Assets at Marriage in Rural Ethiopia

Marcel Fafchamps

University of Oxford *

Agnes Quisumbing

International Food Policy Research Institute †

Abstract

This paper examines the determinants of assets at marriage in rural Ethiopia. We identify and test three separate processes that determine assets brought to marriage: assortative matching; compensating parental transfers at marriage; and strategic behavior by parents. We find ample evidence for the first, none for the second, and some evidence of the third for brides. We also find no evidence of competition for parental assets among siblings. Results suggests that parents do not transfer wealth to children in ways that compensate for marriage market outcomes. Certain parents, however, give more assets to daughters whenever doing so increases the chances of marrying a wealthy groom.

Keywords: intrahousehold allocation; marriage market; inheritance; assets; intergenerational transfers

JEL codes: J12, O15, D13

*Department of Economics, University of Oxford, Manor Road, Oxford OX1 3UQ (UK). E-mail: marcel.fafchamps@economics.ox.ac.uk. Fax: +44(0)1865-281447. Tel: +44(0)1865-281446.

†International Food Policy Research Institute, 2033 K Street N.W., Washington DC 20006. Tel.: (202) 862-5650. Email: a.quisumbing@cgiar.org.

1. Introduction

Economic analysis of marriage and the family has grown tremendously since Becker's (1981) Treatise on the Family. Phenomena such as family formation, intergenerational transfers, and the allocation of resources within the family, previously the domain of anthropology and sociology, have increasingly been subject to economic investigation (e.g. Boulier and Rosenzweig 1984, Bergstrom 1997, Weiss 1997, Becker and Tomes 1986, Behrman 1997, Haddad, Hoddinott and Alderman 1997). Marriage, in particular, is an institution of great interest, since, in many developing countries, it represents the union not only of two individuals, but also of two family or kinship groups (Rosenzweig and Stark 1989). Moreover, in many societies, marriage is the occasion for a substantial transfer of assets from the parent to the child generation (e.g. Fafchamps and Quisumbing 2003, Zhang and Chan 1999). Lastly, recent work testing the collective versus the unitary model of household decision making has paid increased attention to conditions prevailing at the time of marriage. In particular, it has been shown that the distribution of assets between spouses at the time of marriage acts as possible determinant of bargaining power within marriage (e.g. Thomas, Contreras and Frankenberg 1997, Quisumbing and de la Brière 2000, Quisumbing and Maluccio 2003). While it can be argued that assets at marriage do not completely determine the distribution of assets upon divorce (Fafchamps and Quisumbing 2002), these measures are, in themselves, worth investigating because they shed light on the institution of marriage and inheritance.

In agrarian societies, marriage is an event of deep economic importance. First, it typically marks the onset not only of a new household but also of a new production unit, e.g., a family farm. Assets brought to marriage determine the start-up capital of this new enterprise. The success of the enterprise thus depends on what happens on the 'marriage market', that is, on the arrangement between the bride, the groom, and their respective families regarding the devolution of assets to the newly formed household. Farm formation cannot be dissociated from marriage market considerations. Second, in an environment where asset accumulation takes time and is particularly difficult for the poor, assets brought to marriage play a paramount role in shaping the lifetime prosperity of newly formed households: well married daughters can expect a life of relative comfort while poorly married daughters may spend most of their life in utter poverty. Assortative matching between spouses – the rich marry the rich, the poor marry the poor

– not only increases inequality, it also reduces social mobility. Its long-term effects, however, may be mitigated by redistributive policies and other avenues of asset accumulation during marriage (Fafchamps and Quisumbing 2003).

This paper examines the determinants of assets brought to marriage in rural Ethiopia. Two major processes shape what newlyweds bring to the newly formed family unit: the matching between spouses with different assets, and parents' decisions to endow their marrying children with start-up capital. This paper seeks to assess the relative importance of these two processes in arranged marriages such as those encountered in rural Ethiopia.

The importance of the matching process between potential brides and grooms was first brought to light by Becker (1981). In Becker's work, a match (i.e., set of marriages) is an equilibrium if no bride or groom can lure a partner away from a proposed union. Becker showed that this simple, intuitive requirement naturally leads to assortative matching whereby the rich marry the rich and the poor marry the poor. The reason is that rich brides can be lured away from poor grooms by rich grooms but the reverse is not true. Since Becker's initial contribution, assortative matching has been studied in settings other than the marriage market – e.g., hospitals and medical interns, sorority rush, etc. (e.g. Gale and Shapley 1962, Roth 1991, Mongell and Roth 1991, Roth and Sotomayor 1990).

While marriage markets in developed – primarily urban – economies can adequately be described as a pure matching process, this is not true for arranged marriages in traditional rural societies. This is because marriage also marks the creation of a new farming unit. At marriage, parents decide not only about the choice of a bride but also about with how much start-up capital to endow the newlyweds. What they give nearly always constitutes an advanced inheritance. When giving, parents must balance the interest of the marrying child against their old age needs and the inheritance of unmarried siblings. This means that, under fairly general assumptions, parents' incentive to give to their marrying child is a decreasing function of what is given by the spouse's parents: if the groom brings a lot, the bride does not need to bring as much, and the parents can keep more for themselves and their other children. The end result is a 'compensation effect': if the groom brings a lot, the bride brings less.

Assortative matching and compensating transfers from parents thus operate in opposite directions:

while assortative matching generates a positive correlation between assets brought to marriage by both spouses, compensating transfers tend to generate a negative correlation. By itself assortative matching reinforces asset inequality in agrarian societies – or at the very least enables it to persist over time. In contrast, if there is no assortative matching, transfers from parents work to equalize assets brought to marriage: a groom from a rich family married to a poor bride would compensate by bringing more assets than a groom from a similarly wealthy family married to a rich bride. If the equalizing effect of transfers from parents were to dominate, the marriage market would have a strong redistributive effect.

