STRATEGIC BEHAVIOUR AND MARRIAGE PAYMENTS: THEORY AND EVIDENCE FROM SENEGAL

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by

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Abstract. *This paper proposes an original theory of marriage payments based on insights gained from first-hand information collected in the Senegal river valley. This theory postulates that decisions about the brideprice, which are made by the bride's father, take into account the likely effects of the amount set on the risk of ill-treatment of the wife and the risk of marriage failure. Based on a sequential game with three players (the bride's father, the husband and the wife), it leads to a number of important predictions that are tested against Senegalese data relating to brideprices and various characteristics of women. Towards that end, an econometric procedure is used that carefully controls for several endogeneity biases. The empirical results confirm that parents behave strategically by keeping brideprices down so as to reduce the risk of marriage failure for their daughters. Other interesting effects on marriage payments and the probability of separation are also highlighted.*

Keywords: marriage payments, household behaviour, gender, brideprice, domestic violence
JEL classification codes:

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1. Introduction

This paper is an attempt to go beyond the standard theory of marriage and divorce in order to account for the reciprocal relationship between brideprice and probability of divorce that was suggested to us by field observations in West Africa. As such, it can be seen as a continuation of the pioneering effort of Bloch and Rao (2002) to address the issue of domestic violence with the help of economic analysis.

The standard theory of marriage proposed by economists is based on a rather straightforward extension of the market framework to the issue of spouse selection (Becker, 1974, 1981; Grossbard-Shechtman, 1993). Marriages can thus be modelled as the equilibrium of a matching market which 'assigns' men and women to each other or to remain single until better opportunities come along. The so-called assortative mating is effected through the establishment of equilibrium spot prices or incomes that include dowries (understood as payments made by the bride or the bride's family to the groom or the groom's family), brideprices (understood as reverse payments from the groom's to the bride's side), leisure and power. A direct implication is that the side holding the precious resource, e.g. the bride's family in a situation of scarcity of women, can ask for a side payment in order to compensate for the higher value of its indivisible contribution.

At the root of this approach is the utility-maximizing rational choice perspective typical of neoclassical economics. People marry when the expected utility from being married exceeds the utility from remaining single; and they remain married as long as the expected utility from doing so is greater than the utility expected from divorce, where the latter is affected by the prospects for remarriage. In explaining marriage-related events, emphasis is placed on determinants of the gains from marriage, such as the relative

productivity of men and women inside and outside the home; income; age; education and other traits affecting productivity.

In spite of its simplicity, the neoclassical economic theory of marriage and divorce has proven compatible with some significant stylised facts and with some interesting anthropological evidence. For example, given that the presence of a dowry can be interpreted as reflecting a lower wage for the wife, this theory can explain (i) why dowry seems to be strongly linked with monogamous (and polyandrous) marriage all over the world; (ii) why it is that in SubSaharan Africa the institution of brideprice is more often found in polygynous than in monogamous societies; and (iii) why in the same region brideprice payments tend to be higher in more polygynous societies (Grossbard, 1978: 35-36). As a matter of fact, polygamy implies that there is a stronger demand for wife services.

Evidence from the Senegal river valley none the less shows that a long-term decline in brideprices cannot be simply ascribed to a growing supply of girls of marriageable age relative to demand. More congruent with the facts emerging from interviews with Senegalese women and men is an approach that explicitly allows for strategic considerations, notably absent in the neoclassical approach to marriage. We thus want to investigate the impact, on the marriage institution, of the strategic relationships between a bride and her family on the one hand, and between a bride and a groom on the other hand. The central idea is that the bride or the bride's father, when setting the brideprice, takes into account the likely influence of the brideprice amount on conjugal tensions (including ill-treatment of the wife by the husband) and the probability of divorce, which in turn affect the wife's well-being. The focus is therefore put on the simultaneous determination of the brideprice (or dowry) and the probability of divorce. Like efficiency wages, brideprices are not set at the market-clearing level owing to indirect effects on a component of the decision-maker's utility.

The assumption of parametric rationality –people simply adjust their actions to market signals such as the ruling brideprice or dowry, even though their decisions obviously have significant and long-term consequences–, is not the only limitation of Becker's framework. Another difficulty lies in the fact that it relies on a private good approach, since the household is viewed mainly as a source of consumption of private goods by the spouses and as a locus of production and reproduction where managerial economies (scale economies, specialization gains, and complementarities) can be reaped. An alternative approach that we choose to follow is to consider the household or the family as a place where a public good is produced and to ignore the material determinants of the utilities thereby generated.

Our contribution in this paper is both theoretical and empirical. On the level of theory, as indicated above, our purpose is to enrich the dominant theoretical apparatus by allowing factors other than supply-and-demand forces, and other than material determinants of utilities, to bear upon the level and the direction of marriage payments. An antecedent of our idea of strategic determination of marriage payments is a recent effort by Bloch and Rao (2002) to explain dowries in India, to which we shall return later. On the empirical level, we aim at testing the validity of our theory on the basis of first-hand data collected on several aspects of the marriage histories of a sample of women residing in various villages along the Senegal river. The field survey was carried out in 1998.

The outline of the paper is as follows. Section 2 summarizes a number of empirical findings that have motivated the present research. Emphasis is put on the fact that awareness of the potentially perverse effects of a high brideprice provides the ground for strategic considerations while setting its level. In Section 3, our theory of brideprice determination is expounded. We begin by broadly explaining our modelling strategy and situating it in the context of the existing literature. We then proceed by describing in detail the model supporting the theory before deriving its main comparative-static results. Section 4 discusses

and then implements an econometric approach suitable for testing key predictions from the model, given the biases that plague straightforward approaches. Section 5 concludes the paper.

2. Background information

Data have been collected in sixteen villages of the Senegal river valley that lies in the northernmost part of the country and separates it from Mauritania. Of unequal sizes, these villages are located in the delta area (department of Dagana) and the middle valley (departments of Podor and Matam) along the main road running from Saint-Louis to Bakel. Seven of the sample villages are located in the former zone while the remaining nine villages are situated in the latter. In addition to focus group interviews, household questionnaires have been administered separately to 185 women, 60% of them in the middle valley and 35 percent in the delta.[1] These women have been engaged in 220 marriages, which makes for a ratio of 1.2 marriages per woman. From these 220 "marriage stories", a subsample of 148 observations emerges free of missing data for this particular enquiry (the full list of variables used in our estimations is defined in section 4 ; in particular, the women's current ages and ages at first marriage were sometimes missing or suspect). In a companion paper (Platteau and Gaspart, 2005), we have shown evidence of a number of key facts that have motivated the strategic approach to brideprice determination followed in Sections 3 and 4 of the present paper. They are summarized below.

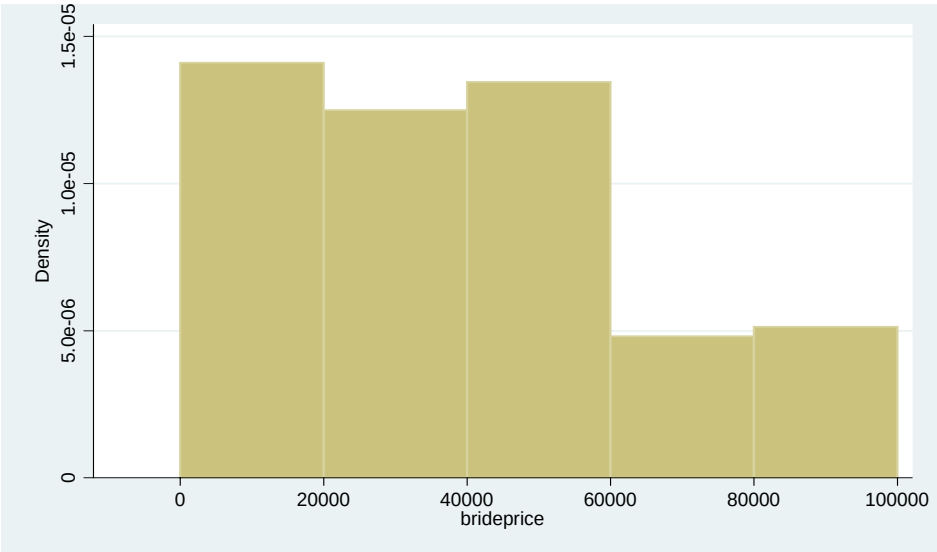
1. In the quasi-totality of our sample cases of marriage the payment has been made by the groom (or his father) to the bride's family. Moreover, the marriage payment is typically made in cash, as the erstwhile practice of offering cattle to pay for the bride is quickly disappearing. Marriage payments may also include personal gifts made in kind to the bride or her family. Assessing their monetary value proved an insurmountable task. Fortunately, there

[1] Questionnaires have also been administered to 83 men (75% in the middle valley).

exists a strong positive between the cash amount of the brideprice and the number of these gifts in kind.

2. The mean (nominal) brideprice observed in our sample is slightly above 51 000 CFA ($101), the median is 35 000 CFA ($69) and the standard deviation is roughly equal to 70 000 CFA. As is also shown on the following histogram, there is considerable variance in the brideprice amounts at any given point of time. These variations are largely due to the discretionary character of an important component of the brideprice, which is fixed in the course of negotiations between the parties concerned and can therefore freely vary from case to case. The variable component of the brideprice corresponds to the compensation made to the bride's parents, and sometimes also elder members of the extended family as well, in order to reward them for their efforts in bringing her up. The custom provides that payments made on this score must be paid back if the woman is considered responsible for the break-up of the marriage and the husband insists on being indemnified. This rule does not apply, however, to the other two components of marriage payments, the expenses incurred toward financing the marriage party, and the so-called "price of virginity".[2] Regarding the former, the absence of repayment obligation arises from the fact that the marriage feast and ceremony have brought benefits to the groom's as well as to the bride's party. Regarding the latter, the rationale is even more evident, since virginity is consumed in marriage, and the husband cannot therefore claim back the price of an advantage that he has himself enjoyed. It is also immediately obvious that payment of the same component is not required when the bride is a widow or a divorced woman.

[2] The component of the brideprice corresponding to the price of virginity is exclusively meant to enable the bride to purchase necessities such as clothes, ornaments, utensils, working tools and other articles necessary for the functioning of the new household. As for the component destined for the financing of the feast, it comprises various gifts of food items, contributions to the local mosque, and other miscellaneous expenses.



Graph 1: Sample histogram of brideprices

3. As is shown in Table 1, given an inflation rate exceeding 6.5% per annum in Senegal (estimate based on IMF data), brideprice amounts in real terms appear to have declined by more than 5 percent a year during the last half century.

Table 1

Evolution of brideprices over time (OLS regression)

Time	0.012609***
	(.004591)
Constant	9.91416***
	(0.1705511)
Number of observations	171
Adjusted R-squared	0.0371
Prob > F	0.0067

Notes: (1) Time is measured by subtracting from the year of the interviews (1998) the differential between the age of the woman at the time of the interview and her age at the time of the marriage concerned. The initial year is 1946.

(2) A triple star indicates statistical significance at the 99 percent confidence level.

If the conventional, supply-demand explanation is valid, one would expect the above trend to be a result of an increasing abundance of girls of marriageable age relative to boys. The evidence points to the opposite conclusion: due to rising age at first marriage for women

and a concomitant decrease for men (see Table 2), the marriage market seems to have evolved toward an increasing scarcity of women.

Table 2

A. Average age at first marriage depending on present age of sample women

Categories of women according to present age	Average age at first marriage	Frequencies
16-30 years old	17.2 years	67
31-40 years old	16.8 years	56
> 40 years old	15.0 years	59

B. *Average age at first marriage depending on present age of sample men*

Categories of men according to present age	Average age at first marriage	Frequencies
22-34 years old	21.7 years	18
35-40 years old	21.5 years	19
41-55 years old	23.8 years	15
56-77 years old	28.0 years	15

Men's outmigration does not alter this picture in so far as migrants typically choose local women as spouses. On the other hand, polygamous unions have clearly receded. The average age of sample women under polygamous unions is 39 years, compared with only 30 years for women under monogamous marriages (the difference is statistically significant), suggesting that the (realized) demand for marriageable women has declined relative to supply. But men's latent demand for them does not seem to abate. Frustration of the desire of many men to have several wives actually provides the adjustment mechanism through which demand for brides is brought down to the available supply. Being on the short side of the marriage market, women are increasingly able to refuse to enter into polygamous unions, thereby following their own evolving preferences for monogamy (see Platteau and Gaspart, 2007, pp. 1224-26, for a more thorough discussion of the factors underlying the evolution of the marriage market in our survey area).

