0$

$$
\begin{cases}
\delta_3'(w^M + w^F + D) + \delta_3 > 0, & \text{when } w^M \text{ and } w^F \text{ are not too large} \\
\delta_3'(w^M + w^F + D) + \delta_3 < 0, & \text{when } w^M \text{ or } w^F \text{ is very large}
\end{cases}
\tag{A27}
$$

This also inficates that δ_3' is comparatively small: $|\delta_3'| << \delta_3$. The discussion of the sign of $\delta_3'(w^M + w^F + D) + \delta_3$ is only limited to the comparative statics of w^M and w^F. In the general cases where both w^M and w^F are not too large, we always have $\delta_3'(w^M + w^F + D) + \delta_3$ as positive considering the fact that dowry benefits both spouses.

Assumption 2: $\partial^2 U_m^F/\partial D^2 < 0$

$$
-\frac{\delta_1}{(W^F + B - D)^2} + \frac{1-\delta_1}{c_m^F}[-\delta_3''(w^M + w^F + D) - 2\delta_3'] < 0 \tag{A28}
$$

Assumption 3: $\frac{\partial c_m^M}{\partial W^M} > 0$, $\frac{\partial c_m^M}{\partial W^F} > 0$, $\frac{\partial c_m^F}{\partial W^M} > 0$, and $\frac{\partial c_m^F}{\partial W^F} > 0$.

$$
\begin{aligned}
&\begin{vmatrix} 1 & 0 & 0 & K_1 \\ 0 & 1 & 0 & -1-K_1 \\ 0 & K_2 & K_3 & K_4 \\ K_5 & 0 & K_6 & 0 \end{vmatrix} \\
&= -K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6 \\
&= \frac{\delta_1(1-\delta_2)[\delta_3'(w^M+w^F+D)+\delta_3]}{c_m^M(W^F+B-D)^2} - \frac{(1-\delta_1)\delta_2[-\delta_3'(w^M+w^F+D)+(1-\delta_3)]^2}{(c_m^F)^2(W^M-B)} \\
&+ \frac{\delta_2}{W^M-B}\left\{ - \frac{\delta_1}{(W^F+B-D)^2} + \frac{1-\delta_1}{c_m^F}[-\delta_3''(w^M+w^F+D) - 2\delta_3'] \right\}
\end{aligned}
\tag{A29}
$$

The expression of $-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6$ indicates that under the situation of a large value of either w^M or w^F, $-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6$ is certainly negative. However, when both w^M and w^F are not too large, $-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6$ can be positive or negative.

Groom's consumption

$$
\begin{aligned}
\frac{\partial c_m^M}{\partial W^M} &= \frac{\begin{vmatrix} 0 & 0 & 0 & K_1 \\ 0 & 1 & 0 & -1-K_1 \\ 0 & K_2 & K_3 & K_4 \\ K_9 & 0 & K_6 & 0 \end{vmatrix}}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} \\
&= \frac{-K_1K_3K_9}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6}
\end{aligned}
\tag{A30}
$$

Since $-K_1K_3K_9 = -\frac{B\delta_1\delta_2[\delta_3'(w^M+w^F+D)+\delta_3]}{(W^F+B-D)^2(W^M-B)W^M} < 0$, we must have $-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6 < 0$

$$\frac{\partial c_m^M}{\partial W^F} = \frac{\begin{vmatrix} 0 & 0 & 0 & K_1 \\ 0 & 1 & 0 & -1-K_1 \\ -K_3 & K_2 & K_3 & K_4 \\ 0 & 0 & K_6 & 0 \end{vmatrix}}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} = \frac{-K_1K_3K_6}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} \tag{A31}$$

$-K_1K_3K_6 = -\frac{\delta_1\delta_2[\delta_3'(w^M+w^F+D)+\delta_3]}{(W^F+B-D)^2(W^M-B)} < 0$

Bride's consumption

$$\frac{\partial c_m^F}{\partial W^M} = \frac{\begin{vmatrix} 1 & 0 & 0 & K_1 \\ 0 & 0 & 0 & -1-K_1 \\ 0 & 0 & K_3 & K_4 \\ K_5 & K_9 & K_6 & 0 \end{vmatrix}}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} = \frac{K_3K_9 + K_1K_3K_9}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} \tag{A32}$$

$K_3K_9 + K_1K_3K_9 = -\frac{B\delta_1\delta_2[-\delta_3'(w^M+w^F+D)+(1-\delta_3)]}{(W^F+B-D)^2(W^M-B)W^M} < 0$

$$\frac{\partial c_m^F}{\partial W^F} = \frac{\begin{vmatrix} 1 & 0 & 0 & K_1 \\ 0 & 0 & 0 & -1-K_1 \\ 0 & -K_3 & K_3 & K_4 \\ K_5 & 0 & K_6 & 0 \end{vmatrix}}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} = \frac{K_3K_6 + K_1K_3K_6}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} \tag{A33}$$

$K_3K_6 + K_1K_3K_6 = -\frac{\delta_1\delta_2[-\delta_3'(w^M+w^F+D)+(1-\delta_3)]}{(W^F+B-D)^2(W^M-B)} < 0$

Bride price

$$\frac{\partial B}{\partial w^M} = \frac{\begin{vmatrix} 1 & 0 & \delta_3 & K_1 \\ 0 & 1 & 1-\delta_3 & -1-K_1 \\ 0 & K_2 & K_7 & K_4 \\ K_5 & 0 & K_8 & 0 \end{vmatrix}}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} \tag{A34}$$

$$= \frac{\delta_3K_2K_5 + K_1K_2K_5 + \delta_3K_4K_5 - K_1K_5K_7 - K_2K_8 - K_1K_2K_8 - K_4K_8}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6}$$