Transfers from parents can, however, work in the same direction as assortative matching if parents act strategically, that is, if they internalize the effect of their transfers on the marriage prospects of their offspring. The intuition is that parents may give more to their daughter if she can attract a wealthier groom. If parents compete for attractive matches on behalf of their offspring, the marriage equilibrium again exhibits assortative matching: children of rich parents marry children of other rich parents. The difference with pure assortative matching à la Becker is that assets brought to marriage then depend on the 'slope' of marriage prospects: at the margin, parents give more if it enables their child to marry a much better prospect.

The purpose of this paper is to investigate these ideas formally. We investigate how rural society endows new couples with the assets they need to set up a farm and family – typically land and livestock, utensils, grains, and consumer durables such as clothing and jewelry. We find that intergenerational transfers take place primarily at the time of marriage. This is particularly true for men, to whom most productive assets are bequeathed, whether at marriage or afterwards. We also test whether parents act strategically. Results suggest that assets brought to marriage by brides follow a strategic motive. This does not hold for grooms.

This paper differs from previous work in several respects. First, we distinguish assortative matching from compensatory transfer motives.[1] Second, we separate factors that affect intergenerational transfers from those that reflect the relative scarcity of brides and grooms. Third, many marriage market studies

[1] In Fafchamps and Quisumbing (2003) we focused on developing an index for ranking spouses in the marriage market as well as examining the determinants of transfers at marriage. We did not examine the issue of compensatory transfers in our previous work.

focus on dowry and brideprice *per se*, that is, on transfers at marriage from one family to the other (e.g. Rao 1993, Foster 1998).[2] Here we examine the totality of assets brought to marriage, whether these were acquired from parents or other sources prior to marriage or received at the time of marriage. This more inclusive measure is more appropriate in rural Ethiopia because gifts from the families to each other and to the couple account for a small proportion of assets brought to marriage. The main purpose of these gifts seems to be to seal the marriage and cover the cost of the wedding rather than to endow the new couple. This lesson should be kept in mind when conducting marriage market studies in other (African) countries.

Ethiopia is an ideal site for studying marriage customs, since it is characterized by extensive agro-ecological and ethnic diversity. Different religions, with widely divergent views regarding matrimonial issues and the status of women, are well represented and tend to dominate different parts of the country- the Orthodox church of Ethiopia in the north, Sunni Muslims in the east and west, recently converted Protestants in the South, and animist believers in parts of the south. The ethnic and cultural makeup of the country is also quite varied, with Semitic traditions in the north, Cushitic traditions in the south and east, and Nilotic traditions in the west. Climatic and ecological variation is equally high, given the mountainous terrain and the fact that the country stretches from the dry Sahel to the humid equatorial zone. Finally, local traditions have remained largely untouched given the lack of roads and the relative isolation of the countryside.

There already exists some research on marriage market issues in rural Ethiopia. Control over assets during marriage and devolution of assets upon divorce or death are studied in detail in Fafchamps and Quisumbing (2002). From this work, we know that most assets brought to marriage are held jointly and managed by the household head. Fafchamps and Quisumbing (2003) show that assortative matching is quite strong in the study area. They also show that assets brought to marriage are positively associated with parents' wealth, indicating that a bequest motive affects assets at marriage. We organize our model and empirical analysis around these earlier findings, but emphasize compensatory transfers and strategic

[2] Zhang and Chan (1999) argue that in the case of Taiwan, dowry is paid directly to the bride and is held by her in sole ownership. As Fafchamps and Quisumbing (2002) show, this is not the case in our study area where brideprice and dowry per se are very small compared to assets brought to marriage by the spouses.

behavior in this paper.

The paper is organized as follows. Section 2 presents the conceptual framework and testing strategy. A brief description of the survey and the survey area follows in Section 3. Section 3 examines the determinants of the value of assets brought to marriage by the bride and groom. We show that intergenerational transfer considerations affect the aggregate amount transferred to the new family unit. The distribution of assets at marriage between spouses is analyzed as a function of personal, parental, and marriage market characteristics. The last Section concludes.

2. Conceptual Framework

The starting point of our enquiry is a model of compensating transfers from parents to children at the time of marriage. Marriage market analysis often focuses on all the assets brought to marriage by the spouses, including health, education, and patrimonial assets (Fafchamps and Quisumbing 2003). Here we focus instead on a narrower issue, namely the patrimonial transfers that take place at and around marriage, conditional on investments already made in the long-term health and education of the spouses. Our model resembles a standard bequest model, except that interpretation is slightly different since the transfer takes place inter vivos. Let the assets brought to marriage by the groom and bride be written μ and β, respectively. Without loss of generality, we focus on the groom's problem.

2.1. Marriage and inter vivos transfers

We begin by taking β as given and we focus on the choice of μ. Parents have initial wealth w^p while the child has initial personal wealth w^c. Parents decide how much of their wealth to transfer to their son.[3] Let the transfer be denoted τ. Parents are altruistic and care about their own utility $v(.)$ and that of their marrying child $u(.)$. Their combined utility is of the form $u(w^p - \tau) + \omega v(w^c + \tau + \beta)$ where $u(.)$ and $v(.)$ are concave increasing functions and ω is a welfare weight. For simplicity, we assume that

[3]It is also conceivable that parents require transfers from their children in order to legitimize marriage – and ensure access to lineage land (e.g. Lucas and Stark 1985, Stark and Lucas 1988). Our model applies to this case as well.