4. The aforementioned fact that part of the brideprice must be returned to the husband or his family in the event of a marriage break-up, provided that the woman is deemed

responsible for the marriage failure,[3] implies that strategic considerations might possibly come into play when marriage payments are decided. Inasmuch as the bride's parents generally receive the brideprice from the groom's party and use it to meet family expenditures, including the payment of brideprices on behalf of their own sons, the repayment obligation in the event of marriage failure falls on the parents of the bride and not on the bride herself. Heavy pressure on the daughter to stay with her husband can then be expected from them. By agreeing to receive a high brideprice on the occasion of their daughter's marriage, the parents would therefore manifest the importance they attach to the union and their willingness to preserve it in all circumstances. Of course, by agreeing to pay a high brideprice in the first place, the groom's parents express the same intent. In short, a high brideprice serves as a commitment device aimed at minimizing the risk of marriage break-up.

Neither the groom's nor the bride's point of view figures out in the above strategies, however. When they become better aware of their own interests and are able to defend them,

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[3] We have estimated a probit model in which the dependent variable is a dummy measuring whether the sample woman has explicitly stated that the brideprice must be returned in the event of marriage failure, and in which the explanatory variables of concern are two dummies measuring the woman's subjective opinion about the most frequent causes of marriage break-ups initiated by women. The first of these two dummies is equal to one when women mention conflicts between co-wives, the taking of a second wife by the husband, and/or unfair treatment of co-wives by a polygamous husband. The second explanatory dummy is equal to one, when the reasons given are an unfaithful, old or impotent husband, or physical ill-treatment of the wife. The reference category, when the two explanatory dummies are set to zero, is made up of 'intermediate', mildly serious reasons, including a lack of love of the woman for her husband, conflict with in-laws, and poor performance of the husband in meeting the needs of the family. Many control variables have been added to the right-hand side of the regression. The results (not shown) are striking: among all independent variables, the two above dummies are the most significant (at the 99% confidence level) and have the highest coefficients. As expected, the coefficient associated with the first dummy is positive while that associated with the second dummy is negative, implying that the brideprice does not have to be repaid when the husband has committed a serious offence, but has to be repaid otherwise. Clearly, assignment of guilt is highly biased against women since it is only when the husband is impotent, irreducibly unfaithful, or when he repeatedly indulges in acts of physical violence against his wife that the latter is forgiven for running away from him. The taking of a new wife by the husband, accusations of unequal treatment of the different wives, and continuous conflicts between co-wives are not regarded as misdemeanours that could justify a woman in leaving her husband.

Moreover, it bears emphasis that no repayment of the brideprice is due when the woman has reached a relatively advanced age, a logical consequence of the fact that she has then already contributed a lot to the household by upbringing children and undertaking agricultural activities.

young women would thus try to bear pressure on their parents so that they accept lower brideprice payments. They would thus be re-assured about their future conditional ability to repay the brideprice and thereby evade the trap of an unhappy union, if that turns out to be the case. Interestingly, the same behaviour has been reported in an anthropological study of marriage in a Hausa society in Niger (Cooper, 1997; see also Jewsiewicki, 1993 for Congo). In Maradi, we are thus told that women in general have an interest in keeping bridewealth payments low: "Since the payment must be returned to the husband if the woman initiates a divorce, high bridewealth can thwart women's efforts to sever a union, for their kin may be unwilling or unable to return it" (Cooper, 1997: 17). According to the author, one consequence of the comparatively low level of bridewealth payments in the Maradi region is that women enjoy "a high degree of freedom in leaving their marriages" (ibidem: 93). What must be emphasised is that a high feeling of such freedom does not necessarily result in a high incidence of actual divorces. A formal model is required to determine the equilibrium relationship between the brideprice level and the propensity to divorce when strategic interactions are allowed. Such a model will be presented in the next section.

If a daughter is able to freely choose her marriage partner and persuade her parents to accept her choice, one may expect the latter to refuse to comply with the husband's (or husband's family's) request for brideprice repayment in case their daughter wants to separate or divorce. Since she will be deemed responsible for the choice of her spouse, she is expected to bear the consequences of her own decisions, which is likely to imply the obligation to return the brideprice in the event of a marriage break-up. Under these conditions, also, the daughter's interest during marriage negotiations is to persuade her parents to be content with a modest brideprice.

Another, even more obvious strategic consideration that would be in the mind of a bride eager to marry a man of her own liking is the concern that such a man may be unable to pay the brideprice if it is set at too high a level by her parents.

5. A majority of women in our sample have found high brideprices to be problematic, for reasons outlined in Table 3.

Table 3

Shortcomings of high brideprices as mentioned by women in our sample

High brideprices …	% of women who made the following answer*
1. alienate women	55.4 %
2. constitute an obstacle to divorce because they are difficult to pay back	18.1 %
3. may prevent a man from marrying a woman he loves	8.4 %
4. cause a waste of money or the indebtedness of the husband	12.0 %
5. make relationships between the two families difficult	3.6 %
6. violate an Islamic tenet	2.4 %
7. have other negative effects	15.7 %
% of women who do not see problems with high brideprices	40.3 %

(* The percentage total exceeds 100 percent because some women have mentioned several shortcomings of high brideprices.)

The main reason given by them is not repayment problems in the event of marriage failure, or the impossibility of marrying a loved groom who is rather poor (bear in mind that 60% of our sample marriages are arranged by the parents), but the fact that high brideprices contribute to "alienate women", "to transform them into commodities" or "into slaves of their husband", all strong expressions intended to reflect deep-seated frustrations and, sometimes, intense suffering. Behind these expressions, as further probing revealed, lies the fear that the husband and his family may resent high brideprices because of the financial stress caused. The resentment lingers on when the brideprice is paid in instalments and the husband or his family regret having agreed to an unbearable burden, especially if they find fault with the wife or daughter-in-law (say, because she does not bear children, is not productive enough, has a difficult character or does not get on well with the in-laws, …). In such conditions, the

woman is exposed to a serious risk of harassment and ill-treatment by the husband and his relatives because she is considered to be the cause of the problems encountered by them.

Revealingly, a quarter of the men in our sample have spontaneously admitted that high brideprices tend "to make marriages difficult", alienate women, or drive husbands to harass and ill-treat their wife. In other words, men themselves are to some extent aware that women can be harmed under conditions of duress created by high brideprices. While fixing the brideprice for his daughter, a man could therefore think of the negative consequences that large sums can entail for her future well-being.

6. Our approach based on strategic behaviour is better conceived as a complement rather than a substitute for the conventional neo-classical approach. This implies that, instead of being ignored, the role of demand and supply factors is to be combined with strategic considerations which may influence brideprices so strongly as to push them in a direction different from that predicted by a simple supply-demand argument**.** To illustrate our point, let us consider an example of a friendly amendment to the market theory of marriage that we want to put forward. It is based on the data processed in Table 4, drawn from a companion paper (Platteau and Gaspart, 2007).

Table 4

Brideprice averages by women's education and marriage type

	Non-educated women	Educated women	All women
Arranged marriages	31,564 CFA (n=93)	54,500 CFA (n=10)	33,791 CFA (n=103)
Love marriages	44,000 CFA (n=62)	53,182 CFA (n=11)	45,384 CFA (n=73)
All marriages	37,376 CFA (n=155)	53,809 CFA (n=21)	38,599 CFA (n= 176)

Our sample evidence that the average brideprice for educated women (defined as those who have completed their primary studies) significantly exceeds that observed for non-educated women is easily explained in terms of the supply/demand framework since educated

women are in scarce supply (they represent only 12.5% of the sample women). Yet, higher brideprices for educated women are only observed for arranged marriages: in the case of love marriages, there is no statistically significant difference between the brideprices paid for educated and non-educated women. To account for this differentiated result, the assumption of strategic behaviour is helpful. It, indeed, suggests the following interpretation: when educated women are involved in love marriages, in which they obviously have more leeway to assert their concerns, they are better able to influence their parents so as to prevent the brideprice from being set at a high level.

3. A theory of brideprice determination

3.1 Prolegomena

The model we write is a simple sequential game borrowing some assumptions that have been influential in population economics. The Sonnenschein-Mäntel-Debreu theorem on the aggregate demand curve has shown that it is a very demanding hypothesis to represent a household's decision process by the optimisation of a single representative agent. Intra-household bargaining, be it cooperative or non-cooperative, has been widely used (Bergstrom, 1996, 1997; Lundberg and Pollak, 1996) because it is considered both as a more satisfactory representation of decision-making processes at the household level and as a source of empirical predictions. A very convenient model to characterize marriage, introduced by Manser and Brown (1980) and McElroy and Horney (1981) among others, consists of depicting a production unit that generates a household public good. The matching issue (who marries with whom) is not addressed in these models, and it is therefore convenient to assume away any endogenous relationship between marriage and welfare. Since the marriage decision itself, as a function of utility considerations, is not contemplated, the public good approach makes marriage an exogenous contribution to welfare. Note that this parametric

assumption is compatible with both the most materialistic and the most romantic conceptions of marriage.

Our model runs as follows. There are three players, who intervene sequentially, with one move of nature. The father of the bride chooses the brideprice in a first stage. Nature then picks up the groom's preference type as reflected in the constant marginal rate of substitution between money and the household public good. Thereafter, the groom chooses his level of contribution to the household public good. Finally, the bride chooses to stay or to leave. The key aspect is that the father of the bride has to repay part of the brideprice to the groom if his daughter leaves her husband, while the latter's propensity to induce such a behaviour (through low contributions to the household public good) is not a public information at the first stage of the game. A low contribution by the husband can therefore be interpreted as a set of actions that will cause his wife to break up the marriage.

Bloch and Rao (2002) also modelled strategic conjugal violence, whereby the husband hurts his wife's well-being in order to extract a payment from his in-laws. There are several differences between our set-up and Bloch and Rao's. In conformity with their field study in India, divorce is not an option in their model, unlike what is implied in the last stage of our game. Moreover, they view conjugal violence exerted by the husband as a way of extracting a voluntary extra-payment (or a partial refund of the brideprice) from the bride's family, and this extra-payment is motivated by the threat of abandoning the wife. Bloch and Rao's story relies on a signalling mechanism, in which the abandonment threat is made credible by resort to violence. The bride's family gives in to violent behaviour because it can only be committed by husbands willing to abandon their wife if their request is not satisfied. Our model is a simpler story of profit maximisation (by the bride's father) under asymmetric information regarding the groom's participation constraint. Such simplicity conveys a benefit

since we do not need to assume that the groom's preferences remain private information after marriage, an hypothesis that underlies Bloch and Rao's signaling model.

There are a number of similarities, mainly on the empirical side, between the two research projects, however. In particular, it is noteworthy that the two models yield the same prediction of a positive relationship between unfavourable marital outcomes (divorce in our model or violence in Bloch and Rao's) and marriage payments. Bloch and Rao estimate the probability of occurrence of violence with an endogenous dowry variable; we do the same with a divorce equation, but we also estimate a brideprice equation with an endogenous divorce probability. On the theoretical side, both models can explain a transition from the brideprice to the dowry system, a phenomenon actually observed in Bloch and Rao's dataset.

3.2 The model

In the following, we want to outline the forces that are susceptible of affecting the evolution of the brideprice in an African context, leaving aside the marriage market which has rather well-known outcomes. This implies that we inquire into the interrelationships between the brideprice, on the one hand, and male agricultural productivity, divorce rate, the assertion of women's interests, women's education level, and the groom's propensity to divorce strategically, on the other hand. More particularly, in line with our discussion in Section 2, we want to produce an explanation for a downward trend of brideprice amounts that does not rely on the increasing number of women of marriageable age relative to that of men.

Two alternative explanations suggest themselves. The first one is derived from the work of Boserup (1970) and Goody (1976) on the basis of long-term empirical facts pertaining to Europe, Asia, and Africa. It is grounded on the presumably diminishing productive role of women as agricultural activities intensify in response to population growth and commercialisation of agriculture. In terms of our model (which uses a strategic

framework rather than a supply/demand argument), the equilibrium brideprice must fall as the husband's agricultural productivity rises relative to that of the wife. The second explanation follows the evidence presented in Section 2, according to which fathers are increasingly sensitive to the aspirations of their daughters, especially to the impact of the brideprice on the risk of divorce. In terms of our model, the equilibrium brideprice must decrease as the bride's father becomes more altruistic with respect to his daughters' welfare.