$\delta_3K_2K_5 + K_1K_2K_5 + \delta_3K_4K_5 - K_1K_5K_7 - K_2K_8 - K_1K_2K_8 - K_4K_8$

$= -\frac{1}{c_m^M w^M}(1-\delta_2)\Big\{(c_m^M - \delta_3 w^M)\big\{\frac{\delta_1}{(W^F+B-D)^2} - \frac{1-\delta_1}{c_m^F}[-\delta_3''(w^M+w^F+D) - 2\delta_3']\big\} + \frac{1-\delta_1}{c_m^F}(\delta_3')^2 w^M(w^M + w^F+D) - \frac{(1-\delta_1)[-\delta_3'(w^M+w^F+D)+(1-\delta_3)]\delta_3' w^M(w^M+w^F+D)}{(c_m^F)^2} - \frac{(1-\delta_1)[-\delta_3'(w^M+w^F+D)+(1-\delta_3)]^2 c_m^M}{(c_m^F)^2} + \frac{(1-\delta_1)\delta_3\delta_3' w^M}{c_m^F}\Big\}.$

The first part $(c_m^M - \delta_3 w^M)\big\{\frac{\delta_1}{(W^F+B-D)^2} - \frac{1-\delta_1}{c_m^F}[-\delta_3''(w^M+w^F+D) - 2\delta_3']\big\} + \frac{1-\delta_1}{c_m^F}(\delta_3')^2 w^M(w^M + w^F+D) - \frac{(1-\delta_1)[-\delta_3'(w^M+w^F+D)+(1-\delta_3)]\delta_3' w^M(w^M+w^F+D)}{(c_m^F)^2} > 0.$

and the second part $-\frac{(1-\delta_1)[-\delta_3'(w^M+w^F+D)+(1-\delta_3)]^2 c_m^M}{(c_m^F)^2} + \frac{(1-\delta_1)\delta_3\delta_3' w^M}{c_m^F} < 0.$

When w^M is comparatively large, in discussing the sign of $-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6$, we can ignore other factors but focus on the coefficient of w^M. The coefficient of w^M in the first part is $\frac{(1-\delta_1)(\delta_3')^2}{1-\delta_3} + \frac{(1-\delta_1)(\delta_3')^2}{(1-\delta_3)^2}$ and the coefficient of the second part is: $-\frac{(1-\delta_1)\delta_3'\delta_3}{(1-\delta_3)^2} + \frac{(1-\delta_1)\delta_3\delta_3'}{1-\delta_3}$. Thus the absolute value of the coefficient in the second part is larger. Hence, $-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6 < 0$. When w^M is small or not too large, $-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6 > 0$.

$$\frac{\partial B}{\partial w^F} = \frac{\begin{vmatrix} 1 & 0 & \delta_3 & K_1 \\ 0 & 1 & 1-\delta_3 & -1-K_1 \\ 0 & K_2 & K_7 & K_4 \\ K_5 & 0 & 0 & 0 \end{vmatrix}}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} \tag{A35}$$

$$= \frac{\delta_3K_2K_5 + K_1K_2K_5 + \delta_3K_4K_5 - K_1K_5K_7}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6}$$

$\delta_3K_2K_5 + K_1K_2K_5 + \delta_3K_4K_5 - K_1K_5K_7 = \frac{1-\delta_2}{c_m^M}\Big\{\delta_3\big\{-\frac{\delta_1}{(W^F+B-D)^2} + \frac{1-\delta_1}{c_m^F}[-\delta_3''(w^M+w^F+D) - 2\delta_3']\big\} + \frac{(1-\delta_1)\delta_3'[\delta_3'(w^M+w^F+D)+\delta_3]}{c_m^F} + \frac{(1-\delta_1)\delta_3'(w^M+w^F+D)[-\delta_3'(w^M+w^F+D)+(1-\delta_3)]}{(c_m^F)^2}\Big\} < 0.$

$$\frac{\partial B}{\partial W^M} = \frac{\begin{vmatrix} 1 & 0 & 0 & K_1 \\ 0 & 1 & 0 & -1-K_1 \\ 0 & K_2 & 0 & K_4 \\ K_5 & 0 & K_9 & 0 \end{vmatrix}}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} = \frac{-K_2K_9 - K_1K_2K_9 - K_4K_9}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} \tag{A36}$$

Since $-K_2K_9 - K_1K_2K_9 - K_4K_9 = \frac{B\delta_2}{W^M(W^M-B)}\{-\frac{\delta_1}{(W^F+B-D)^2} + \frac{1-\delta_1}{c_m^F}[-\delta_3''(w^M+w^F+D) - 2\delta_3'] - \frac{(1-\delta_1)[-\delta_3'(w^M+w^F+D)+(1-\delta_3)]^2}{(c_m^F)^2}\} < 0$, $\frac{\partial B}{\partial W^M} > 0$.

$$\frac{\partial B}{\partial W^F} = \frac{\begin{vmatrix} 1 & 0 & 0 & K_1 \\ 0 & 1 & 0 & -1-K_1 \\ 0 & K_2 & -K_3 & K_4 \\ K_5 & 0 & 0 & 0 \end{vmatrix}}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} = \frac{K_1K_3K_5}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} \tag{A37}$$

Since $K_1K_3K_5 = -\frac{\delta_1(1-\delta_2)[\delta_3'(w^M+w^F+D)+\delta_3]}{c_m^M(W^F+B-D)^2} < 0$, $\frac{\partial B}{\partial W^F} > 0$.