$u(x) = v(x) = x^\rho$. Since $\mu = w^c + \tau$, it follows that $\tau = \mu - w^c$ and thus that:

$$w^p - \tau = w^p + w^c - \mu \tag{2.1}$$

Let the combined wealth of the groom and his parents be denoted $\overline{\mu} \equiv w^p + w^c$. We assume that the groom's parents and the bride's parents transfer a non-negative amount to their children.[4] This means that $\mu \geq 0$ and $\beta \geq 0$. In the context of rural Ethiopia, this is an appropriate assumption.[5] The optimization problem of the groom's parents can be written:

$$\max_{0 \leq \mu \leq \bar{\mu}} \frac{1}{\rho} \left[(\bar{\mu} - \mu)^\rho + \omega(\mu + \beta)^\rho \right] \tag{2.2}$$

The interior solution to this problem has a linear form:

$$\begin{aligned} \mu^* &= \frac{\omega^\sigma}{1 + \omega^\sigma} \bar{\mu} - \frac{1}{1 + \omega^\sigma} \beta & (2.3) \\ &\equiv a\bar{\mu} - b\beta \geq 0 & (2.4) \end{aligned}$$

where σ is the elasticity of substitution, i.e., $\frac{\sigma - 1}{\sigma} \equiv \rho$. What parents give to their son is an increasing function of their combined wealth but a decreasing function of what the bride brings to the marriage β. The bride's parents solve a similar problem which yields the interior solution:

$$\beta^* = c\bar{\beta} - d\mu \geq 0 \tag{2.5}$$

where $\overline{\beta}$ is the combined wealth of the bride and her parents and β^* similarly decreases with assets brought by the groom. This is the substitution effect we discussed in the introduction. In the population we study, brides bring few assets to marriage. In the context of our model, this can be represented by a smaller welfare weight for brides. We therefore expect that $c < a$ and $d > b$.

[4] This is equivalent to assuming that groom's parents cannot extort payment from the bride's parents simply to allow them to marry. This assumption can be justified if participation in the marriage market is voluntary. Brides and grooms can avoid extortion by eloping.

[5] In our model, what parents give is used as start-up capital by the newly formed household. Even though there might be exceptions, dowry payments in other parts of the world such as India largely fall within this general category provided we include consumer durables.

We now examine the Nash equilibrium of the transfer game between parents. Equations 2.4 and 2.5 describe the behavior of the groom's and bride's parents when they both give and can easily be solved jointly. The resulting equilibrium configuration is as follows:

$$\begin{array}{lll} \mu^* = 0 & \text{and } \beta^* = c\bar{\beta} & \text{if } \bar{\mu} \leq \frac{bc}{a}\bar{\beta} \\ \mu^* = \frac{a\bar{\mu} - bc\bar{\beta}}{1-bd} & \text{and } \beta^* = \frac{c\bar{\beta} - ad\bar{\mu}}{1-bd} & \text{if } \frac{bc}{a}\bar{\beta} \leq \bar{\mu} \leq \frac{c}{ad}\bar{\beta} \\ \mu^* = a\bar{\mu} & \text{and } \bar{\beta} = 0 & \text{if } \bar{\mu} \geq \frac{c}{ad}\bar{\beta} \end{array} \tag{2.6}$$

2.2. Assortative matching

We are now ready to examine the matching process between all potential brides and grooms. We assume all parents have the same utility and thus the same decision functions. By plugging equilibrium values of μ^* and β^* from 2.6 into the utility function of both parents, we can compute the utility of all possible matches. Matching can then proceed as in Becker (1981).

Problems of this sort are referred to as two-sided matching (e.g. Shapley and Shubik 1972, Demange and Gale 1985, Gale and Shapley 1962, Gale 2001, Alkan and Gale 1990, Roth and Sotomayor 1990). Substituting the Nash equilibrium into the parents' utility function, we see that the utility of the groom's family is increasing in the wealth of the bride's family, regardless of the groom's family wealth. Consequently the grooms agree on the ranking of brides and vice versa. It should therefore be possible to show, using the approach pioneered by Shapley and Shubik (1972) and extended by Roth and Sotomayor (1990), that there is a unique stable equilibrium that involves perfect assortative matching on wealth. Although a formal proof is beyond the scope of this paper, as long as we use the right kind of algorithm, the same perfect assortative outcome should obtain irrespective of who moves first (e.g. Roth and Sotomayor 1988, Mongell and Roth 1991, Roth and VandeVate 1990, Board 1994).[6] The only caveat concerns the incomplete ranking of brides and grooms. This is because zero β and zero μ create ties: a groom with initial wealth $\bar{\mu}$ is indifferent between all brides for whom $\beta = 0$. To resolve these ties, we assume random assignment.

To illustrate how transfers from parents statistically affect the distribution of wealth across newlyweds,

[6] Thanks to an anonymous referee for pointing this out.

we construct a simple Monte Carlo simulation exercise based on the following algorithm. For a given population of brides and grooms, an equilibrium match is computed by letting the groom's parents sequentially choose the bride that yields the highest utility. Since the order of play should not matter, we assume that parents with the highest $\bar{\mu}$ choose first, parents with the next highest $\bar{\mu}$ move next, etc, and parents with the lowest $\bar{\mu}$ move last. When the parents of a groom are indifferent between several brides because they bring the same β, they are assumed to choose one at random. The match is an equilibrium because the bride married to the highest groom has a high combined value $\mu + \beta$ and could not obtain a higher utility with another groom. Applying this argument recursively to all brides, it should be true that no alternative allocation exists by which a bride and a groom would both be willing to switch. This is because no one could guarantee himself or herself a utility higher than the one guaranteed by the solution to this algorithm.

The above algorithm is applied to M randomly generated populations of brides and groom. We posit values for ω and σ which are held constant across all M replications. For each replication, we select N random realizations of $\bar{\mu}$ and $\bar{\beta}$ from a uniform distribution. For each pair of realizations of $\bar{\mu}_i$ and $\bar{\beta}_j$, we compute $\mu^*(\bar{\mu}_i, \bar{\beta}_j)$ and $\beta^*(\bar{\beta}_j, \bar{\mu}_i)$ using (2.6). We then compute the value of this union to the parents of the bride and groom $U_{i,j} = U(\bar{\mu}_i, \beta^*(\bar{\beta}_j, \bar{\mu}_i))$ and $V_{j,i} = V(\bar{\beta}_j, \mu^*(\bar{\mu}_i, \bar{\beta}_j))$. We recursively apply the algorithm described in the previous paragraph to match all brides and grooms.[7] The solution is a series of matched pairs $\{\mu_i^*, \beta_j^*\}$.

The statistical part of the Monte Carlo simulation regresses transfers on each other. Noise is added to the data to represent the effect of various random factors not included in our model.[8] To illustrate the contradictory effects of parental transfers and assortative matching on the correlation between μ^* and β^*, we regress μ^* first on β^* alone and then on β^* and $\bar{\mu}$ jointly.