There are three players: the bride's father, the husband and the wife. In the course of marriage life, both husband and wife contribute, although not necessarily on a equal footing, to a local public good that affects their individual utilities. Such a public good needs not be interpreted narrowly as an economic output but can more realistically be viewed as the couple's degree of harmony resulting from their respective actions. In the model, also, the husband's refusal to provide any contribution to the household will induce the wife to separate with the consequence that she will have to repay the brideprice to her husband. Prescribed by custom, such an obligation on the part of the woman creates a room for strategic playing by the husband. The strategic play of the husband can also operate in a different manner that is nevertheless analytically equivalent to the afore-described mechanism.

At this stage, it is important to discuss two modelling choices that are available regarding the groom's behaviour. First, the groom's decision to marry or not is left outside the model. One may wonder why he would want to get married and then behave in such a way as to cause a divorce. The reason lies in incomplete information about his happiness within marriage. When contracting marriage, indeed, the groom does not know whether he will consider it to be in his best interest to contribute to the household's harmony in the future. He wants to experiment with married life, yet might be disappointed in a number of ways after having got a taste of it. For example, his wife will not bear children as expected.

In the following, we assume that all relevant information revealed by his decision to get married is appropriately summarized in his distribution of types in his stepfather's eyes.

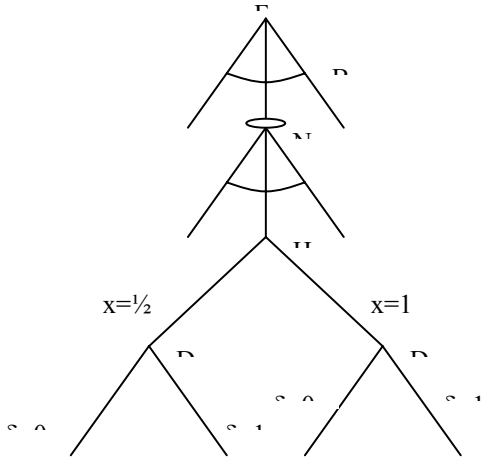
Second, while the outside option to remain single is rightly ignored for the aforementioned reason, the possibility of getting re-married is presumably affected by the overall level of the brideprice, creating a kind of market-wide effect that is left outside the picture of the model as well. While we do not exclude market-level effects, it is important that the story of the model be self-contained and that effects outside the scope of the model enter through parameters rather than through a key endogenous variable such as the brideprice. From the theory of gift exchange (see Aoki, 2001: 66-67; Carmichael and McLeod, 1997, for full theoretical elaborations), we know that engagement expenses can play a role not only of a signal of good intentions (to cooperate), but also of a commitment device that decreases the probability of eventual break-up. The key condition is that these expenses take a non-recyclable form (e.g., a ring, or the food consumed in the marriage party**).** In our case, the very fact that the variable portion of the brideprice must be repaid to the husband in the event of a divorce (provided that he was not guilty of a serious lapse in behaviour –see supra), makes it recyclable. Therefore, when deciding whether to cause a break-up, the husband is generally not pondering over a new irreversible investment, but is making a much simpler decision.

The last crucial aspect of our game is that the bride's father does not know the type of the groom, that is, his specific propensity to divorce strategically. Given this asymmetric information, the brideprice is set by the former in the light of probabilistic considerations. Bearing in mind that the game is played sequentially, the game tree represented in Figure 1 describes the way in which the successive moves take place.

In the first stage, the bride's father (F) chooses the amount of the brideprice (B). In the second stage, Nature (N) draws the type (v) of the groom (the game does not specify

whether the father or the bride is responsible for the choice of the groom). In the third stage, the groom or husband (*H*) chooses his contribution (*x*) to the household's local public good while in the fourth and last stage the wife or daughter (*D*) decides (δ) whether to stay in, or separate from the household. *B* takes on a real value; δ is equal to one if divorce occurs and zero otherwise; and *x* is equal to either 1/2 or 1, bearing in mind that *x=1* implies that the husband contributes his fair share to the household (with the result that his wife is induced to stay) while *x=1/2* implies that he does not (with the result that she is motivated to depart). The discrete nature of this choice represents the inability for the husband to fine-tune his contribution with a view to making his wife just indifferent between leaving or staying. The information needed to make such fine adjustments is extremely difficult to gather even within a household. Instead of making *x* a continuous choice under uncertainty, which will result in two local utility maxima, we take the short route of a binary choice under certainty so as to keep the model as simple as possible without diminishing its relevance.

Figure 1: Game tree



The payoff functions of the three agents, U_F (the utility of the bride's father), U_H (the utility of the husband), and U_D (the utility of the bride or daughter), are specified as follows:

$U_F = u(B) + \beta U_D$, with $u'(B) \geq 0$, $u''(B) \leq 0$; $\beta > 0$;

$U_H = f[ax + (1-a)(1-\delta)] + \delta vB - cx$, with $f'(x) \geq 0$; $a \geq 0$; $v \geq 0$; $c \geq 0$;

$U_D = (1-\delta) f[ax + (1-a)] + \delta (W-B)$, with $f(1) > W$,

where β is the caring parameter, or the weight attached by the father to his daughter's utility (the father is assumed to be altruistic); c is the unit (constant) cost of contributing to the household; a is the productivity of the husband's contribution while $(1-a)$ is that of the wife or daughter; the function $f[\cdot]$ is the household's production function describing the way in which contributions by both spouses get transformed into a local public good interpretable as the household's well-being; W is the wife's exit option, that is, the amount of wealth that she can obtain outside of her marriage; and v is a random variable describing the groom's type which corresponds to the extent to which he is willing to trade off the local public good f against the recouped brideprice payment (grooms are thus assumed to differ in terms of their preferences).[4] We denote by G the cumulative distribution function of v. Note that, when the husband contributes 1 unit to the household and his wife stays with him, the joint amount of their contributions is equal to 1. Also, x is not allowed to take on the zero value (but only a positive value arbitrarily set at either ½ or 1, for the sake of commodity), so that the husband's welfare in case of marriage break-up remains dependent on a.

The utility of the bride's father is the sum of two components: (i) the direct utility coming from the wealth acquired through the payment of the brideprice by the groom or the groom's father, and (ii) the indirect utility that he derives from his daughter's well-being. We assume non-paternalistic altruism (or pure altruism), since what enters into the father's utility function is the utility of his daughter, and the latter is a normal good for the father. Notice that the choice of ascribing to D or to F the responsibility to repay the brideprice is of limited importance. If the custom requires F to bear the responsibility of repayment, his utility would

[4] It is therefore apparent that v is the marginal rate of substitution between $f[\cdot]$ and B.

be equal to $u(B) + \beta(1-\delta)f(ax+1-a) + \beta\delta W - \delta B$. The only difference with our version in which this responsibility is assumed to befall the daughter is that the "caring parameter", β, does not multiply the last term δB. The only altered result is the disappearance of the possibility for the woman to get locked into marriage by the impossibility to repay too high a brideprice (see below). We have chosen to present the theoretically richer version where the lock-in phenomenon is possible, although our field data cannot confirm its occurrence.

The utility of the groom or husband in the event that the marriage holds ($\delta = 0$) is the amount of the local public good f minus the cost of his own contribution to that good, whereas it is equal to $f(ax) + vB - cx$ in the event that the marriage breaks up ($\delta = 1$).

Likewise, the utility of the daughter or the wife is the amount of the local public good f in the event that the marriage holds (the cost of her contribution can be ignored for the sake of convenience since it will not affect our analytic results), and the amount of her exit option net of the repaid brideprice in the event that the marriage breaks up. We make the sensible assumption that, if her husband contributes fairly to the household ($x = 1$), the bride obtains a higher utility from marriage than from being alone: $f(1) > W$. Since $f(1) > W$ automatically implies $f(1) > W - B$ when $B > 0$ (that is, in the case of the brideprice system), this assumption is tantamount to assuming that, in the case of a fairly contributing husband, the woman prefers to stay with him than to separate or divorce.[5]

A last important remark is in order. It concerns the caring parameter β. Instead of being viewed simply as an emotional predisposition, β can be considered to be crucially

[5] Note that in the above specification of the production function $f(-)$ the inputs of the two spouses are assumed to be perfect substitutes. It might appear more realistic to treat these inputs as complementary instead, that is, to use a Leontief production function. Doing that does not modify the results, however, except for the fact that a comparative static result on a is no more meaningful (when the two factors are complementary, there is obviously no sense in querying about the impact of a change in their relative productivities). In fact, the choice of the functional form of $f(-)$ is immaterial since its arguments take on only discrete values in our specification of the model. The only thing that really matters is the ranking between the four values in the image of $f(-)$: $f(0, ½)$; $f(0, 1)$; $f(1, ½)$; $f(1,1,)$, where the first argument refers to the input applied by the wife (varying according to whether she stays with her husband or leaves him) and the second one to that applied by the husband (x).

influenced by the daughter's bargaining strength. This is evident in so far as such strength translates itself in the extent to which a girl is able to persuade her father that caring for her own interests is a fair stand. In other words, β can be seen as the outcome of the leverage exercised by the daughter on her father, or the reflection of her ability to self-assert. Bear in mind that any efficient social choice function expressing the fairness principle at play in transactions between father and daughter can be represented by a weighted sum of utilities in a single profile environment as this one. Bargaining power considerations are therefore embedded into the model indirectly through parameter β. We choose not to endogenize this parameter because the advantage of the model in terms of simplicity and clarity would be lost if a bargaining framework had to be incorporated in it, and because there is actually little benefit to be derived from such a complication. The women's bargaining strength is, indeed, subject to many complex determinants, both observable (e.g., education) and unobservable, as will become clear in the discussion of empirical results.

The full derivation of the equilibrium brideprice and other endogenous variables is presented in Appendix 1. Because our model serves mainly as a micro-foundation for the econometric analysis that follows, we do not want to delve into theoretical considerations, but rather to focus on comparative static results susceptible of being tested. The comparative statics is based on the following interior solution for the level of the brideprice:

$$\Omega = u'(B) - \beta(1 - G(v^*)) - \beta G'(v^*)\left(\frac{v^*}{B}\right)\left[f(1) - W + B\right] = 0, \qquad (1)$$

assuming that $B^* < W - f(1-a/2)$ (otherwise the equilibrium brideprice is infinite).

3.3 Comparative statics

We are interested in knowing the effects on the equilibrium brideprice of changes in the woman's education level, in the attention paid by the father to her daughter's own perception of her well-being, in the productivity of men compared to women in agricultural

activities, in the intrinsic preferences of couples to stay together rather than to divorce, and in the distribution of men's preferences. Within the framework of the above model, a higher level of education of women is translated into a higher exit option value W and, possibly, into a higher productivity level $(1-a)$ and a stronger bargaining strength reflected in β; an increased attention of the father to her daughter's own perception of her well-being is reflected in an increase of β; an increase in comparative male agricultural productivity is represented by an increase in a; an increased payoff of staying together holding the exit option value constant is described as a parallel shift of the function f; and, finally, a change in the distribution of men's preferences is reflected in a similar shift of the cumulative distribution function $G(v^*)$, with the appropriate truncation to ensure that G is bounded by one.

Using the implicit function theorem and knowing that the second-order condition holds ($d\Omega/dB < 0$), we compute the first derivatives of the equilibrium brideprice B^* with respect to the above parameters. Four of these derivatives can be signed unambiguously (with slight abuses of notation, we denote by dB^*/df the impact of an upward parallel shift in f, and by dB^*/dG the impact of a first-order stochastic dominating change of G):[6]

$$dB^*/d\beta < 0;\ dB^*/dW > 0;\ dB^*/df < 0;\ dB^*/dG > 0; \qquad (2)$$

The first and most important result is that the brideprice is negatively correlated with the father's caring parameter in equilibrium. This can be interpreted as the effect of changing cultural conditions. An aspect of modernity is indeed that a father judges his daughter's well-being according to her perception rather than paternalistically. Another way to understand an increased β is that women's well-being in marriage (as represented by f) is taken increasingly into account when the father sets the brideprice, possibly because women exert more influence in the decision-making process. This shows how modernization, independently of

[6] A fifth, ambiguous result relates to the Boserup/Goody hypothesis and is discussed in Appendix 2.

marriage market effects, can cause a continuous downfall in the brideprice. As such, it can even explain a reversal of the brideprice, that is, its transformation into a dowry.

The second result shows that the women's exit option value is positively correlated with the brideprice set by the father. A father worries less about his daughter's separation prospect if she has better fall-back options in case she finds herself on her own. Hence he can ask for a higher brideprice. The parameter *W* reflects several forces simultaneously: the rising level of women's education, the opening up of non-agricultural job opportunities for women, the enhanced social status of divorced or separated women can all account for growing brideprices.