Dowry

$$\frac{\partial D}{\partial w^M} = \frac{\begin{vmatrix} 1 & 0 & 0 & \delta_3 \\ 0 & 1 & 0 & 1-\delta_3 \\ 0 & K_2 & K_3 & K_7 \\ K_5 & 0 & K_6 & K_8 \end{vmatrix}}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} = \frac{-\delta_3K_3K_5 + K_2K_6 - \delta_3K_2K_6 - K_6K_7 + K_3K_8}{-K_1K_3K_5 - K_2K_6 - K_1K_2K_6 - K_4K_6} \tag{A38}$$

$$
\begin{aligned}
&- \delta_3 K_3 K_5 + K_2 K_6 - \delta_3 K_2 K_6 - K_6 K_7 + K_3 K_8 \\
&= \frac{\delta_1(1-\delta_2)(c_m^M - \delta_3 w^M)}{c_m^M w^M (W^F + B - D)^2} + \frac{(1-\delta_1)\delta_2[1 + \delta_3^2 - 2\delta_3 + c_m^F \delta_3' - \delta_3'(w^M + w^F + D) + \delta_3' \delta_3 (w^M + w^F + D)]}{(c_m^F)^2 (W^M - B)} \\
&= \frac{\delta_1(1-\delta_2)(c_m^M - \delta_3 w^M)}{c_m^M w^M (W^F + B - D)^2} + \frac{(1-\delta_1)\delta_2(1-\delta_3)^2}{(c_m^F)^2 (W^M - B)}
\end{aligned}
\tag{A39}
$$

We can notice the sign of the expression should be positive. However, in terms of discussing w^M, the expression shows w^M is in the power of -2. However, the denominator $-K_1 K_3 K_5 - K_2 K_6 - K_1 K_2 K_6 - K_4 K_6$ has the maximum power of w^M being -1. This indicates that the value of the derivative should be small and insignificant.

$$
\begin{aligned}
\frac{\partial D}{\partial w^F} &= \frac{\begin{vmatrix} 1 & 0 & 0 & \delta_3 \\ 0 & 1 & 0 & 1-\delta_3 \\ 0 & K_2 & K_3 & K_7 \\ K_5 & 0 & K_6 & 0 \end{vmatrix}}{-K_1 K_3 K_5 - K_2 K_6 - K_1 K_2 K_6 - K_4 K_6} \\
&= \frac{-\delta_3 K_3 K_5 + K_2 K_6 - \delta_3 K_2 K_6 - K_6 K_7}{-K_1 K_3 K_5 - K_2 K_6 - K_1 K_2 K_6 - K_4 K_6}
\end{aligned}
\tag{A40}
$$

Since

$$
\begin{aligned}
&- \delta_3 K_3 K_5 + K_2 K_6 - \delta_3 K_2 K_6 - K_6 K_7 \\
&= -\frac{\delta_1 \delta_3 (1-\delta_2)}{c_m^M (W^F + B - D)^2} + \frac{(1-\delta_1)[1 + \delta_3^2 \delta_3 + c_m^F \delta_3' - \delta_3'(w^M + w^F + D) + \delta_3(-2 + \delta_3'(w^M + w^F + D))]}{(c_m^F)^2 (W^M - B)} \\
&= -\frac{\delta_1 \delta_3 (1-\delta_2)}{c_m^M (W^F + B - D)^2} + \frac{(1-\delta_1)\delta_2(1-\delta_3)^2}{(c_m^F)^2 (W^M - B)} \\
&= -\frac{\delta_1(1-\delta_2)}{(w^M + w^F + D)(W^F + B - D)^2} + \frac{(1-\delta_1)\delta_2}{(w^M + w^F + D)^2 (W^M - B)}
\end{aligned}
\tag{A41}
$$

$-\frac{\delta_1(1-\delta_2)}{(w^M+w^F+D)(W^F+B-D)^2} < 0$ and $\frac{(1-\delta_1)\delta_2}{(w^M+w^F+D)^2(W^M-B)} > 0$. When w^F is small $-\delta_3 K_3 K_5 + K_2 K_6 - \delta_3 K_2 K_6 - K_6 K_7 > 0$ and when w^F is large $-\delta_3 K_3 K_5 + K_2 K_6 - \delta_3 K_2 K_6 - K_6 K_7 < 0$.

$$\begin{aligned}\frac{\partial D}{\partial W^M} &= \frac{\begin{vmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & K_2 & K_3 & 0 \\ K_5 & 0 & K_6 & K_9 \end{vmatrix}}{-K_1 K_3 K_5 - K_2 K_6 - K_1 K_2 K_6 - K_4 K_6} \\ &= \frac{K_3 K_9}{-K_1 K_3 K_5 - K_2 K_6 - K_1 K_2 K_6 - K_4 K_6}\end{aligned} \tag{A42}$$

Since $K_3 K_9 = -\frac{\delta_1 \delta_2 B}{(w^M+w^F+D)^2(W^M-B)W^M} < 0$, $\frac{\partial D}{\partial W^M} > 0$.

$$\begin{aligned}\frac{\partial D}{\partial W^F} &= \frac{\begin{vmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & K_2 & K_3 & -K_3 \\ K_5 & 0 & K_6 & 0 \end{vmatrix}}{-K_1 K_3 K_5 - K_2 K_6 - K_1 K_2 K_6 - K_4 K_6} \\ &= \frac{K_3 K_6}{-K_1 K_3 K_5 - K_2 K_6 - K_1 K_2 K_6 - K_4 K_6}\end{aligned} \tag{A43}$$

Since $K_3 K_6 = -\frac{\delta_1 \delta_2}{(w^M+w^F+D)^2(W^M-B)} < 0$, $\frac{\partial D}{\partial W^F} > 0$.