Monte Carlo simulation results are summarized in Table 1 for various values of parameter σ. Results show that the simple correlation between μ^* and β^* depends on σ. If the elasticity of substitution σ

[7] In practice we proceed as follows. Let grooms be ranked by wealth so that $\bar{\mu}_1 > \bar{\mu}_2 > ... > \bar{\mu}_N$. We start by allocating to $\bar{\mu}_1$ the bride that gives utility $U(\bar{\mu}_1, \beta^*(\bar{\beta}_j, \bar{\mu}_1))$. In practice, this is the one with the highest $\bar{\beta}$ unless all brides contribute nothing ($\beta^* = 0$) in which case parents are indifferent. In this case, a bride is chosen randomly from the set of equivalent matches. The matched bride is then removed from the list of potential matches and we move to the next groom. The process is repeated until the last groom has been matched with the last bride.

[8] In practice, we regress μ^* on β^* and $\widehat{\mu} \equiv \bar{\mu} + \varepsilon$ where ε is measurement error. This is meant to capture the idea that the econometrician only has an imperfect measure of initial wealth. Without measurement error, a perfect fit is obtained in many cases, which is unrealistic.

between children and parents is high in the parents' utility function, μ^* and β^* tend to be negatively correlated: the substitution effect more than compensates for the assortative matching effect. In contrast, if σ is low, μ^* and β^* tend to be positively correlated. Consequently, observing a positive correlation between assets brought to marriage does not, by itself, rule out the existence of parental transfers. The important thing is to note that once we control for initial wealth, the conditional correlation between μ^* and β^* is always negative. Estimating Model 2 in Table 1 using real data should therefore tell us whether parents reduce inter vivos transfers when then bride brings more wealth.

Table 1. Results of Monte Carlo simulations[9]

	$\sigma = 0.2$		$\sigma = 1.5$	
A. Groom:	$E[\widehat{b}]$	$Var[\widehat{b}]$	$E[\widehat{b}]$	$Var[\widehat{b}]$
model 1: $\mu_i^* = a + b\beta_i^* + \varepsilon_i$	1.475	0.376	-6.402	2.047
model 2: $\mu_i^* = a + b\beta_i^* + c\bar{\mu}_i + \varepsilon_i$	-0.372	0.092	-0.598	0.169
B. Bride:				
model 1: $\beta_i^* = a + b\mu_i^* + \upsilon_i$	0.520	0.158	-0.234	0.083
model 2: $\beta_i^* = a + b\mu_i^* + c\bar{\beta}_i + \upsilon_i$	-0.421	0.086	-0.734	0.077

Suppose, in contrast, that parents do not make compensatory transfers.[10] In this case, assortative matching is the only force at work and sorting according to μ^* and $\bar{\mu}$ coincide. This ensures that high $\bar{\mu}$ grooms are matched with high $\bar{\beta}$ brides. In this case, regressing μ^* on $\bar{\mu}$ and β^* yields a significant coefficient for $\bar{\mu}$ and 0 for β^*. However, if $\bar{\mu}$ is measured with error, as is likely, the correlation between μ^* and β^* remains positive once we control for $\bar{\mu}$. This is because β^* contains additional information about unobservables through assortative matching.[11] This possibility must be kept in mind in the empirical estimation.

A test of compensatory transfers at marriage can thus be constructed by estimating equations (2.4)

[9] These simulation results were obtained using M =100 replications, each with N =60 pairs of brides and grooms. Parental assets $\bar{\mu}$ and $\bar{\beta}$ are generated independently using a [0,100] uniform distribution. Welfare weights are 1 of grooms and 0.3 for brides. To avoid a perfect fit, noise is added to $\bar{\mu}$ and $\bar{\beta}$ afer matching using a uniform distribution [-5,5]. The true values of b are -0.5 for grooms and -0.56 for brides when $\sigma = 0.2$ and -0.5 and -0.81 when $\sigma = 1.5$.

[10] Formally, suppose that parents solve $\max_{0 \leq \mu \leq \bar{\mu}} \frac{1}{\rho} [(\bar{\mu} - \mu)^\rho + \omega(\mu)^\rho]$. The solution is of the form $\mu^* = \mu(\overline{\mu})$ where $\mu(.)$ is a monotonic increasing function. In this case, sorting according to μ^* is equivalent to sorting according to $\overline{\mu}$.

[11] We have $\mu^* = \bar{\mu}$, $\beta^* = \bar{\beta}$, $\widehat{\mu} = \bar{\mu} + \varepsilon$, and $\widehat{\beta} = \bar{\beta} + \nu$. Due to assortative matching, β^* and μ^* are correlated, i.e., $\beta^* = m + n\mu^* + \upsilon$. Consequently, $\beta^* = m + n\bar{\mu} + \upsilon = m + n(\widehat{\mu} - \varepsilon) + \upsilon$, from which we obtain that $-\varepsilon = (\beta^* - m - \upsilon)/n - \widehat{\mu}$. We thus have $\mu^* = \widehat{\mu} - \varepsilon = (\beta^* - m - \upsilon)/n$: the regression only captures assortative matching, hence $\widehat{\mu}$ drops out and the coefficient on β^* is always positive. If β^* is also measured with error, $\widehat{\mu}$ may contain information that is not included in β^* and may be significant as well.

and (2.5). If only assortative matching is present, the coefficients of β^* and μ^* will be zero or – in case we do not measure endowments $\bar{\mu}$ and $\bar{\beta}$ completely accurately – positive. If, however, parents transfer fewer assets when the spouse brings more, the coefficient on β^* and μ^* should become negative once we control for $\bar{\mu}$ and $\bar{\beta}$. Estimating (2.4) and (2.5) forms the basis of our testing strategy.