A positive uniform unit shift in *f* reflects an increase in the household's intrinsic value of staying together and hence in the opportunity cost of separation. The negative sign of dB^*/df results from the fact that fathers anticipate this effect and, accordingly, lower the brideprice in order to reduce the probability of divorce. Note that, the brideprice being held constant, an uniform unit shift in *f* would change neither v^* nor $[1-G(v^*)]$, the probability of divorce. This is not as surprising as it may seem because, in the logic of the model, the woman's decision to divorce is induced by the action of her husband whose exit option value measured by $f(a/2)$ is unaffected by an uniform rise in *f*. Since U_D increases as a result of that rise, the father restores the tangency condition by lowering B^* so that $u'(B^*)$ increases. Owing to this change in the equilibrium brideprice, the probability of divorce is lower at the new equilibrium.

The comparative statics with respect to *G* must be performed with caution as uniform (upward) shifts in *G* are not compatible with *G* being a cumulative distribution function (by definition, bounded by one). However, this is unimportant here since we know that in equilibrium $G < 1$. A first-order stochastic dominating change in G can then be applied to carry the same intuition as an upward parallel shift. Consequently, all other things remaining

equal, the probability of divorce is also lower. The bride's father uses this favourable opportunity by increasing the brideprice.

From the results synthesized in (2), it is evident that the impact on brideprices of modernization, understood as the combined effect of many of the above-analysed factors, is ambiguous. In particular, if an increased sensitiveness of fathers to their daughters' own perceptions of happiness tends to push brideprices down, the effect of rising levels of women's education is ambiguous. On the one hand, an enlarged access to non-agricultural employment opportunities, and higher women's productivity in marriage, *(1-a),* (provided that the elasticity of $G'(v^*)$ is smaller than -1), should lead to an increase in brideprices. But, on the other hand, education conceivably helps women to better assert their own interests (so that β becomes larger), which should cause a fall in brideprices. Therefore, if the main effect of girl education is to expose them to modern values of individual emancipation and self-development, while access to non-agricultural jobs is expanded only slowly and the impact of education on their agricultural productivity in marriage is not important, brideprices can be predicted to fall as a result of policies promoting girl education.

As for the effects arising from the marriage market, they would only add to this indetermination in the evolution of brideprices. For example, when girls enjoy better access to education and strategic considerations come into play, brideprices fall only if age at first marriage is not raised too quickly as a result of this improved access.

Using the definition of v^*, the comparative statics can be easily computed for the probability of divorce in equilibrium, $Prob = [1 - G(v^*)]$. We thus have:

$$\partial Prob/\partial B > 0;\ \partial Prob/\partial \beta = 0;\ \partial Prob/\partial W = 0;\ \partial Prob/\partial a > 0;\ \partial Prob/\partial c > 0 \qquad (3)$$

These are partial effects that ignore the impact of the parameters' variations via B since they are measured along the best reply curve of the husband. The results derived in (3) provide micro-foundations for the estimation of an econometric equation regressing the

probability of divorce on its determinants, assuming that the brideprice is pre-determined. As a matter of fact, the level of the brideprice is obviously known to all agents before divorce can occur, and this information will be used to test for the determinants of divorce probabilities. In the brideprice equation, of course, the estimated coefficients are predicted on the basis of the results depicted by (2).

4. Econometric methodology and results

4.1 Methodological considerations

In this section, we want to test for the most central prediction of the model presented above, namely the presence of a negative relationship between the brideprice and the probability of divorce expected by the father of the bride. This is done by estimating a system of two equations : a brideprice equation and a divorce equation. The first one can be interpreted as the best response curve of the father of the bride, while the second one corresponds to the groom's best response curve.

This exercise can be interpreted in two ways. First, since our model gives a very particular and partial view on the determinants of the brideprice and of the divorce probability, it is essential to test this theory against other ones. In particular, we want to examine whether a demand-based theory supported by certain assumptions on the determinants of woman's desirability –a type of argument with which we are a priori uncomfortable for epistemological reasons–, does not square with the facts at hand better than our own theory. Here the empirical test is a radical necessity that can potentially ruin the whole undertaking of the paper. From a different viewpoint, the empirical exercise is also necessary. This is because it allows us to quantify the power of the model as a deterministic pull in marriage-related issues, i.e. in behaviours that are mainly idiosyncratic. Indeed, even if the model is correct in the sense that it represents a valid causal relationship, it is pertinent

only if it explains a non-trivial share of the phenomenon under concern. The presence or absence of significant statistical relationships as predicted by the model is therefore a crucial question, in this investigation especially.

With the radical interpretation in mind, it is important to build econometric specifications that can actually refute our theory. It will certainly be refuted 1°) if the brideprice actually paid does not influence the divorce probability or 2°) if the expected groom type does not influence the brideprice. The first test is comparatively easy since it relies just on raw data: the brideprice being already observed when any decision regarding divorce is taken, there is no genuine simultaneity problem in the divorce equation. Hence there is no need to instrument here. Testing for the second main prediction of the model is more complicated and requires the construction of a tailored specification.

As a proxy for the expected groom type, we will use an instrument for the risk of divorce on the right-hand side of the brideprice equation. Although the setting of brideprice occurs before divorce is considered (if ever), it is useful to include an instrumented divorce variable in the brideprice equation, because it represented the groom's expected propensity to cause a divorce later on. Here, our methodological decision to ignore the groom's traits actually avoids more trouble. As a matter of fact, some observable traits could be used by the groom as signalling devices intended for influencing the father's beliefs and strategy regarding the brideprice. They would therefore have to be also instrumented for on the basis of other exogenous variables.

Our model also predicts the impact of several other factors. Fortunately, our Senegalese dataset allows for the testing of the signs of almost all the parameters present in the model. Thus, the woman's education and economic activity (or lack thereof) at the time of marriage, –which are known– are correlated with her outside option in case of divorce (W). The parameter β is partly represented by whether the person receiving the brideprice (often

the father of the bride) is financially responsible for its repayment in the event of divorce. The civil situation (widow, separated, single) of the woman before marriage is well-known to influence the groom's willingness to pay a high brideprice (see the function *G* in the model) and to act for the better rather than for the worse subsequently.

The fact that partners have freely chosen each other rather than obeyed the choice arranged by their families should have a positive influence on the brideprice. We hypothesize that, in the case of love marriages, the welfare derived from the household is more important to the groom than the prospect of recouping the brideprice by causing a divorce. Such preference pattern is known to the bride's parents who adjust their brideprice demand accordingly, that is, by raising the amount required.

The predicted impacts of several of the above determinants have opposite signs under alternative theories. For example, if the demand side were decisive in the bargaining about brideprices, holding the bride's father responsible for repayment in the event of divorce would actually lead to a higher brideprice, since the groom would deduce a risk premium from his transfer payment in alternative cases where only the bride bears responsibility for repayment. If the hardest sociological determinism were to prevail, a freely chosen partner would be the same as an arranged one, and the estimated coefficient of this dummy variable would be zero. Finally, if the economic value of the woman were the main determinant of the brideprice, her activity before marriage would be positively valued and would imply a higher brideprice, rather than have an ambiguous effect –negative through β (her bargaining strength), positive through *W* (her exit option). There is therefore ample scope, in the chosen specification, for the rejection of our theory to the benefit of an alternative.

In our empirical strategy, several control variables are also included. They are not explicitly mentioned in our admittedly partial model, but nevertheless they provide for useful and noticeable side-effects on the dependent variables. Variables measuring space and time

are two such controls. Location is distinguished according to whether the household lives in the delta region or in the middle valley of the Senegal river. A combination of two factors underlie our *a priori* expectation that brideprices are higher in the former than in the latter area. First, irrigation has gradually spread from the zone of the delta to the middle valley over the last decades. In-depth interviews conducted with groups of men and women in randomly selected villages suggest that, if anything, the workload for women has increased with the shift to irrigated agriculture, particularly in the delta where this form of agriculture is more widespread.[7] Women work more on the husband's land and/or on their own parcel (including parcels on irrigated perimeters created at the initiative of external agencies).[8] Such a tendency, which runs counter to the Boserup/Goody hypothesis, –women's productive contribution falls as one moves from extensive to intensive agriculture– is to be seen in the specific context of a Muslim culture in which, as stressed by Goody himself, a husband is expected, by custom, to provide for all the needs of his wives and children. A direct implication of this tenet is that a man's social status is inversely related to the amount of work done by his wife (wives) in the fields. Starting from a low customary level, women's relative contribution to agricultural tasks can only increase when labour-intensive practices are adopted.

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[7] Started on a modest scale during the colonial period, the irrigation move was part of a government policy aimed at drastically curtailing food imports and evolving towards national food self-sufficiency by encouraging rice cultivation. In the mid-sixties and the seventies effort was concentrated in the zone of the delta where large-scale irrigation perimeters were created over several thousands of hectares under the aegis of a specialised parastatal (known as SAED). Prior to SAED's efforts, lands of the delta were almost empty, being salty and exclusively used for grazing purposes by Fulani herdsmen. Later, attention was increasingly paid to developing or supporting irrigated cultivation in the middle and upper parts of the valley where local inhabitants had already taken initiatives by building medium-scale village-level irrigation schemes (Minvielle, 1977; Diemer and Van Der Laan, 1987). With the introduction of irrigation, the most fertile lands, which were traditionally inundated during the river's yearly spate and cultivated under the flood-recession system, have been converted into irrigated fields devoted to the cultivation of traditional staple crops (millet, beans and *niébé*), rice and more recently vegetables.

[8] In the latter case, the husband benefits (indirectly) from her wife's work in so far as he is able to shift to her responsibilities (such as satisfying her own needs for superfluous items) that used to befall the woman under the customary system.

Second, while the middle valley has long been inhabited by *Toucouleur* (*Haalpulaar,* in local parlance) who are known to be conservative and custom-abiding, the delta zone has been recently settled by *Wolof* immigrants (from as far south as the Sine-Saloum) who are apparently more opened to cultural and social change. In particular, *Wolofs* would have fewer objections against bargaining about brideprices in contrast to the *Toucouleurs* who attach more importance to the customary, fixed elements of marriage payments. As a result of the above considerations, one therefore expects brideprices to be higher in the delta zone than in the middle valley.

So much for the spatial variable. As for the time variable, its role is to measure the time that has elapsed since a woman's marriage. The idea, here, is to control for evolving circumstances such as inflation, changes in the relative scarcity of brides in the marriage market (due to rising ages at first marriage for girls, for example), and shifts in land use patterns and agricultural technology. On all these counts, we expect (nominal) brideprices to increase as time elapses. The woman's past conjugal history is also largely a control variable, because it can have several other effects than the one operating through the groom's type (e.g. think of the time-varying attitude of the woman towards marriage, given the factual correlation between civil status and age). Other control variables are discussed when results are presented. We can now turn to some important technical difficulties linked with the nature of our dependent variables.

Special attention is devoted to the way we represent divorce. The model is a one-period game, but a divorce occurring ten years after marriage is quite different from one occurring two years after it. The net present value of the brideprice to be repaid is indeed much lower in the first case. As a result, a divorce equation based on a binary dependent variable is not satisfactory. For this equation, since we are fortunate enough to have data about the duration of marriages, we chose a survival-time model (or "duration model")

instead. In this kind of model, the dependent variable (denoted by λ) is the probability of divorcing at period *T* conditional on having stayed together until time *(T-1)*. A reasonable assumption in this set-up is that the distribution of marriage duration is exponential[9], with a parameter depending on the regressors. In the data, a vast majority of marriages did not end by a divorce (about 18 percent of sample women have divorced or separated at least once) and their duration is therefore regarded as right-censored. The relative paucity of uncensored cases is not a problem in duration models. If we denote by *D* the observed marriage duration, by *Y* a vector of regressors, and by *u* a residual term, the divorce model can be summarized as follows:

$\lambda^* = \alpha + \beta Y$

$E(D^*) = f(\lambda^*, u)$ where f is the exponential transfer function and *u* is a residual[10];

$D^* = D$ if the marriage ends with a divorce, and $D^* > D$ otherwise.

The likelihood function associated with this model is numerically maximized by a number of statistical packages, including *Stata* (used here).