A.3.1. Bride Price and Spouses' Income

The results from the theoretical model indicate that the impacts of the groom's income on the bride price are in a quadratic form. When a groom's income is low, with the increase of his income, the bride price will decline initially until reaching a turning point. After the lowest point, with the further growth of the groom's income, the bride price keeps rising. From the perspective of the theory, the initial downturn is due to the comparatively large absolute value of the second-order derivative of the bride's family utility with respect to the dowry amount and the altruistic utility function form. This reflects the fact that when the groom's income is low, the bride's family will choose to retain a large portion of the bride price. Because one role of dowry is the bride's family's willingness for higher bargaining power for their daughter, the bride's family does not

need a large dowry to ensure favored bargaining power for the bride when the groom's income is not high. In other words, the marginal utility of retaining bride price is high for the bride's family. This consequently leads to less dowry transferred to the couple as well as less consumption for the groom. This also leads to a lower incentive for the groom's family to pay a high bride price. However, with the further increase in the groom's income level, the bride's family needs to pay a higher dowry to improve their daughter's bargaining power. The decreasing marginal utility of the bride's family hampers them from retaining bride price and leads to a higher dowry transfer. In this case, the groom's family will have a higher incentive to transfer wealth to their son through bride price.

The theoretical model suggests that the bride price is always positively correlated with the bride's income. The explanation from the perspective of the marriage market model is because of the diminishing marginal utility of the bride's family with respect to dowry and the positive impacts of dowry on both bride's and groom's consumption. Different from the case in which the groom's income is low, even when the bride's income is not high, the bride's family still has incentives to transfer wealth to their daughter through dowry. Because dowry is a shared resource, the groom's family also has incentives to transfer wealth through the bride price.

A.3.2. Dowry and Spouses' Income

The theoretical model indicates that a groom's income level has a very limited impact on the dowry amount (when the bride's income is not too low). The derivative of dowry with respect to the groom's income sees the effect of the bride's consumption being canceled out. This results in the groom's income entering into the derivative in a form of reciprocal. Because the decision-making of the dowry amount is on the bride's family's side and they only consider their daughter's utility, unless both spouses have very low income, the groom's income is not a major factor that the bride's family would concern about when they decide how much bride price to retain.

On the other hand, the impacts of the bride's income on dowry are also in a quadratic form from the theoretical model's derivative results. With an initial downturn, the dowry amount increases with the growth of a bride's income. In the model, the derivative implies that both groom's and bride's consumption enter into the decision-making of the dowry amount. This is because dowry is from bride price and the decision-making of bride price involves the consumption of the groom. The analysis of a low bride's income to the groom's family is similar to the scenario where the groom's income is low. When the bride's income is low, the marginal utility from the effect of improving the bargaining power of the bride through dowry payment is low. In this situation, the bride's family chooses to retain a large portion of the bride price and the groom's family will pay a low bride price. After the turning point, the groom's consumption plays a larger role and the groom's family has

higher incentives to pay more bride price, which leads to higher payment of dowry as well.

A.3.3. Marriage Payments and Natal Families' Wealth

The theoretical model presents relatively simple derivatives between marriage payments and the natal families' wealth. Either bride price or dowry is positively correlated with either side of the family. Firstly, the derivative of dowry with respect to the wealth of the bride's family in the theoretical model simply indicates a negative relationship. The interpretation of the theoretical result is straightforward: when the bride's family is wealthy, they are willing to transfer more to the couple, which increases the consumption of their daughter. Similar to the bride's family's wealth, a wealthier groom's family is also associated with a higher payment of dowry. The derivative of dowry with respect to the groom's family's wealth is positive and positively correlated with the bride price.

The derivative of bride price with respect to the wealth of the bride's family is positive regardless of the income levels of the couple. The explanation is straightforward considering that a wealthier bride's family has a higher potential to transfer greater dowry to the couple. The positive relationship between bride price and the groom's family's wealth is due to the fact of a negative second-order derivative of the bride's family's utility with respect to dowry and that dowry always brings positive utility to a wife. As explained from the economic intuition, the wealthier a groom's family is the higher the upper limit for the bride price. Considering the bride's family seeks the bride price as high as possible, the bride price in equilibrium should be positively correlated with the groom's family's wealth.

Apeendix B: Empirical Appendix

First, I test the relationships between marriage payments and family characteristics of both spouses and their parents. Second, I attempt to uncover the pattern of the dowry-to-bride price ratio using empirical evidence considering the unclear solutions from the theoretical model. Even though causality is not the main goal in the analysis, it is equally important to test whether the patterns are consistent with what we can claim theoretically.

B.1. Bride Price

As suggested in the model, the bride price under equilibrium B is correlated with all four factors: the incomes of the couple and the wealth of their parents. Specifically, the bride price value is correlated with the groom's income in a quadratic form and has a positive linear relationship with the bride's income. Figure B1 shows that the trends from the data are consistent with the model prediction. We can notice that the higher percentage of women out of the labor force dwindles the scale of the relationship. This is because in the decision-making to set bride price and dowry, the parents consider the children's potential incomes. However, those potential high-income earners may choose not to work. I will further inspect this issue in the following analysis.