2.3. Reciprocity

Other explanations have been proposed to account for assortative matching, most notably the idea of reciprocity. Suppose that groom's parents move first and arrange a match. The bride's parents then reciprocate by bringing as much as they can as a sign of goodwill to improve the ex post quality of the match. The anthropological literature seems to suggest that this is an important motive in the setting of dowry payments.[12]

The expectation of reciprocity increases the incentive for the groom's parents to give more. This is because what the bride brings β^* is an increasing function of what they give, i.e., $\beta^* = \beta(\mu^*)$. Reciprocity could even work both ways with $\mu^* = \mu(\beta^*)$.[13] The reciprocity motive therefore tends to reinforce the correlation between assets brought by spouses since, if the groom brings more, so does the bride.

Given the data at our disposal, we do not observe the negotiation process. Consequently it is impossible for us to distinguish reciprocity from assortative matching. This should be kept in mind when interpreting the results.

2.4. Strategic behavior

So far we have assumed that parents do not adjust transfers at marriage to improve the ranking of their son or daughter in the marriage market. If parents act strategically in this sense, (2.6) no longer represents their optimal behavior. Overbidding by parents to improve marriage market outcomes must be taken into account. Suppose parents realize that the ranking of their offspring on the marriage market

[12] If reciprocity is a motive, the behavior of parents is reminiscent of the way most people play the trust game in the experimental economics literature (e.g. Henrich, Boyd, Bowles, Camerer, Fehr, Gintis, McElreath, Alvard, Barr, Ensminger, Hill, Gil-White, Gurven, Marlowe, Patton, Smith and Tracer 2002, Barr 2002): the person who has received reciprocates even though in a one-shot game it is against her interest.

[13] From a formal point of view, the reciprocity motive is reminiscent of the Stackelberg model of oligopoly: one player – here the groom – takes into account the reaction function of the other. If both players take into account the reaction function of the other, the resulting equilibrium often coincides with the simple Cournot-Nash equilibrium. This is left for further research.

can be manipulated by increasing the size of the transfer/bequest. In this case, a lower ranked bride may seek to attract a better ranked groom by bidding more than what is dictated by (2.6). The reason for doing so is that parental utility increases with the quality of the match, even though, conditional on a match, it decreases when the transfer is larger than β^*. Intuitively, parents should be more willing to overbid – i.e., to transfer more than what is dictated by (2.6) – if the quality of the match increases a lot with overbidding. If the 'price' of a better match is much higher than that of a low match, parents should be less inclined to overbid.

A formal treatment of such a model would take us too far from our main focus, which is empirical. It is nevertheless possible to get a flavor of the resulting outcome by considering an economy with 2 grooms and 2 brides. Order them so that $\bar{\mu}_1 > \bar{\mu}_2$ and $\bar{\beta}_1 > \bar{\beta}_2$. Assume that welfare weights ω are such that brides bring less to marriage than grooms. As a result, brides have more to gain from switching rank. We therefore focus on brides' strategic behavior. Without strategic bidding, the utility of bride 2's parents for each possible marriage is:

$$V_{2,2} = \frac{1}{\rho}\left[(\bar{\beta}_2 - \beta^*_{2,2})^\rho + \omega(\mu^*_{2,2} + \beta^*_{2,2})^\rho\right] \quad (2.7)$$

$$V_{2,1} = \frac{1}{\rho}\left[(\bar{\beta}_2 - \beta^*_{2,1})^\rho + \omega(\mu^*_{1,2} + \beta^*_{2,1})^\rho\right] \quad (2.8)$$

where $\mu^*_{i,,j}$ and $\beta^*_{j,i}$ are the assets brought to marriage when groom i is matched with bride j. Since $\bar{\mu}_1 > \bar{\mu}_2$, in general $\mu^*_{1,2} > \mu^*_{2,2}$ and $V_{2,1} > V_{2,2}$. Other things being equal, $V_{2,1} - V_{2,2}$ is an increasing function of $\mu^*_{1,2} - \mu^*_{2,2}$: the more groom 1 brings to marriage relative to groom 2, the more bride 2 prefers groom 1.

For simplicity, suppose there is no tie so that groom 1 strictly prefers bride 1.[14] The question is whether bride 2 can lure groom 1 away from bride 1. The maximum $\beta^{\max}_{2,1}$ the parents of bride 2 would be willing to pay to switch to groom 1 is given by:[15]

$$\frac{1}{\rho}\left[(\bar{\beta}_2 - \beta^{\max}_{2,1})^\rho + \omega(\mu^*_{1,2} + \beta^{\max}_{2,1})^\rho\right] = V_{2,2} \quad (2.9)$$

[14] This requires that $\beta^*_1 > \beta^*_2$ and thus that $\beta^*_1 > 0$.

[15] Strictly speaking we should allow groom 1 to adjust $\mu^*_{1,2}$ but, for the sake of this simple presentation, this complication is ignored. All we need is that $\mu^*_{1,2}$ remains higher than $\mu^*_{2,2}$.

It immediately follows that $\beta_{2,1}^{\max} > \beta_{2,1}^*$ and that $\beta_{2,1}^{\max}$ is an increasing function of $\mu_{1,2}^*$ and a decreasing function of $V_{2,2}$.[16] In order to keep groom 1, bride 1 must bring just a bit more than $\beta_{2,1}^{\max}$. Since by assumption, $\bar{\beta}_1 > \bar{\beta}_2$, doing so is less costly for the parents of bride 1 than for the parents of bride 2. The end result is that bride 1 keeps groom 1 but what bride 1 brings to marriage is $\beta_{2,1}^{\max}$, which is an increasing function of $\mu_{1,2}^*$ and a decreasing function of $V_{2,2}$, the utility of the lower ranked bride. Since $V_{2,2}$ is itself an increasing function of $\mu_{2,2}^*$, it follows that $\beta_{2,1}^{\max}$ is increasing in the difference between $\mu_{1,2}^*$ and $\mu_{2,2}^*$: what the top bride bring to marriage increases if the difference between the two grooms is large, i.e., if the slope of the marriage market is steep.