Methodological problems also appear in the equation of brideprices. First, a significant number of brideprices (more than one-third of the sample) have been set to 15,000 CFA, while it is only under special conditions (levirates, re-marriages at old age) that a lower amount is observed. A reasonable estimation procedure must therefore assume that the dependent variable is left-censored at that level. The Tobit technique is specially designed for that problem. If we denote by *B* the observed brideprice, by *v* a residual term, and by *X* a vector of regressors, our estimated equation looks as follows:

$B^* = \gamma + \delta X + v$

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[9] A more complicated parameterisation was tested, in which duration was distributed according to the Weibull law and gamma excessive dispersion ("frailty") was allowed for. This was not significantly different from the restricted form we have finally chosen, with exponential duration and no frailty.

[10] If λ is the conditional divorce probability, the probability of having the marriage last exactly *T* periods is $\lambda(1-\lambda)^{T-1}$. It is clear, then, that the expected marriage duration f(λ) is $\sum_T T(1-\lambda)^{T-1}\lambda$.

$B = B^*$ *if* $B^* > 15{,}000$, B is censored otherwise

The most serious problem in both equations is the endogeneity of several regressors. There is no genuine reciprocal causation in our specifications, since brideprice is observed before divorce is considered. However, a lot of unobserved heterogeneity in the brideprice equation makes it likely that some regressors are correlated with missing variables. Notice that in the divorce equation, this problem does not occur because divorce is the last thing that can happen in a marriage and all "relevant" information has by definition been observed before it occurs. Still, no less than four instruments appear in the brideprice equation: the risk of divorce (standing for the groom's type), education, a dummy indicating an arranged marriage and an interaction term between the last two mentioned variables.

We therefore need to find identifying restrictions that exclude some control variables from the brideprice equation. These restrictions will be tested ex post by means of an exogeneity test, and it will be shown that none of the identifying constraints introduced in our specification is binding. The roles of the control variables used in the first-stage equations will be discussed when results are presented. Let us now mention the problems associated with each of the endogenous regressors in turn.

The girl's level of education is generally chosen by her family, who may pay attention to the impact of this decision on her marriage prospects. This is a very clear case of endogeneity bias. Once it is controlled, education has two opposite effects on the brideprice. On the one hand, the woman's outside option (parameter W in the model) is higher if she is educated. As a result, her father may be tempted to require a higher brideprice, anticipating that in case of divorce she will be able to fend for herself reasonably well (see supra, Section 3). The requirement of a higher brideprice is all the more likely if the husband attaches a high intrinsic value to being married to an educated woman (implying a low expectation for v in

the model), or if her productivity in marriage is thereby enhanced– which discourages him from pushing her to leave.

On the other hand, an educated women is better able to articulate her views in front of her parents when the brideprice is being discussed; this effect is reflected in a high value for the parameter β in our model. The first effect pushes the brideprice up, while the second one depresses it, so that the total impact may be of either sign. Moreover, as pointed out in Section 2, the effect of education on the brideprice differs between arranged marriages and love marriages because it is presumably easier for an educated woman to influence the brideprice within a love marriage framework. One particular reason why it may be so is that a high education level enhances the threat of elopement used as a bargaining device by women. The threat is effective if parents fear that the rights of their future grandsons to family land are jeopardized when a union has not been sanctioned according to custom. And women in love marriages would not care too much about such a prospect –their threat of elopement is credible– only if they are educated. Indeed, a good exit option enables them to dispense with customary fall-back options (access to family land) in the event of marriage break-up. In order to test this hypothesis, an interaction term between education and the type of marriage must be added in the specification.

The type of marriage itself must be instrumented for in the brideprice equation. For one thing, true simultaneity suggests a story according to which the type of marriage may be influenced by the opportunities to extract a good brideprice from the groom. In other words, a father might well turn down a groom's offer because he expects a higher brideprice from a marriage of another nature (arranged or freely chosen). As an alternative, a girl could opt out of an arranged union and marry a freely chosen partner if the brideprice is set too high by her father. For another thing, instrumentation can be justified by the fact that unobserved determinants of the brideprice and of marriage duration are correlated with the propensity to

freely choose one's partner. Since those unobserved determinants are left in the residual term, the latter is correlated with the 'chosen vs arranged marriage' dummy if we don't instrument for this regressor. In the divorce equation, the type of marriage is not instrumented for because it is pre-determined and publicly known before divorce can occur. A correlation of the type of marriage with unobserved determinants of the odds of divorce would actually be good news, since they then become partly observed through this dummy and less (wasted) information is left in the residual.

For the sake of illustration, consider the case of a woman with an independent character (unobserved trait). She wants to choose her husband herself and, moreover, she has enough willpower to convince her father to require a brideprice affordable by her lover. In the brideprice equation, we do not want to include the effect of the woman's character into the coefficient of the binary variable reflecting the type of marriage (arranged or not). In the context of our story, failing to instrument for this dummy would bias its coefficient downwards. Indeed, the woman's intervention to keep down the brideprice would then be ascribed to the dummy, with the effect that the expected positive coefficient would be spuriously low. On the contrary, in the divorce equation, the type of marriage, a publicly known information at the time of decision, reveals the woman's character so that the latter's influence on marriage duration is not completely bypassed.

The brideprice and the risk of divorce are of course co-determined, as shown in the model. However, as has already been stressed before, there is a big difference between the two equations. The divorce probability is positively correlated with the actual brideprice along the best-response curve of the groom. By contrast, along the best response curve of the bride's father, the equilibrium brideprice is negatively correlated with the groom's propensity to trigger a divorce rather than with the actual occurrence of divorce (obviously unknown at the time of marriage). In the brideprice equation, a proxy for the marriage duration must

therefore be interpreted as the father's expectation of the groom's type (computed from the distribution function *G* in the model). Plausibly, the father of the bride has a better information than we do about the chances of divorce. Because the proxy for the groom's type is imperfectly defined, its coefficient will be biased towards zero without its sign being altered: if its estimated value turns out to be significant, we can *a fortiori* be sure that the father's expectation about the groom determines the brideprice. After trying various instruments for the marriage duration (expected median duration, expected mean duration, cumulative divorce probability after ten years,...), we settled for the predicted conditional hazard rate[11] (λ itself). We expect a negative sign for its coefficient. This is the crucial prediction derived from our model.

Endogeneity in a specification with qualitative or censored dependent variables must be treated according to the method of instrumentation described by Mallar (1976). A first-stage equation is estimated using exogenous variables only; the predicted index of this estimation is the instrument that replaces the endogenous dummy in the second-stage equation. This technique was originally developed for simultaneous probit equations, but it generalises in a straightforward way for other specifications. The key issue is to find relevant exogenous variables to construct the instruments and identification constraints for the second-stage equations. In this instance, all the exogenous variables present in these second-stage equations can be complemented with three additional regressors that are excluded from the brideprice equation.

The major drawback in using instruments for qualitative or censored variables is the loss of reliable standard errors. Actually, estimators may not be normally distributed at all. Since statistical inference is critical for our declared goal of testing the model, a special care is

[11] If the divorce probability is p, the divorce hazard rate is p/(1-p).

devoted to constructing a confidence interval and a significance for most of the estimated coefficients.

We choose to bootstrap the whole estimation procedure, including the first-stage computations of the instruments.[12] Our bootstrap procedure takes into account the clustered sampling approach followed during our fieldwork, that is, the fact that the sampling procedure has taken place in two successive steps: the purposeful selection of the villages, on the one hand, and the random selection of women within each selected village, on the other hand. Two-stage, clustered sampling has a non-trivial effect on the confidence intervals of the estimated coefficients, even though it does not affect the values of these coefficients. In the present instance, it turned out that correcting for clustered sampling did not affect the significance of our estimations.

4.2 Results

We are now in a position to discuss the econometric results obtained with the methodology explained above. Let us first note that the observation unit is a marriage reported by one of the sample women. Out of the 220 marriage stories that we have collected (see supra), only 148 are retained for the econometric analysis. For one thing, we have eliminated 24 cases of marriage because the payment was made in cattle the monetary value of which could not be reliably assessed. For another thing, 48 marriage stories had to be scrapped because of missing data about the brideprice, age at marriage, or age at the time of the interview.

[12] Bootstrapping consists in drawing with replacement in the original sample to get a new sample of the same size, for which the estimation is performed. By doing so a large number of times, an empirical distribution is generated for each estimated coefficient. Confidence intervals may then be constructed without any assumption about asymptotic distributions. Even so, two exogenous regressors which are binary variables often take a zero value; in most of the new samples drawn for the bootstrap, they came out with an identically zero value; as a result, confidence intervals are not available for their estimated coefficients.

We can now look at the estimation of the second-stage brideprice equation as presented in Table 5, bearing in mind that the dependent variable, *brideprice,* is the nominal amount of cash paid by the groom's to the bride's family. An important result emerging from Table 5 is the critical importance, for determination of the brideprice level, of the past conjugal history of the woman concerned. In our estimation, this history is represented by two binary variables, *widow* and *separat. Widow* takes on unit value when the woman was a widow at the time of her (re)marriage, whereas *separat* is equal to one when the woman had separated from a previous husband before embarking on a new marriage. The reference situation in which both dummies are equal to zero is that of women who are married for the first time.

Insert Table 5 about here

As our estimations show, the brideprice is lower by more than 48,000 CFA (74 Euro) when the woman is a widow at the time of her (re)marriage. No bootstrapped confidence interval could be constructed for the *widow* dummy, yet the magnitude of its coefficient suggests that its effects cannot be ignored. This conjecture is supported by the significance of a simple means test carried out on the raw data. When the woman is separated or divorced, the brideprice is also lower, but by a smaller margin (almost 12,000 CFA, or 18 Euro), than the price received for a girl who has never been married before.[13] The effect of *separat* on the brideprice is not statistically significant, though, which confirms the result of a simple means test based on raw data. This result implies that the 'price of virginity' does not represent a sizeable portion of the brideprice. If widows receive lower brideprices than separated women, it is because they are comparatively old at the time of their (re)marriage.[14]

[13] By declining order of importance, the average brideprice is equal to 42,600 CFA for single girls, 32,000 CFA for separated/divorced women, and 19,400 CFA only for widows.

[14] Average age at remarriage for widows is 31 years as compared with 23 years for separated or divorced women. This difference is statistically significant at 1 percent confidence level.

The conditional divorce hazard rate, labelled *riskdiv** in the above table, –to be carefully distinguished from the *separat* variable, which refers to an actual situation obtaining at the time of a (re)marriage– appears to have a negative influence on the brideprice of the order of no less than almost 55,000 CFA (84 euros) per unit, and this effect is statistically significant and robust to various alternative specifications of the explanatory variables included. For example, a groom with 50% probability of treating his wife in a way that triggers a divorce in any period for a given brideprice (odds of .5/.5 = 1) will be asked to pay about 42 euros less than a groom with a 33% probability of behaving badly (odds of .33/.66 = 1/2). Such a finding confirms the model's major prediction that a comparatively high divorce risk, as evaluated *ex ante* by the bride's father, leads to a relatively low brideprice.

The influence on marriage payments of the bride's autonomy in choosing her spouse is measured by the coefficient of the instrumented variable *lovemar**. The original, non-instrumented binary variable, has unit value when the woman has freely chosen her husband, and zero value when her marriage has been arranged by her parents. The instrument is the predicted index of a probit estimation on exogenous regressors (see infra for details). What Table 5 shows is that woman's autonomy in selecting her spouse has the effect of raising the brideprice by almost 17,000 CFA (26 euros), which is statistically significant and borne out by a simple examination of raw data: indeed, the average brideprice works out to 45,700 CFA (70 euros) in the case of love marriages as against only 33,800 CFA (51 euros) in the case of arranged marriages (a statistically significant difference).

The positive influence of a love marriage on the brideprice is the outcome predicted by our model. In the case of a love marriage, indeed, the father knows that he can extract a higher price from the groom without triggering marriage failure too much. Or, to put it in another way, because a love marriage is perceived as entailing a lower risk of failure (see infra for an empirical confirmation), the father is incited to require a higher brideprice. In

terms of the model, partners in a love marriage generate larger values of *G(-)* for all values of *v*, and we know from equation (2) that *dB*/dG >0.*[15]

Education of the bride does not appear to significantly affect the brideprice except through an interaction term with the propensity to freely choose one's spouse. The variable *educ** is the predicted index of an ordered probit estimation of three categories of education (bear in mind the above-explained need to instrument this variable): a first category including women who have no education at all, a second one including those who have received some education yet did not complete primary schooling, and a third one including women who completed their primary education and possibly added a few years of secondary school (no woman in our sample has actually completed her secondary education). The interaction term *loveXed** is the product between the two instrumental variables *lovemar** and *educ**.