[Insert Figure B1 here]

The reduced-form specification for the relationship is below:

$$Bride\ Price_{i,k,t} = \boldsymbol{X}_{i,k,t_{2018}}\boldsymbol{\beta}_1 + \boldsymbol{Y}_{i,k,t_{2018}}\boldsymbol{\beta}_2 + \kappa_k + \tau_t + \varepsilon_{i,k,t} \tag{B1}$$

where $Bride\ Price_{i,t,k}$ stands for the bride price for the couple in household i in province k and getting married in time range t. $\boldsymbol{X}$ is the vector that includes the quadratic form of the groom's income and linear form of the bride's income. Considering that it is implausible to survey the income in the wedding years, I use the incomes in the 2018 surveys (i.e. the annual incomes in 2017), which should be reasonable proxies to the expected incomes at that time. $\boldsymbol{Y}$ is the vector that reflects the groom's and bride's parents' characteristics. I adopt the *hukou* statuses and education levels of the parents on both sides as proxies for their wealth. This includes whether at least one of the parents finished high school and their fathers' *hukou* types. Table B1 presents the estimation results:

[Insert Table B1 here]

In Column (1)-(4), I use the actual incomes of brides and the brides' education levels are adopted as the proxy for their potential incomes in Column (5)-(8). We can notice that the quadratic form of grooms' incomes always holds across the columns. In addition, the coefficients of the linear term are negative and are positive

for the quadrative term. The signs of grooms' incomes' coefficients indicate that with the increase of a groom's income, the bride price declines initially then gradually starts to rise. The coefficient for brides' actual incomes shows a positive sign but is less significant in Column (1)-(4). This could be due to two facts that a bride's and groom's incomes can be positively correlated and that a larger percentage of women do not work even though their potential income is high. To tackle these issues, I replace the actual income of the brides with their education levels (whether they finished high school). The replacement results in positive and significant estimation.

In the analysis of the dynamics of the bride price, we know the turning point for the grooms' income is $\overline{w}$. The empirical evidence shows that the turning point is as low as 100 *yuan*. This can be interpreted as that generally the bride price is positively correlated with the income of a groom except for the situation where the groom does not work or earns very limited income. On average, for a groom who earns mean income ($34,000$ *yuan* as in Table 1), a 1% increase in his income is associated with a 16.2% raise in the bride price. Even though the magnitude of the bride's actual income coefficient is lower, the adoption of education levels as the measurement sees significantly larger impacts. A bride who finished high school education could expect a $40-60\%$ increment in the bride price.

B.2. Dowry

To test the empirical evidence on the dynamics of the amount of dowry, I inspect two parts: the relationship between the values of bride price and dowry, and the relationship between all family characteristics and dowry. Figure B2 shows the distribution of the amounts of bride price and dowry in each family. It is noticeable that the majority of the sample falls below the line with a slope of one. The lower end tail shows the ratio of dowry to bride price is larger than one. However, the number of observations is low.

[Insert Figure B2 here]

To test the relationship between the two prices, I simply include the explanatory variable and other fixed effects as specified below:

$$Dowry_{i,k,t} = Bride\ Price_{i,k,t}\beta_3 + \kappa_k + \tau_t + \varepsilon_{i,k,t} \tag{B2}$$

For other fixed effects, I adopt at either provincial or city level. Considering the surveys only select a very limited number of cities in each province, we would not expect a substantial difference between the outcomes. Table B2 below presents the estimation results:

[Insert Table B2 here]

The coefficient estimation without any fixed effects controlled is 0.91. However, with the province or city and wedding year fixed effects controlled, the coefficients are reduced to close to the average of the dowry-to-bride price ratio of 80% (A logarithmic form is adopted in the estimation so that they are not equivalent) and the scale of the constant term falls down. This alludes to the role of regional cultural difference. I will further test this in the next part.

Different from the specification of the bride price regressions, the disccusion of dowry involves two parts: testing the significance of groom's income's effect and the direction of the impacts of bride's income. Figure 4 below experiments curve fitting with the specified forms of the spouses' incomes:

[Insert Figure 6 here]

We have learned that bride price is a function of all four family characteristics and tested the relationships graphically above. Fellowing the last step, I inspect the relationships between dowry and all family characteristics. The dowry regression specification consists of a linear groom's income and a quadratic form of bride's income. The specification is below:

$$Dowry_{i,k,t} = \boldsymbol{X}_{i,k,t_{2018}}\boldsymbol{\beta}_4 + \boldsymbol{Y}_{i,k,t_{2018}}\boldsymbol{\beta}_5 + \kappa_k + \tau_t + \varepsilon_{i,k,t} \tag{B3}$$

[Insert Table 4 here]

Column (1)-(4) show the results where I directly use brides' actual income and I replace brides' income with their education levels in Column (5)-(8). All the columns show no significance of the impacts of groom's income on the dowry amount. In addition, we can notice that both negative and positive signs show in the coefficients. When the quadratic forms of the bride's income is adopted, significant results that are consistent with the graphic evidence can be observed. Different from the groom's income in the discussion of the bride price, the turning point for the bride's income is smaller. The turning point for the bride's income is around 50 *yuan*, which is half the amount of the groom's turning point. In light of the cause for the turning point of the bride's income is the same as of the groom's income and dowry is from the bride price,

As for the parents' sides, very similar conclusions can be drawn as in the bride price analysis part. Proxied by fathers' *hukou* types and parents' education levels, the estimation results indicate that dowry is positively associated with the wealth of both sides. Whether measured with *hukou* or education levels, the coefficients exhibit highly significant levels in dowry regressions. Nevertheless, similarly, the correlation between *hukou* and education also leads to boosted standard errors when both indicators are regressed together.