This heuristic treatment of a 2×2 case illustrates that the resulting equilibrium will not satisfy equations (2.4) and (2.5). The model can be extended to a $N \times N$ matching game by applying the above treatment recursively, starting from the lowest ranked bride. The resulting model resembles a two-sided auction-like game in which brides (and grooms) bring to marriage just as much as could credibly be offered by the next best bride.[17] In this world, β and μ also depend on the slope of the marriage market: if the difference between grooms is large relative to the difference between brides, brides must bring more to fend off competition from lower ranked brides who wish to improve their ranking. In the last part of the this paper, we test this idea empirically.

Parents may also seek to affect the welfare of their daughter during marriage by transferring assets to her in person (Zhang and Chan 1999). Assets held in sole ownership by the wife are expected to raise her bargaining power during marriage. As Fafchamps and Quisumbing (2002) have shown, this does not appear to be the case in rural Ethiopia. Brides bring little to marriage and whatever they bring tends to be controlled by the household head, who is typically male. Livestock held in sole ownership by the bride, for instance, is likely to be shared equally between spouses upon no-fault divorce. Consequently, we ignore this complication here.

[16] This is easily seen by totally differentiating 2.9. For instance, for $V_{2,2}$ we obtain (dropping some of the notation for improved reading):

$$\frac{d\beta^{\max}}{dV} = \frac{1}{-(\bar{\beta} - \beta^{\max})^{\rho-1} + \omega(\mu^* + \beta^{\max})^{\rho-1}}$$

Since $\beta^{\max} > \beta^*$ and $\rho < 1$ by construction, the numerator is negative, which proves the claim.

[17] Since $\beta_{2,1}^{\max}$ is a decreasing function of $V_{2,2}$, in the case of multiple brides it is the utility of the lowest ranked bride that determines $\beta_{2,1}^{\max}$. However, a offer to give $\beta_{2,1}^{\max}$ need not be credible in this case if the lowest rank bride could obtain a higher utility at lower cost from a lower ranked male. This illustrates that the strategic equilibrium could be quite complicated. Such complications are beyond the scope of this paper.

In the rest of this paper we estimate equations (2.4) and (2.5) and we test whether the coefficient on β and μ are negative. If they are, this constitutes evidence that parents transfer wealth to their marrying children in part to compensate for assets brought by the spouse. If the coefficients are positive, this constitutes evidence that parents do not take into account spouse assets when transferring assets to their child at marriage. In this case, the relationship between μ and β in equation 2.4 is entirely driven by assortative matching and reciprocity.

A positive relationship may also result if parents act strategically. In this case, it is due to strategic bidding by parents who bid more if it helps them match their child with a more richly endowed spouse. In the empirical part of this paper, we seek to distinguish between these two alternative explanations by controlling for strategic bidding directly. This is achieved by using the slope of the marriage matching relationship $\partial\mu/\partial\beta$ as additional regressor. If strategic bidding is a consideration for brides, parents are expected to give more if they can leverage a higher quality spouse, that is, if $\partial\mu/\partial\beta$ is high.

3. Study site and survey description

Having presented our conceptual framework and outlined our testing strategy, we purport to apply these ideas to marriage outcomes in rural Ethiopia. The choice of country is dictated by the fact that Ethiopia is primarily an agrarian economy where how one fares in the marriage market is an important determinant of welfare. Ethiopia is indeed a low-income, drought-prone economy with the third largest population on the African continent. While some work has been done on South Asia (Foster 1998) and West Africa (Jacoby 1995), very little is known about marriage markets in East Africa. An additional attraction of Ethiopia as a study site is that it has extensive agro-ecological and ethnic diversity, with over 85 ethnic groups and allegiance to most major world and animist religions (Webb, von Braun and Yohannes 1992). This diversity should provide enough variety in marriage market outcomes to identify important determinants.

For our analysis, we rely on the 1997 Ethiopian Rural Household Survey (ERHS) which was undertaken by the Department of Economics of Addis Ababa University (AAU) in collaboration with the International Food Policy Research Institute (IFPRI) and the Center for the Study of African Economies (CSAE) of

Oxford University. The 1997 ERHS covered approximately 1500 households in 15 villages across Ethiopia, capturing much of the diversity mentioned above. While sample households within villages were randomly selected, the choice of villages themselves was purposive to ensure that the major farming systems were represented. Thus, while the 15 sites included in the sample may not be statistically representative of rural Ethiopia as a whole, they are quite representative of its agro-ecological, ethnic, and religious diversity.

The questionnaire used in the 1997 round includes a set of fairly standard core modules, supplemented with modules specifically designed to address intrahousehold allocation issues, particularly conditions at the time of marriage. These modules were designed not only to be consistent with information gathered in the core modules, but also to complement individual-specific information. These modules were pretested by the authors in February/March 1997 in four non-survey sites with a level of ethnic and religious diversity similar to the sample itself. Data collection took place between May and December 1997. Questionnaires were administered in several separate visits by enumerators residing in the survey villages for several months. Careful data cleaning and reconciliation across rounds were undertaken in 1998 and 1999 by Bereket Kebede and IFPRI staff.

The intrahousehold modules collect information on: the parental background and marriage histories of each spouse; the circumstances surrounding the marriage (e.g. type of marriage contract, involvement in the choice of a spouse); and the premarital human and physical capital of each spouse. A variety of assets brought to the marriage were recorded, as well as all transfers made at the time of marriage. These questions, which were asked separately for each union listed by the household head, pertained to assets brought to marriage by the head and his spouse(s) (or if the household head was female, for herself and her last husband). Questions were as exhaustive as possible; they covered the value and quantity of land and livestock, as well as the value of jewelry, linen, clothing, grains, and utensils that each spouse brought to marriage. In the analysis, values at the time of marriage are converted to current values using the consumer price index. Given the difficulties inherent in a long recall period and in the choice of an inflation correction factor suitable for all 15 villages, these values are likely to be measured with error. We also collected information on the value of the house brought to marriage by each spouse, if any. Although questions were asked about cash as well, they yielded very few responses, if any. This is because accumulation in the form of cash or financial instruments is essentially absent in the study area. Questions were asked about transfers from the bride's and groom's families at the time of marriage, whether to the couple, or to a specific individual. Parental background information was collected for each spouse and each union; these included landholdings of the parents at the time the household head was married, as well as educational attainment of each parent of each spouse. Human capital characteristics of each spouse included age, education, and experience in three categories of work prior to marriage: farm work, wage work, and self-employment.