As is evident from Table 5, only the interaction term has a significant coefficient, which is negative. That there is no independent effect of women's education on brideprices should not come as a surprise since we know that two opposite effects are actually at play. To repeat, the groom's willingness to pay and the bride's exit option are higher when the woman is better educated and, as a result, the brideprice should go up in terms of our model yet, on the other hand, an educated woman is better able to put pressure on her parents so as to keep down the brideprice. The negative impact of *loveXed** means that the brideprice is lower for educated women only when they have freely chosen their husband. In arranged marriages,

[15] There is another explanation for the positive effect of love marriages on the brideprice. As a matter of fact, the type of marriage (love or arranged) and the existence of a kinship link between the bride and the groom are strongly correlated: a very large majority of arranged marriages (close to 90 percent) are contracted among kin-related partners while hardly 60 percent of love marriages have this characteristic. Since bargaining about marriage payments is presumably tougher with strangers than with relatives, we expect brideprices to be lower in the case of arranged marriages. Our data do not appear to support this explanation, however: if brideprices are smaller for marriages between kin-related spouses than for marriages between strangers, the difference turns out to be statistically insignificant. Note that the dummy *famlink* –which is equal to one when spouses are related through kinship ties– has not been included in the regression due to its strong collinearity with *lovemar* and the impossibility of instrumenting it properly.

bride's education does not appear to affect the brideprice. This result confirms the difference-of-means test mentioned in Section 2. Since brideprices are higher in the case of love marriages (see supra), the effect of the interaction term goes against the effect of the type of marriage when the woman is relatively educated. The estimated coefficients obtained are such that the two effects cancel each other out. In other words, education neutralizes the positive effect of love marriages on brideprices. This is no doubt one of the most interesting findings of our study, and an effective test of the validity of our explanation of brideprices based on strategic considerations.

The variable *time,* a continuous variable that measures the number of years elapsed between the woman's marriage and the time of the interview, has no significant influence on the brideprice. When introduced as the only explanatory variable, *time* appears with a positive and significant coefficient. Adding the type of marriage variable on the right-side of the equation destroys this relationship, indicating that the upward trend of nominal brideprices (in real terms, brideprices have a tendency to fall) arises mainly from the rising incidence of love marriages.

There are no significant differences in brideprices between the delta zone and the middle valley: the coefficient of *area,* –a dummy equal to one when the woman lives in the middle valley, and to zero when she lives in the delta–, is not statistically different from zero.[16] Our hypothesis regarding the influence of intensive agriculture in migrant communities is thus not borne out by the data. This implies that no empirical ground exists to argue that brideprices amounts are culturally determined: the logic of brideprice determination is the same in the two sub-regions of the survey area.

[16]The average brideprice is 39,123 CFA in the delta and 40,758 CFA in the middle valley.

The independent variable, *nrgifts,* is a dummy which is equal to one when, in addition to the monetary brideprice, the bride's family has received gifts under the form of clothes and jewels. Since this practice is most commonly followed by rich families, *nrgifts* serves as a control term that takes care of a few special cases: gifts tend to be offered when brideprices are high.

The variable, *actmar,* is a dummy aimed at testing whether the brideprice is influenced by the bride having a professional activity before marriage. This possibility arises with a very small frequency, however, which explains why a bootstrapped confidence interval is not available: in many sub-samples, the dummy takes on a constant (zero) value. Nonetheless, the estimator can be interpreted, albeit with care given the impossibility to make any statistical inference. The average impact is about 21,000 CFA (32 Euro), to be compared with a sample average of the brideprice of 37,000 CFA (57 Euro). Since the coefficient is negative, the interpretation is that the groom's increased willingness to pay and the impact of a higher exit option for the bride are outweighed by the stronger independence of the woman reflected in a greater ability to bargain with the parents to keep the brideprice low.

The variable *respons,* a dummy equal to one when the recipient of the brideprice is explicitly responsible for its repayment in the event of separation/divorce, has a negative but non-significant coefficient. Upon first look, the sign is as expected: confronted with the risk of repayment, the caretaker has an interest in keeping the brideprice down. In our model, however, there is another possible scenario, namely that the bride's father may want to raise the brideprice to such an extent that it prevents separation through a lock-in effect (which corresponds to the corner solution discussed in Section 3). In other words, it is only at an interior solution that financial responsibility of the brideprice's recipient in case of divorce should result in a lower equilibrium brideprice.

Let us now say a few words about our first-stage equations (see Appendix 3 for the detailed results). Regarding the construction of *riskdiv*,* an important exogenous variable is the dummy *firstwife,* which is equal to one when the married woman is the first wife of her husband in the marriage arrangement considered, and equal to zero when she is her second or third wife under a polygamous union. (All wives under monogamous marriages are automatically considered as first wives according to this definition). The coefficient of *firstwife* is negative and highly significant. The same result obtains when *firstwife* is introduced as an explanatory variable in the second-stage divorce (and not brideprice) equation, which is good news for our identification. As will soon be explained while discussing the divorce equation, the inverse relationship between the risk of divorce and whether a woman is her husband's first wife is congruent with our intuition.

Regarding the instrumentation of *lovemar*,* the critical role is played by another dummy, denoted *rankmar,* which is equal to one when the marriage concerned is not the woman's first marriage. The coefficient is positive, and again highly significant, confirming the lesson previously learned when examining raw data: women have a tendency to comply with the system of arranged marriages upon their first conjugal event but to call that system into question if and when they re-marry.

Finally, the instrumental variable *educ** is constructed essentially on the basis of two age dummies: the first one, called *age1,* is equal to one for women aged between 27 –34 years while the second one, called *age2,* is equal to one for women who are more than 34 years old. It turns out that *age1* has a highly significant and positive effect on the woman's education. In other words, the youngest among our sample women are comparatively less educated than the women in the intermediate age category. This apparently surprising result is a direct consequence of the peculiar structure of our sample. Since our sample consists of married women only, and since we were keen to include women of all age categories, it is inevitable

that the youngest women in our sample had married at an early age which automatically implies that they are also uneducated, at least in comparison to women in the intermediate age category. The oldest women do not differ much from the youngest ones because in a country like Senegal girl education is a rather recent phenomenon, especially in rural areas.[17]

The variables *firstwife, rankmar, age1* and *age2* have been excluded from the brideprice equation, so as to allow the proper identification of this equation. To test for the success of identification, we have followed the spirit of a Davidson-McKinnon identification test by performing a likelihood-ratio test on the brideprice equation against an alternative where all endogenous variables were removed but all exogenous variables were included. If the variables that we chose to exclude in our specification have some explanatory power besides their role as instruments, the likelihood should improve. The test shows that this is not the case, with a value of 8.85 for a chi2 statistics with 13 degrees of freedom, which leads to a significance level of 78.5%. We can therefore safely assert that identification was correctly addressed. If we ignore this test and adopt an a priori viewpoint, it must be stressed that plausible stories in which our excluded variables (such as being one's spouse's first wife, or the number of marriages previously contracted by the woman) have an impact on the brideprice rely on the correlation with another regressor that is included in our specification (e.g., love marriage or current civil status).[18] Hence, it is reasonable to say, as is supported by the aforementioned test, that the excluded variables do not influence the brideprice once the influences of included regressors are controlled for.[19]

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[17] A simple examination of the raw data shows that 30% of women belonging to the youngest age category have no education at all, to be compared with 48% for the oldest women and only 19% for those of the intermediate age category.

[18] To keep the size of this paper manageable, such stories are not reported here but are available for the interested reader upon request to the authors.

[19] Endogeneity problems may be impossible to surmount. Thus, we know that brideprices are significantly higher when the woman's husband is a migrant. Yet, there is a serious risk that the migrant variable is endogenous: only families with certain characteristics choose migrants as spouses for their daughters. One must admit that marriages with migrants have particular characteristics in our sample (their wives are more educated, for example). Since no proper control variables are available

By contrast, given our interpretation of the divorce equation as the groom's best response curve, all the marriage variables are pre-determined at the time of the divorce decision (see supra). As a consequence, the problem of identification does not arise in the case of this equation which we discuss below. The estimation of the second-stage divorce equation is presented in Table 6. The dependent variable is *riskdiv* which in the present context represents an objective probability rather than a perceived risk as is the case in the brideprice equation (where it appears as a simulated explanatory variable, implying that residuals are not taken into account).

Insert Table 6 about here

The most important finding is that the coefficient of *brideprice* is positive and highly significant. Our hypothesis according to which higher brideprices are susceptible of causing conjugal tensions and ill-treatment of wives that may eventually result in divorce, is thus borne out by the available econometric evidence. One implication is that this perverse effect eventually dominates the other effect whereby high brideprices discourage women from leaving their husband owing to brideprice repayment problems. Combined with the corresponding result obtained in Table 6, such a finding establishes the existence of the reciprocal relationship between brideprice and divorce risk that is predicted by the model presented in Section 3.

Unlike what we observed in the brideprice equation, the coefficient of the *time* variable is (highly) significant, and is negative. The implication is that marriages contracted in older times are less subject to the risk of breakup. Such a result is not surprising in so far as modern, individual-centered values diffused through varied forms of contact with the

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to instrument the *migrant* variable satisfactorily, we have refrained from using it in the RHS of our brideprice equation. None the less, it is interesting to note that, when it is introduced in this equation, it comes out with a large, positive, and highly significant coefficient (equal to about 16,300), and that the other coefficients are barely altered as a result. In particular, the impact of the risk of divorce remains highly significant, that of education remains non-significant, and that of the interaction term between education and the type of marriage continues to be significant. Our essential results are therefore confirmed.

Western world (including exposure to mass communication media), have the effect of making divorce decisions easier. By contrast, education does not appear to influence the likelihood of divorce. In this equation, education is represented by two binary, hierarchically ranked variables: *educprim*, which is equal to one when the woman has completed primary school, and *educseco*, indicating whether the woman has completed secondary school. Remember that a woman's education is publicly known at the time of her marriage, so that there is no need to instrument for this categorical variable.

On a priori grounds, it is actually hard to predict the impact of education on the woman's conditional probability to divorce since there are several effects that do not necessarily go into the same direction. In particular, educated women think more carefully before getting involved in a long-term love relationship or, if the marriage is arranged, before giving their consent to the match proposed by their parents. As a result, the risk of divorce should be smaller for them. On the other hand, however, education has the effect of reducing the cost of a divorce decision, for at least two reasons. First, by instilling into women more self-confidence, assertiveness (including the ability to question existing institutions and mores) and autonomy, education makes a breach of traditional commitment easier. Second, by providing access to better income opportunities, it confers upon women a higher exit option value in the event of separation.

When a woman is her husband's first wife, the risk of divorce is smaller. Bear in mind that the category of first wifes comprises all cases of monogamous marriages. Interestingly, though, the result holds true even if we would consider only polygamous marriages. The higher status of the first wife in a polygamous union probably explains why she is less likely to be parted with.[20] According to custom, first wives are entitlled to have a larger share of the

[20] When the number of children born of the marriage is introduced as an explanatory variable in the divorce equation, it turns out to have a highly significant and negative coefficient, indicating that a larger family tends to discourage the break-up of the marriage. If we did not include this variable in the final report of estimations presented in Table 2, it is because it is liable to be endogenous: when

marriage public good than second or third wives. Hence, they have fewer incentives to divorce.

Another strongly significant variable is *lovemar*, the coefficient of which is negative. In fact, there are two reasons why such a result conforms with our intuition. For one thing, love marriages are presumably more successful than arranged marriages because the partner has been freely chosen by the persons concerned. The second reason arises from a constraint that renders the prospect of separation more risky for women who did not go through an arranged marriage. Indeed, they have to bear total responsibility for marriage failure, which typically implies that their family will not easily come to help them in the event of separation or divorce. On the contrary, when marriages have been arranged, in times of crisis women can call forth traditional mechanisms of social protection based on their right to return to their own family in order to get material and psychological support. Qualitative interviews nevertheless suggest that this second argument ought not to be overplayed: parents today tend to behave in an essentially similar manner when a daughter is separated from her husband, whether the union had been arranged or not.