B.3. Dowry-to-bride price Ratio

A question that was raised in the last part is the factors that influence the dowry-to-bride price ratio. The regressions regarding bride price on dowry imply that regional fixed effects may have noticeable explanatory power. The theoretical model shows complexity and uncertainty in what factors affect the dowry-to-bride price ratio and what are the directions of the effects. Hence, as the extension to Figure 4, I classify part of the sample into different groups according to the geographic locations: East China, North China, Northeast China and Southwest China[20].

[Insert Figure 7 here]

We can notice that the lines for the four regions are relatively parallel to each other. The two regions in the south are above the two in the north. In consideration of the fact that it is difficult to incorporate regional and cultural differences into the previous model, I rely on testing whether the significant difference can be captured in the dowry-to-bride price ratios between different regions. In Table 5, I first present the average dowry-to-bride price ratios in different geographic regions. Then I did two tests: ANOVA test in order to test if we can reject that all the ratios are the same and pairwise t-tests to compare regions two by two.

[Insert Table 5 here]

As can be noticed, northern regions see much lower ratios than the southern ones and in Southwest China, the average dowry-to-bride price ratio is even slightly higher than 1. Both ANOVA and t-tests suggest that regional difference does exist in dowry-to-bride price ratios. However, North and Northeast China see a minor and insignificant difference, which can be attributed to the historical similarities of the cultural backgrounds in these two regions.

B.4. Patrilocality and Bride Price

This part attempts to examine the relationship between the levels of patrilocality and the bride price. Since patrilocality is a major factor resulting in the payment of bride price and a higher degree of patrilocality (in terms of the gain of utility for the groom's family) is positively correlated with the bride price asked by the bride's family, the critical part of the discussion is the find proxies for the levels of patrilocality.

To proxy the levels of patrilocality, I use the distance between the wife's original and current places and the

[20]East China includes Provinces of Jiangsu, Zhejiang, An'hui and Fujian, and the city of Shanghai; North China includes Province of Hebei and the city of Beijing; Northeast China includes Provinces of Heilongjiang, Jilin, and Liaoning; Southwest China includes Provinces of Sichuan, Yunan, and Guizhou. These are some major geographic regions in China for which the survey data is available. There are other provinces that cannot be simply classified into one of the groups of the classification is disputed.

frequency of the wife's visits to her maiden family each year. A longer physical distance between the wife's natal and current families reflects the patrilocality on both families' sides. If a wife lives far from her natal family, her family would suffer a larger loss as it is hard for her to contribute to the production. Meanwhile, this forces her to integrate into her husband's family and the local society, which results in a higher chance that she could contribute more to the production. Similar to the distance but more straightforward, the frequency of visiting her natal family indicates whether she contributes more to her natal or her husband's family.

For the measurement of the distance, I adopt the direct geographic distance between the city the wife currently lives in and the city where she was born or the city where she was when she was fourteen years old. The survey also selected a portion of the sample for an extended version that asked about their routines. These included the frequency of visiting their parents if the individual lives in a different location than their parents. In the following regressions, I use the number of days that the wife usually visits in a year and the times she visited last year. The basic specification is below:

$$Bride\ Price_{i,t} = \boldsymbol{\beta}_0 + \boldsymbol{\beta}_1 Patri_{i,t} + \boldsymbol{\beta}_2 X_{i,t} + \varepsilon_{i,t} \tag{B4}$$

$Patri_{i,t}$ is one of the four proxies for the levels of patrilocality, and $X_{i,t}$ is the control variable that varies for the two proxies where I either control the income levels or the provincial and wedding year fixed effects.

[Insert Table 2 here]

The first four columns present the regression results proxied with the geographic distances. The second and fourth columns further control the income of the two spouses. The last two columns show the results where the visiting frequencies are the indicator for patrilocality. The results estimated with the distance proxy at different ages do not display a large difference. Considering the low mobility in the society, especially due to the *hukou* policy, a minor difference is expected. A 10% increase in the physical distance is associated with one percent higher in the bride price. Additionally, it is more common to have a marriage happen between two people from the same location (a zero physical distance under the specification). A groom marrying a bride from another town sees 1.5 times higher bride price on average. Consistent conclusions can be found when patrilocality is proxied by the frequency of the wife visiting her natal family. The more she visits her parents, the stronger connection she maintains with her maiden family and less contribution to her spouse's one. A 10% increase in her frequency of visiting her maiden family is reflected in a 4% less bride price.

B.5. Structural Estimation on Bargaining power

$$\begin{aligned}\mathcal{L} = \gamma\Big\{ & \sigma_3\big\{\tau_1^M log(c_m^M) + \tau_2^M[\rho_1 log(h^M) + \rho_2 log(h^F) + (1-\rho_1-\rho_2)log(g)] + \tau_3^M log(\ell^M)\big\} \\ & + (1-\sigma_3)\big\{\tau_1^F log(c_m^F) + \tau_2^F[\rho_1 log(h^M) + \rho_2 log(h^F) + (1-\rho_1-\rho_2)log(g)] + \tau_3^F log(\ell^F)\big\}\Big\} \\ & + \lambda[c_m^H + g - \omega^M(1-h^M-\ell^M) - \omega^F(1-h^F-\ell^F) - D]\end{aligned} \tag{B5}$$