One asset, land, deserves a few words of caution. For some twenty years prior to the survey, rural land was owned by the Ethiopian state and distributed to individual farmers by the Peasants' Association (PA), a local authority operating at the village level. Land is then periodically reallocated between farmers to accommodate the needs of young couples. Between these reallocations, farmers hold full user rights on the land. In practice, reallocations have occurred rather infrequently. Different regions also seem to have interpreted the law differently, some opting for a collectivist approach while others essentially followed the old system of inheritance (e.g. The World Bank 1998, Gopal and Salim 1999). Young couples typically obtain land through their parents, either directly (gift or land loan) or indirectly by having their parents lobby the PA. It is also worth noting that, although the sale of agricultural land has been illegal in Ethiopia for over twenty years, virtually all surveyed households were able to value the land they had brought to marriage. This leads us to suspect that, in rural Ethiopia, parents continue to determine the land base of newly formed couples.

Table 2 breaks down the sample by household category. We see that twenty percent of surveyed households are headed by unmarried individuals, most often divorced or widowed women. Monogamous couples living together represent some 62% of the sample. Polygamous households – or parts thereof – account for 7.6% of the sample, while separated couples account for the remaining 9%. Starting from these household level data, we construct a marriage data set that contains information recorded for each union separately. The rest of the analysis presented here is based on this union-level data set.

Survey results show that grooms bring nearly ten times more assets than brides to the newly formed family unit (Table 3), an average of 4,270 Birr (in 1997 prices), compared to 430 birr for brides. For grooms, land is the asset with the highest average value. The next most valuable asset is livestock, followed by grain stocks and other minor assets. In contrast, brides bring very little land to the marriage. They bring some livestock but less than grooms. Two-thirds of the brides report bringing no asset to marriage. Gifts at the time of marriage are distributed more evenly between the groom and the bride but they are very small relative to assets brought to marriage, except for the bride where they are roughly equivalent. The survey area can thus be described as a system where grooms bring most of the start-up capital of the newly formed household.

4. Estimation results

We are now ready to proceed with estimation of equations (2.4) and (2.5). For a couple with husband i and wife j, the model to be estimated is of the form:

$$\mu_i = a_i \bar{\mu}_i + b_i \beta_j + u_i \geq 0 \quad (4.1)$$

$$\beta_j = c_j \bar{\beta}_j + d_j \mu_i + u_j \geq 0 \quad (4.2)$$

where $a_i = \frac{\omega_i^\sigma}{1+\omega_i^\sigma}$, $b_i = \frac{-1}{1+\omega_i^\sigma}$, $c_j = \frac{\omega_j^\sigma}{1+\omega_j^\sigma}$, and $b = \frac{-1}{1+\omega_j^\sigma}$. To capture the fact that parents give much less to brides than to grooms, we let welfare weights differ for brides and grooms.

From equation (2.1), we know that $\overline{\mu}_i \equiv w_i^p + w_i^c$. We measure parental wealth w_i^p using a parental wealth ranking,[18] land owned by parents, and father's education. To avoid spurious correlation, we measure w_i^c primarily in terms of human capital: schooling, age at marriage, and work experience at marriage. These variables are predetermined and are not affected by compensating parental transfers at the time of marriage.[19] We also include the number of previous marriages because we suspect that they affect asset accumulation before a new marriage, particularly for women. The number of times a spouse

[18] Respondents were asked to rank the wealth of their parents into five categories from poor to rich.

[19] The emphasis of our analysis is on the transfer of assets to the bride and groom at the time of marriage, conditional on the human capital that they bring to marriage. While it could be argued that variables such as age at marriage, number of unions, and number of children from previous unions are endogenous, our aim is to include regressors that would explain the variation in what the spouse brings to the marriage. At the time of marriage, these variables cannot be changed. The key regressor of interest—which will be instrumented– is the assets brought by the other spouse.

has been widowed is included as additional regressor because Fafchamps and Quisumbing (2002) have shown that widows and widowers customarily inherit from their deceased spouse. The number of children from previous marriages is included because, as Fafchamps and Quisumbing (2002) have documented, what a divorced or widowed wife receives depends on whether she has children to care for or not. We also control for the geographical origin of spouses. While men typically stay in the village of their birth upon marriage, wives often come from another village. We expect spouses originating from outside the village to bring fewer assets, especially land. 17 village dummies are included as well.

The dependent variables μ_i and β_j are the value of all assets brought to marriage by the bride and the groom; they are constructed as described in the previous section. They include the value of all the physical assets that form the start-up capital of the newly created household. Sample correlation coefficients between μ_i and β_j are significantly positive. This is consistent with assortative matching and reciprocity and does not support the idea of compensating parental transfers with a large value of σ. To test compensating transfers, it is therefore necessary to rely on equations (4.1) and (4.2). The model is estimated in logs to limit the effect of outliers. Assets brought by the spouse and father's land also enter the regression in logs. The estimator is tobit.

Regression estimates are reported in Table 4. We obtain large positive values for b_i and d_j. This constitutes *prima facie* rejection of the compensating transfers model presented in Section 2. Parental wealth has a positive effect on assets brought to marriage by both bride and groom while parental education has no effect. The latter result is hardly surprising since the average education level of parents is quite low. Moreover, study areas remain centered primarily on traditional agriculture where returns to education are low or non-existent. Farming experience has a positive effect on assets brought to marriage, reflecting individual accumulation by the spouses. Experience in wage work is negative for men, suggesting that men who work for a wage are less capable of accumulating assets than farmers.

For women, we find that experience in self-employment is associated with higher values of assets at marriage. This is hardly surprising given that, in the study area as in much of Africa, off-farm work is the primary – if not only – avenue through which women can earn an independent income. Widows and women with children from previous marriages bring more assets to marriage, a result in line with the findings of Fafchamps and Quisumbing (2003).