Whether there exists a kinship relation between husband and wife does not apparently affect the risk of divorce. This is not a robust result, however. As a matter of fact, the coefficient of *famlink* becomes significant (and negative) once the variable *lovemar* with

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spouses are more confident in the durability of their union, they are more likely to have children, say, because they are staying longer together. Note that, when the number of children is taken into account, the coefficient of *firstwife* remains significant. Likewise, if introduced into the divorce equation, the dummy variable (called *migrant*) indicating whether the woman's husband works abroad comes out with a highly significant and negative sign. But again, there is a risk of an endogeneity bias: indeed, a husband may decide to go abroad for income-earning purposes only if he stands assured that his wife will remain in the native village and take continuous care of the land and the children. Because we are unable to find proper instruments to control for these two endogeneity biases, we have refrained from presenting the estimated results with the corresponding variables introduced in the divorce equation. The same holds true of two other variables, namely *polygamy,* –indicating whether the marriage is polygamous or monogamous– and the woman's age at marriage. As a matter of fact, both variables are endogenous and, since we do not have available adequate instruments, we are unable to isolate their specific effects on the risk of divorce. Alternatively, one could treat *polygamy* as an indicator of wealth of the husband, that would therefore have an exogenous status. When introduced in the regression, however, this variable does not come out with a coefficient significantly different from zero.

which it is strongly correlated (see supra) is dropped from the equation. Prior family links between spouses have therefore the effect of diminishing the risk that the marriage will be broken. The likely reason behind this result is that pressures exercised by families concerned to prevent separation or divorce of their children are stronger when they are related.

The coefficient of the variable *separat* is positive and not far from being significant. One would have perhaps expected that, when a woman has already separated from a previous husband, the risk of a new marriage failure is increased. This would be so because the cost of breaking a marriage gets lower when it has already been borne in the past. On the other hand, however, it can be retorted that a woman with a painful conjugal history will be more careful before engaging in a new marital link, thereby lowering the risk of a new marriage failure. The result reported in Table 2 seems to indicate that the former effect outweighs the latter.

Finally, the risk of separation or divorce does not vary between the two sub-regions of our field area (the coefficient of *area* is not statistically different from zero), which tends to confirm that cultural homogeneity between migrant and settler communities in the Senegal river valley may be greater than what is usually thought.

5. Conclusion

Marriage decisions are obviously critical decisions, whether they are made by parents in the framework of an arranged union or by the people concerned themselves on the basis of a love attraction. In so far as payments are to be made to render the marriage socially valid and, in particular, to establish the future rights of children to the land assets of their parents, it is difficult to conceive that they are not the result of strategic thinking. Thus, the suspicion that, by requiring a high brideprice for consenting to give their daughter to a man, parents may cause her harm in future conjugal life and perhaps even damage the prospect of a lasting union, will most likely lead them to weigh the advantages of a high marriage payment against

such a risk. This outcome is more likely if a daughter is aware of her own interests and able to exert pressure so that her parents take them in account. Lower brideprices may follow.

In this paper, it has been rigorously shown that the above prediction can indeed be inferred from a model built around the idea of strategic and sequential decision-making. Other interesting comparative-static results have been derived, such as the impact of better exit options for the woman and the effect of the increasing willingness of parents to assess their daughter's well-being from her own standpoint rather than paternalistically. Such increased willingness is an expected outcome in a context where as time elapses women become more emancipated and vocal in asserting their own right to happiness. In other words, by raising the degree of parental altruism the enhanced bargaining strength of women ought to result in lower brideprices.

On the empirical level, the paper has brought forward two kinds of evidence, drawn from the Senegal river valley, in favour of the thesis that brideprices tend to be determined strategically in the light of their adverse effect on women's well-being in married life and the concomitant risk of marriage failure. The first type of evidence is essentially qualitative, derived from queries about opinions of both men and women. As for the second type, it has relied on econometric testing using brideprice data and information regarding various characteristics of women and their marriages.

The most important result supports our central proposition according to which there exists a two-way relationship between brideprices and the risk of marriage break-up. More precisely, duly controlling for endogenous effects, it has been shown that the higher the perceived risk of divorce the lower the brideprice set for the marriage, whereas, in the other way around, a higher brideprice tends to increase the actual risk of divorce.

Other significant results include the following ones. First, brideprices tend to be higher for women who have freely chosen their husband than for women who went through

an arranged marriage. Moreover, the risk of divorce is lower for the former than for the latter category. Note, in addition, that the order of marriage bears significantly on the propensity to go for a love marriage: love marriages are more characteristic of women who have already been married before than of women entering into their first marriage (and are therefore more subject to the influence of their parents). Second, there is no effect of women's education on brideprices nor on the risk of divorce. Yet, the brideprice appears to be smaller for educated women when they have freely chosen their husband, thus suggesting that women wielding more bargaining power vis-à-vis their parents are better able to keep brideprices down.

Third, brideprices are lower for widows but, perhaps surprisingly, not significantly so for separated women. Since widows generally remarry at a later age than separated women, this suggests that the customary component of the brideprice plays a rather insignificant role nowadays. Fourth, when women have non agricultural incomes at the time of marriage, the effect of their enlarged exit options appears to be outweighed by their enhanced ability to keep the brideprice low through bargaining with their parents. Fifth, when a woman is her husband's first wife, the risk of divorce is smaller. Sixth, the same result obtains when the families of the spouses are linked through kinship ties. And, seventh, marriages contracted in older times are more stable than recent unions.

A final remark is in order. A rival theory would contend that ill-treatment of women for whom high brideprices have been paid results from the declining economic value of women relative to men (say, for the reasons put forward by Goody and Boserup), therefore causing a maladjustment of brideprices, rather than from the diffusion of new values emphasizing women's rights to happiness. If this is true, so the argument would run, conscious attempts by brides and their parents to limit the amount of the brideprice required may be seen as a mechanism aimed at bringing brideprices back to their equilibrium level. This interpretation, however, does not stand the scrutiny of the facts highlighted by our

econometric analysis. In particular, the correlation of brideprices with the practice of love marriage, with the availability of exit options for women, and with parental responsibilities regarding brideprice repayment in the event of marriage failure cannot be predicted by a disequilibrium theory. In such a theory, indeed, the marriage payment is only a function of the prevailing custom and the extent of disequilibrium measured by the expected divorce rate.

Table 5

A Tobit Estimate of the Best Response Curve of the Bride's Family
(with bootstrapped significance levels and confidence intervals)

F(11,4) = 26.97 Prob > F = 0.0030

brideprice	Coef.	BS Signif.	BS average	BS conf. interval (90%)	
time	-723.93	19%	-567.74	-1603.79	492.57
area	6174.66	68%	7004.24	-4687.90	21098.91
nrgifts	17060.20	9%	16014.71	170.28	42626.82
actmar	-21016.13	n.a.			
respons	-11523.08	20%	-8141.69	-25833.74	11210.89
widow	-48275.80	n.a.			
separat	-11880.03	16%	-16345.28	-44987.71	7705.87
riskdiv*	-54691.56	5%	-44921.02	-130227.98	-16.29
educ*	535.65	97%	-1038.99	-15370.36	13261.47
lovemar*	16849.95	7%	22134.59	447.32	69762.17
loveXed*	-13955.59	9%	-10480.14	-33773.96	-191.74
constant	54943.34	n.a.			
/sigma	31274.72	n.a.			

Obs. summary: 106 uncensored observations
42 left-censored observations
Note: An instrumented variable is marked with a star.

Table 6

A Duration Model of the Best Response Curve of the Husband

Log likelihood = -83.454583 Wald chi2(9) = 129.48
Prob > chi2 = 0.0000

riskdiv	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
time	-.0800744	.0246405	-3.25	0.001	-.128369	-.0317798
area	-.3630985	.3229352	-1.12	0.261	-.99604	.2698429
firstwife	-2.2652710	.6634882	-3.41	0.001	-3.565683	-.9648576
educprim	.3129087	.4869268	0.64	0.520	-.6414504	1.267268
educseco	.3488301	.8626988	0.40	0.686	-1.342028	2.039689
lovemar	-1.6627020	.6115707	-2.72	0.007	-2.861358	-.4640452
famlink	.3254102	.5474623	0.59	0.552	-.7475961	1.398416
separat	.8152295	.5470467	1.49	0.136	-.2569623	1.887421
brideprice	.0000141	5.38e-06	2.63	0.009	3.60e-06	.0000247
constant	-2.3265790	.5034806	-4.62	0.000	-3.313383	-1.339775

References

Aoki, M., 2001, "Toward a Comparative Institutional Analysis", Cambridge Mass. & London : MIT Press.

Becker, G.S., 1974, "A Theory of Marriage: Part II", *Journal of Political Economy,* Vol. 82, N° 2, pp. S11-26.

Becker, G.S., 1981, *A Treatise on the Family,* Cambridge Mass.: Harvard University Press.

Bergstrom, T.C., 1996, "Economics in a Family Way", *Journal of Economic Literature,* Vol. 34, N° 4, pp. 1903-1934.

Bergstrom, T.C., 1997, "A Survey of Theories of the Family", in M.R. Rosenzweig and O. Stark (eds.), *Handbook of Population and Family Economics –Vol. 1A,* Amsterdam: Elsevier, pp. 21-79.

Bloch, F., and V. Rao, 2002, "Terror as a Bargaining Instrument: A Case Study of Dowry Violence in Rural India", *American Economic Review,* Vol. 92, N° 4, pp. 1029-1043.

Boserup, E., 1970, *Women's Role in Economic Development,* London: Allen and Unwin.

Carmichael, H.L. and W.B MacLeod, 1997, "Gift-giving and the Evolution of Cooperation", *International Economic Review*, Vol. 38, pp. 485-509.

Cooper, B.M., 1997, *Marriage in Maradi –Gender and Culture in a Hausa Society in Niger, 1900-1989,* Portsmouth and London: Heinemann and James Currey.

Diemer, G., and E.C.W. Van Der Laan, 1987, *L' irrigation au Sahel : La crise des périmètres irrigués et la voie haalpulaar,* Paris : Edition Karthala.

Ensminger, J., and J. Knight, 1997, "Changing Social Norms –Common Property, Bridewealth, and Clan Exogamy", *Current Anthropology,* Vol. 38, N° 1, pp. 1-23.

Goody, J., 1976, *Production and Reproduction – A Comparative Study of the Domestic Domain,* Cambridge : Cambridge University Press.

Grossbard, A., 1978, "Towards a Marriage Between Economics and Anthropology and a General Theory of Marriage", *American Economic Review,* Papers and Proceedings*,* Vol. 68, N° 2, pp. 33-37.

Grossbard-Shechtman, S., 1993, *On the Economics of Marriage: A Theory of Marriage, Labor and Divorce,* Boulder: Westview Press.

Lam, D., 1988, "Marriage Markets and Assortative Mating with Household Public Goods: Theoretical Results and Empirical Implications", *Journal of Human Resources,* Vol. 23, pp. 462-87.

Lundberg, S., and R.A. Pollak, 1996, "Bargaining and Distribution in Marriage", *Journal of Economic Perspectives,* Vol. 10, N° 4, pp. 139-158.

Manser, M., and M. Brown, 1980, "Marriage and Household Decision Theory –A Bargaining Analysis", *International Economic Review,* Vol. 21, pp. 21-34.

McElroy, M., and M. Horney, 1981, "Nash-Bargained Decisions: Towards a Generalization of the Theory of Demand", *International Economic Review,* Vol. 22, pp. 333-349.

Minvielle, J.P., 1977, *La structure foncière du waalo fuutanké – Les terres inondables de la moyenne vallée du Sénégal, région de Matam,* Centre ORSTOM (Office de la Recherche Scientifique et Technique d'Outre-Mer), Paris and Dakar.

Ndiaye, S., M. Ayad, and A. Gaye, 1997, *Enquête Démographique et de Santé au Sénégal (EDS-III) 1997*, Ministère de l'Economie, des Finances et du Plan, Direction de la Prévision et de la Statistique, Division des Statistiques Démographiques, Dakar.

Platteau, J.P., and F. Gaspart, 2005, "The Perverse Effects of High Brideprices", Working Paper, Center for Research in the Economics of Development (CRED), University of Namur.

République du Sénégal, 1992, *Recensement Général de la Population et de l'Habitat 1988 –Rapport Régional pour la Région de Saint-Louis,* Ministère de l'Economie, des Finances et du Plan, Direction de la Prévision et de la Statistique, Dakar.