First-order conditions:

c_m^H:

$$\gamma\big\{\sigma_3\tau_1^M\frac{1}{c_m^H} + (1-\sigma_3)\tau_1^F\frac{1}{c_m^H}\big\} + \lambda = 0 \tag{B6}$$

g:

$$\gamma\big\{\sigma_3\tau_2^M(1-\rho_1-\rho_2)\frac{1}{g} + (1-\sigma_3)\tau_2^F(1-\rho_1-\rho_2)\frac{1}{g}\big\} + \lambda = 0 \tag{B7}$$

h^M:

$$\gamma\big\{\sigma_3\tau_2^M\rho_1\frac{1}{h^M} + (1-\sigma_3)\tau_2^F\rho_1\frac{1}{h^M}\big\} + \lambda\omega^M = 0 \tag{B8}$$

h^F:

$$\gamma\big\{\sigma_3\tau_2^M\rho_2\frac{1}{h^F} + (1-\sigma_3)\tau_2^F\rho_2\frac{1}{h^F}\big\} + \lambda\omega^F = 0 \tag{B9}$$

ℓ^M:

$$\gamma\sigma_3\tau_3^M\frac{1}{\ell^M} + \lambda\omega^M = 0 \tag{B10}$$

ℓ^F:

$$\gamma\sigma_3\tau_3^F\frac{1}{\ell^F} + \lambda\omega^F = 0 \tag{B11}$$

Appendix Figures

Figure B1: Relationships between bride price and groom's (left) and bride's (right) incomes

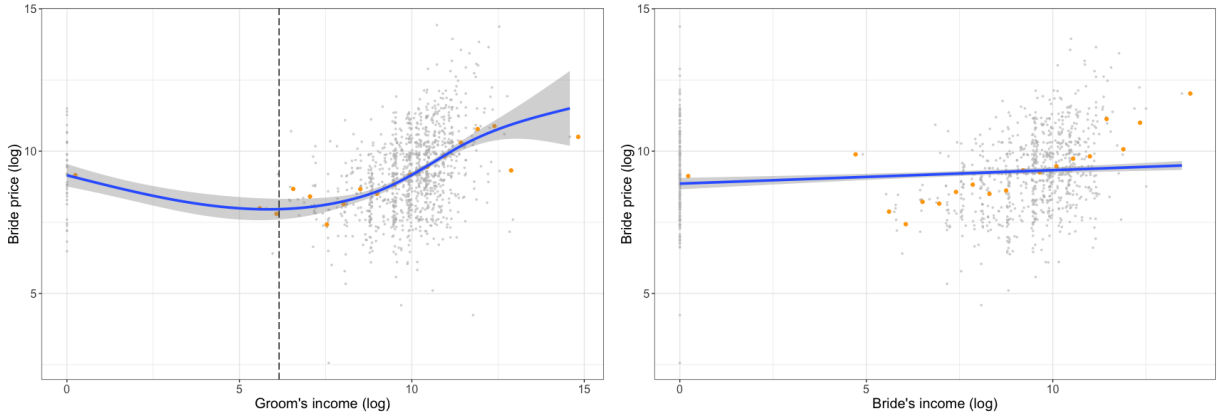


Figure B2: Relationships between dowry and bride price

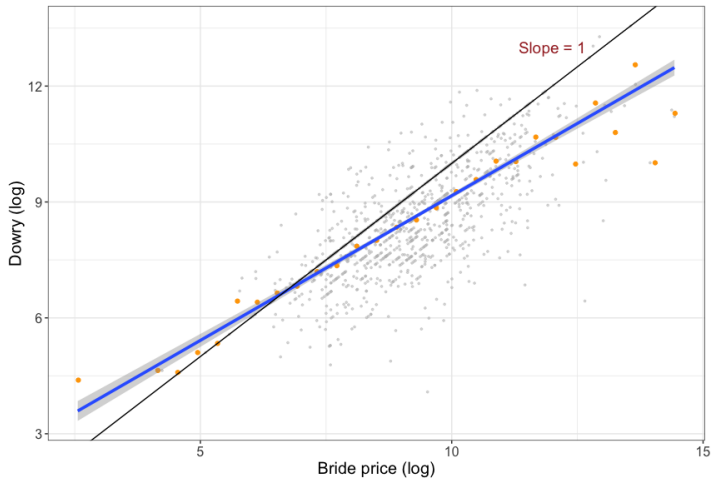


Figure B3: Relationships between dowry and groom's (left) and bride's (right) incomes

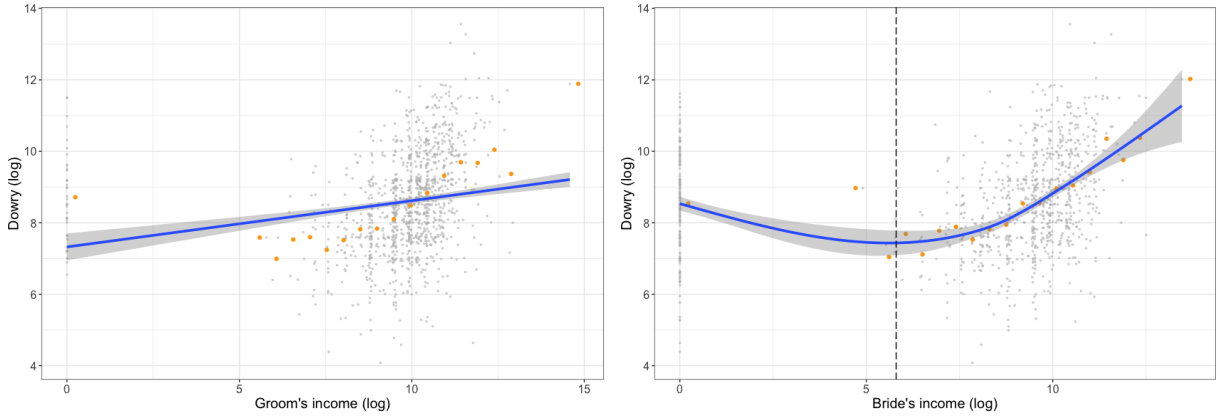


Table B1: Reduced-form Evidence I: Relatiobship between Bride Price and Family Characteristics

	Dependent variable: Bride price							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Groom's Income	-0.225***	-0.162**	-0.151***	-0.143**	-0.193***	-0.121**	-0.137***	-0.110*
	(0.051)	(0.065)	(0.056)	(0.066)	(0.047)	(0.060)	(0.050)	(0.060)
(Groom's Income)^2	0.022***	0.016***	0.015***	0.014***	0.019***	0.012***	0.013***	0.011**
	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)
Bride's Income	0.020**	0.014	0.017*	0.015				
	(0.008)	(0.012)	(0.009)	(0.012)				
Bride's High School					0.529***	0.424***	0.367***	0.348***
					(0.081)	(0.114)	(0.099)	(0.121)
Natal Families' Education		X		X		X		X
Natal Families' *Hukou*			X	X			X	X
Province Fixed Effects	X	X	X	X	X	X	X	X
Wedding Year Fixed Effects	X	X	X	X	X	X	X	X
Observations	1,128	667	907	666	1,380	811	1,119	809
R^2	0.418	0.410	0.415	0.413	0.427	0.415	0.414	0.418

Note: Standard errors in brackets and errors are clustered at the household level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. The dependent vairiable of the bride price, and the explanatory variables of the bride's and groom's income are all transformed with the Inverse Hyperbolic Sine (IHS) function. The variable of a bride's education is a dummy variable which equals 1 if she has finished high school and 0 if she has never. Both parents' education and *hukou* variables are dummy variables. For education, the variable is 1 if at least one of the parents has finished high school and 0 if neither has. For *hukou*, the variable is 1 if their father holds an urban *hukou* and 0 if he does not. Wedding year fixed effects indicate the year ranges in which the couple got married. They are 1970s, 1980s, 1990s, and 2000s.

Table B2: Reduced-form Evidence II: Relatiobship between Dowry and Bride Price

	Dependent variable: Dowry				
	(1)	(2)	(3)	(4)	(5)
Bride price	0.909***	0.939***	0.792***	0.790***	0.652***
	(0.065)	(0.069)	(0.081)	(0.082)	(0.094)
Province Fixed Effects		X	X		
City Fixed Effects				X	X
Wedding Year Fixed Effects			X		X
Observations	1,461	1,461	1,461	1,461	1,461
R^2	0.117	0.172	0.180	0.333	0.340

Note: Standard errors in brackets and errors are clustered at the household level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. The dependent vairiable of dowry and the explanatory variables of the bride price are both transformed with the Inverse Hyperbolic Sine (IHS) function. Wedding year fixed effects indicate the year ranges in which the couple got married. They are 1970s, 1980s, 1990s, and 2000s.

Table B3: Reduced-form Evidence III: Relatiobship between Dowry and Family Characteristics

	Dependent variable: Dowry							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Groom's Income	-0.00003	0.037	-0.013	0.037	0.025	0.046	0.012	0.045
	(0.046)	(0.053)	(0.048)	(0.053)	(0.043)	(0.050)	(0.045)	(0.050)
Bride's Income	-0.403***	-0.514***	-0.397***	-0.469***				
	(0.136)	(0.178)	(0.153)	(0.178)				
(Bride's Income)^2	0.039***	0.049***	0.039***	0.045***				
	(0.012)	(0.016)	(0.014)	(0.016)				
Bride's High School					1.047***	1.506***	0.684**	1.257***
					(0.255)	(0.344)	(0.315)	(0.368)
Natal Families' Education		X		X		X		X
Natal Families' *Hukou*			X	X			X	X
Province Fixed Effects	X	X	X	X	X	X	X	X
Wedding Year Fixed Effects	X	X	X	X	X	X	X	X
Observations	1,128	667	907	666	1,380	811	1,119	809
R^2	0.152	0.185	0.180	0.198	0.151	0.188	0.172	0.192

Note: Standard errors in brackets and errors are clustered at the household level. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. The dependent vairiable of dowry, and the explanatory variables of the bride's and groom's income are all transformed with the Inverse Hyperbolic Sine (IHS) function. The variable of a bride's education is a dummy variable which equals 1 if she has finished high school and 0 if she has never. Both parents' education and *hukou* variables are dummy variables. For education, the variable is 1 if at least one of the parents has finished high school and 0 if neither has. For *hukou*, the variable is 1 if their father holds an urban *hukou* and 0 if he does not. Wedding year fixed effects indicate the year ranges in which the couple got married. They are 1970s, 1980s, 1990s, and 2000s.

Table B4: Reduced-form Evidence I: Relatiobship between Bride Price and Patrilocality

	Dependent variable: Bride price					
	(1)	(2)	(3)	(4)	(5)	(6)
City distance	0.101***	0.078***				
	(0.022)	(0.024)				
City Distance at 14			0.112***	0.090***		
			(0.023)	(0.025)		
Times visit					-0.404**	
					(0.187)	
Times visited last year						-0.423**
						(0.173)
Groom's Income		X		X		
Bride's Income		X		X		
Province Fixed Effects					X	X
Wedding Year Fixed Effects					X	X
Observations	1,390	1,073	1,391	1,075	108	107
R^2	0.015	0.068	0.017	0.070	0.511	0.510