Appendix 1: The Equilibrium of the Brideprice Game

In order to solve the game, we start by computing the daughter's best reply, then the groom's, and, finally, the father's. From the daughter's utility function, we can assert that $\delta = 1 \Leftrightarrow f(ax + 1 - a) < W - B$. Given our assumption that $f(1) > W$, this condition is tantamount to x = ½ and $B < W - f(1 - a/2)$. In particular, we can conclude that, if the brideprice is set at too high a level, the woman becomes locked into her marriage. Otherwise, she leaves if and only if her husband does not contribute fairly to the household. Aware of this reaction and the associated lock-in phenomenon, the husband will never contribute fairly if the brideprice is too high. More formally,

x = 1 $\Leftrightarrow$ $B < W - f(1 - a/2)$ and $f(1) - c > vB + f(a/2) - c/2$

Rewriting the second condition, we have

$$v < v^* = \frac{f(1) - f(\frac{a}{2}) - \frac{c}{2}}{B}$$

Consider the case where an interior solution may arise, namely, $B < W - f(1 - a/2)$.

Bearing in mind that $G(v^*) = prob\ (v \leq v^*) = prob\ (x=1) = prob\ (\delta=0)$, and that

$[1 - G(v^*)] = prob\ (v > v^*) = prob\ (x = 1/2\ ) = prob\ (\delta=1)$, the utility of the daughter's father can be written as the following expected utility function:

$$EU_F = E\{u(B) + \beta[f(ax + 1 - a)(1 - \delta) + \delta(W - B)]\} =$$
$$u(B) + \beta G(v^*) f(1) + \beta[1 - G(v^*)](W - B)$$

We are now in a position to compute the father's best response, i.e. the equilibrium brideprice. It is clear from the above that no finite brideprice exceeding $W - f(1-a/2)$ will be the father's optimum, since the daughter's dominant strategy would then be to stay with her husband as a result of which her utility is independent of the brideprice. In formal terms:

$B^* = argmax\ U_F$ and $B^* > W - f(1-a/2) \Rightarrow B^* = \infty$

The case of an interior solution is characterized by the inequality B* < *W - f(1-a/2)* and the following first-order condition:

$$\Omega = u'(B) - \beta(1 - G(v^*)) - \beta G'(v^*)(\frac{v^*}{B})\left[f(1) - W + B\right] = 0 \qquad (1)$$

The first two terms of equation (1) reflect the direct impact of the payment of one additional unit of brideprice on the bride's father's utility. It actually comprises a positive and a negative effect. The positive effect is the increased utility associated with the marginal income thereby obtained. As for the negative effect, it is the expected loss of utility that is caused by the increased repayment burden weighing on the daughter if she is induced to divorce, which she does with probability *[1- G(v*)]* in equilibrium. The third term in equation (1) is an indirect effect resulting from the increase in the probability of divorce that is caused by an increase in the brideprice amount[21]. The first-order equilibrium condition therefore means that the brideprice amount must be set by the daughter's father at a level such that his marginal direct utility gain *u'(B)* is exactly equal to the expected loss of utility arising from the increased repayment burden weighing on his daughter plus the utility loss resulting from the increased probability of divorce[22].

In the following, we will focus our attention on the empirically pertinent case of a finite equilibrium brideprice. The assumption guaranteeing this in the model is:

*B** solves equation (1) => $lim_{\infty}\, U_F(B) < U_F(B^*)$

Clearly, this condition implies that the function *u(B)* does not increase unboundedly with *B*[23].

---

[21] This becomes evident when it is borne in mind that *(-v*/B)* is the derivative of *v** with respect to *B*, *dv*/dB,* and that *[f(1) – W + B]* is the utility gain for the woman if she is married with a husband who contributes fairly compared to a situation where she is alone.

[22] Given that *[G(v*) = 1 ⇒ G'(v*) = 0],* we can immediately infer that *G(v*)<1* in equilibrium, implying that the probability of divorce is positive. Indeed, if this were not the case, the second and third terms of the FOC (1) would vanish, leaving only a positive term that would make the condition impossible to satisfy.

[23] We assume that $U_F = \Phi(B)$ tends asymptotically towards a finite value after having reached a local maximum.

Appendix 2: Discussion on the Boserup-Goody thesis

From equation (1), it can be shown that :

$$sign[dB^*/da] = -sign\left[1-\frac{f(1)-W+B^*}{B^*}\left(1+\frac{G''(v^*)}{G'(v^*)}v^*\right)\right] = sign[dB^*/dc]$$

This comparative static result provides a direct test of Boserup/Goody's hypothesis according to which an increasing role of men in agricultural activities ought to result in falling brideprices and, ultimately, in the emergence of the dowry system. Here it is evident that such a prediction does not obtain in all cases. A sufficient condition for it is that the elasticity of v's density function, $G'(v^*)$, is smaller than -1.[24] There is actually no guarantee that such a condition is fulfilled. When set into a strategic interaction framework, the Boserup/Goody's hypothesis is not automatically vindicated. Instead of relying on the commonsense demand argument, we invoke the intra-household bargaining mechanism underlying the demand shift caused by the lower productive contribution of women. Indeed, realizing that women are no more worth the payment made to marry them, men are more likely to induce a divorce. Anticipating such an outcome, parents require lower brideprices for their daughters. Yet, the strategic interaction framework which governs behaviours explains why the effect cannot be signed unambiguously in all generality.[25]

As a final remark, the Boserup-Goody hypothesis is ultimately related to the possibility that the fall of brideprices will eventually lead to a transformation of the brideprice payment system into the dowry system, a case that may indeed arise in our model : the reversal occurs when the brideprice amount, B, becomes negative. The specification of the

[24] Note that it is equivalent to the condition that the first derivative of the expected marginal type of the groom with respect to the threshold value of the type, $d[v^*G'(v^*)]/dv^*$, is negative (bear in mind that an increased v^* corresponds to a larger proportion of husbands willing to contribute fairly to the household).

[25] With B constant, if $(1-a)$ falls or a rises, the exit option of the husband, $f(a/2)$, increases and, as a consequence, v^* is smaller and the probability of divorce, $[1-G(v^*)]$, is higher. Apparently, B should be reduced to restore equilibrium. Yet, this is forgetting the effect operating through $G'(v^*)$ in equation (1). Indeed, if G'' is positive and sufficiently so as to outweigh the above effect, a fall in B will cause a fall in G' while G' must be actually raised in order for (1) to be satisfied.

daughter's utility then implies that she would take her dowry along with her in case of separation. This acts as a threat which may compel the husband to contribute fairly to the household even though it is costly for him to do so. If the range of v does not comprise sufficiently low values, the husband, rather than the wife, becomes the spouse susceptible of being locked in the marriage (although this case is not frontally contemplated in our model since the husband does not decide to stay or divorce). Note furthermore that, if c were too small, no divorce would be predicted in the model under the dowry system. Indeed, it would always be in the interest of the husband to contribute fairly to the household.

Appendix 3: Estimating the first-stage equations

A set of three first-stage equations must be estimated in order to construct instrumental variables for *riskdiv*, *lovemar* and *educ*. The first one is a duration model based on the same assumptions as the divorce equation presented in Table 6. The second one is a probit model of *lovemar*. The third one is an ordered probit model since education is represented by the categorical variable *educ* taking on three values (as it is mentioned in the text).

Among the exogenous variables that are used in the following equations, some appear as regressors neither in Table 5 nor in Table 6. These are *firstwife*, *rankmar*, *age2734*, *age3567* and *landaccess*. *Firstwife* indicates whether the woman is her husband's first wife (including all the cases of monogamous marriages). *Rankmar* takes on unit value when the woman had already been married prior to the considered marriage. *Age2734* and *age3567* are binary variables that indicate respectively if the woman is between 27 and 34 years old and if the woman is 35 years old or more. Finally, *landaccess* is equal to one if and only if the woman has access to land outside the family system – generally parcels in irrigated perimeters initiated by village authorities or development projects and organisations.

All these variables are excluded from the second-stage equations. Including any of them gives rise to no significant change in the performances of those estimations, as is shown by likelihood-ratio tests. Since *riskdiv** is heavily correlated with *firstwife*, as is *lovemar** with *rankmar* and *educ** with *age2734* and *age3567*, we can be sure that the second-stage equations are properly identified.

```
Exponential regression -log relative-hazard form   LR chi2(9)      =     49.65
Log likelihood  =   -89.909492                     Prob > chi2     =    0.0000
------------------------------------------------------------------------------
 riskdiv     |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 time        |  -.0311458   .0340786    -0.91   0.361    -.0979386     .035647
 ethny       |  -.5807684   .4462343    -1.30   0.193    -1.455371    .2938347
 landaccess  |   .1339172   .4878038     0.27   0.784    -.8221608    1.089995
 actmar      |  -.4566559    .769315    -0.59   0.553    -1.964486    1.051174
 respons     |  -.3216254   .4060242    -0.79   0.428    -1.117418    .4741674
 firstwife   |  -2.600236   .5947461    -4.37   0.000    -3.765917   -1.434555
 separat     |   .1169059   .5074859     0.23   0.818    -.8777481     1.11156
 age2734     |  -1.123169   .5539261    -2.03   0.043    -2.208844   -.0374933
 age3567     |  -1.759794   .8405961    -2.09   0.036    -3.407332   -.1122563
 constant    |  -.9857615   .6403611    -1.54   0.124    -2.240846    .2693233
------------------------------------------------------------------------------

Probit estimates                                  Number of obs   =        152
LR chi2(9)      =      21.81                      Prob > chi2     =     0.0095
Log likelihood = -93.134211                       Pseudo R2       =     0.1048
------------------------------------------------------------------------------
 lovemar     |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  time       |  -.0319061    .016178    -1.97   0.049    -.0636143   -.0001978
  ethny      |  -.0736795   .2324836    -0.32   0.751    -.5293389    .3819799
  landaccess |  -.1886219   .2974461    -0.63   0.526    -.7716056    .3943618
  actmar     |  -.0875259   .4299576    -0.20   0.839    -.9302273    .7551754
  respons    |   -.341146   .2304239    -1.48   0.139    -.7927685    .1104765
  firstwife  |   .3754615   .2446958     1.53   0.125    -.1041335    .8550565
  age2734    |   .1294941   .3088351     0.42   0.675    -.4758115    .7347997
  age3567    |   .1343679   .4521727     0.30   0.766    -.7518742     1.02061
  rankmar    |   .8787872   .3416757     2.57   0.010     .2091153    1.548459
  constant   |   .1956472   .3422849     0.57   0.568    -.4752189    .8665132
------------------------------------------------------------------------------

Ordered probit estimates                          Number of obs   =        156
LR chi2(10)     =      44.74                      Prob > chi2     =     0.0000
Log likelihood = -126.84868                       Pseudo R2       =     0.1499
------------------------------------------------------------------------------
     educ    |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  time       |  -.0212465   .0140484    -1.51   0.130    -.0487809    .0062879
  ethny      |   .8176682   .2137714     3.82   0.000      .398684    1.236652
  landaccess |   .4489343   .2602015     1.73   0.084    -.0610513    .9589199
  actmar     |    .206773   .3965602     0.52   0.602    -.5704708    .9840167
  respons    |   .0517864   .2074813     0.25   0.803    -.3548695    .4584424
  firstwife  |     .41976   .2209428     1.90   0.057      -.01328       .8528
  widow      |   .7155403   .4412841     1.62   0.105    -.1493606    1.580441
  separat    |  -.3045552    .344384    -0.88   0.377    -.9795355    .3704251
  age2734    |   .7638853   .2824696     2.70   0.007     .2102551    1.317516
  age3567    |   .1288047    .408743     0.32   0.753    -.6723169    .9299263
-------------+----------------------------------------------------------------
       _cut1 |   .3113154   .3154644          (Ancillary parameters)
       _cut2 |   2.210973   .3500872
```

In the three first-stage equations, the hypothesis that all coefficients are equal to zero can be rejected with a high degree of confidence. For example, a divorce occurred in 46% of the marriages for which the predicted value of the conditional hazard rate of divorce is above 17%, while only 15% of the other marriages ended up so. Likewise, in instances where the predicted probability of a love marriage is above 50%, two-third of the cases were actually love marriages, while this fraction is halved for the other cases. Bear in mind that the existence of kinship ties between spouses (as represented by the dummy *famlink*) is strongly correlated with *lovemar*. If *famlink* is not introduced in the first-stage equation for *lovemar,* it is because it is the choice of a love rather than an arranged marriage that influences the existence or the absence of kinship ties between the bride and the groom, and not the other way around.

As for *educ**, its relationship with the original education categories is shown in the following table. Means testing is significant at more than 99% of confidence.

educ	*educ** Mean	Std. Dev.	Freq.
0	.35472215	.65512822	53
1	.9586466	.58067361	84
2	1.3583277	.51195342	19
Total	.80214625	.68892913	156

As a conclusion, we can safely state that the three instrumental variables *educ**, *lovemar** and *riskdiv** are satisfactory reflections of the underlying raw data.