Parents presumably divide their assets among their children so that, other things being equal, grooms with more brothers and sisters should receive less. Competition among siblings may be correlated with matching outcomes in such a way as to invalidate our results. To test for this possibility, we reestimate the model with sibling effects. We assume that welfare weights vary as a function of the number of siblings. In practice, this means that a_i and b_i vary systematically with the number of siblings of the groom. This effect is captured by including cross terms between number of siblings and $\bar{\mu}_i$ and β_j. The same applies to brides. Because daughters bring much less to marriage, we focus on competition with brothers.[20] To keep the model sparse, we only include the most important cross terms.

Results with sibling effects are presented in Table 5. The number of brothers is shown to have no effect on assets brought to marriage, suggesting that sibling competition is not an important concern in the study area.[21] Contrary to expectations, we find that parental land crossed with number of siblings has a positive sign in both cases; the effect is significant for brides. This means that brides with more brothers receive more from their parents. This may be because siblings, particularly brothers who are more likely to be gainfully engaged in farming or other work, indirectly contribute to the marriage as well.[22] According to expectations, we find that β_j and μ_i crossed with siblings have negative signs: spouses with more siblings bring less to marriage if their spouse brings more. But the effect is not significant. Sibling effects are not jointly significant for grooms.

For inference based on equations (4.1) and (4.2) to yield correct conclusions, the complete vector of $\bar{\mu}_i$ and $\bar{\beta}_j$ must be observable. If not, matching on unobservables in the marriage market will ensure that assets brought by the bride are positively correlated with unobservable assets of the groom. The presence of incomplete measurement in $\bar{\mu}_i$ therefore biases the coefficient of β_i in (4.1) toward being positive. Whenever the dependent variable μ_i and regressor β_j are positively correlated because of matching on unobservables, the coefficient of β_j is biased toward a positive value. The same thing happens for μ_i in equation (4.2). For our test to be conclusive, it is therefore necessary to instrument β_j and μ_i in their

[20] We also experimented with the number of sisters, but they are never significant.

[21] Competition from male siblings is more important in the case of inheritance, where a deceased persons estate is divided among all heirs at the same time (Fafchamps and Quisumbing 2003).

[22] In contrast, in Bangladesh, the number of brothers decreases the wife's assets at marriage, but has positive effects on current assets (Quisumbing and de la Brière 2000) and on child health (Hallman 1998).

respective regression.

In order to instrument β_j in the groom equation (4.1), we need regressors that help predict assets brought to marriage by the bride $E[\beta_j]$ but not by the groom. We cannot, however, use characteristics of the bride as instrument because, due to assortative matching, they may be correlated with unobserved characteristics of the groom, and vice versa for the bride. Taking these considerations into account leads us to use as instruments the number of brothers and sisters of the newlywed. From Table 5 we know that the number of brothers someone has is not a significant determinant of the assets this person brings to marriage. For the groom we also include as instrument the number of children from previous marriages. We have already seen that this variable has a strong influence on assets brought to marriage for women, but it is not significant for men. The instrumenting regressions are shown in Appendix. Instruments are jointly significant for both groom and bride.

Instrumented regression results are reported in Table 6. Since the estimator is tobit, we adopt the Smith-Blundell approach to instrumentation and include the residuals from the instrumenting regression as additional regressors. This procedure produces a test of endogeneity as a by-product. We also report the results of a test of over-identifying restrictions and a Hausman test of endogeneity estimated on ordinary least squares. In both cases, the over-identifying restriction test is satisfied. Endogeneity tests suggest the presence of endogeneity in the bride regression only – although the Hausman test is nearly significant for grooms when ordinary least squares are used instead of tobit (see bottom of Table 6).

We again obtain a strong positive estimated coefficients for assets brought by the bride in the groom's regression, hence rejecting the compensating parental transfer model without strategic behavior. For brides, however, the coefficient is negative and nearly significant, suggesting that parents may reduce what they give to their daughter if the groom happens to bring more. Both results – positive and significant for the groom, negative but non-significant for the bride – are quite robust: they obtain if we drop/add regressors or use different sets of instruments.

4.1. Testing strategic behavior

As discussed in Section 2, there are two potential interpretations for the positive coefficient for grooms: either (1) parental transfers do not compensate for assets brought by the spouse and all we observe is assortative matching; or (2) parents act strategically. To try to disentangle the two explanations, we construct a test of strategic behavior based on the idea that, if parents act strategically, the slope of expected marriage market outcomes should affect their behavior. This is equivalent to saying that parents adjust transfers not only in response to assets brought by the spouse but also in response to how easily they can obtain a better match.

To show this formally, we amend the parental transfer model to include a slope effect. Let the conditional expected match be written:

$$E[\beta|\mu] = g(\mu) \tag{4.3}$$

In contrast with the compensating transfer model, we now assume that parents do not take β as given but anticipate the effect that μ has on β. The amended optimization problem is:[23]

$$\max_{0\leq\mu\leq\bar{\mu}} \frac{1}{\rho}\left[(\bar{\mu}-\mu)^{\rho} + \omega(\mu + g(\mu))^{\rho}\right]$$

Solving the first order condition yields a modified equation (2.4):

$$\mu^* = \frac{(1+g'(\mu))^{\sigma}\omega^{\sigma}\bar{\mu} - \beta^o + g'(\mu)\mu^o}{1 + g'(\mu) + (1+g'(\mu))^{\sigma}\omega^{\sigma}} \geq 0 \tag{4.4}$$

A similar condition can be derived from brides.

To transform equation (4.4) into a relationship that can be used estimation purposes, we take a first-order Taylor approximation of $g(\mu)$ around $\{\mu^o, \beta^o\}$:

$$g(\mu) \simeq \beta^o + g'(\mu^o)(\mu - \mu^o) \tag{4.5}$$

We think of equation (4.3) as a linear approximation to the true matching relationship around the parental optimum with $\mu^* = \mu^o$ and $\beta = \beta^o$. The term $g'(\mu^*)$ measures the slope of the matching relationship at μ^*. To simplify the notation, let κ stand for $g'(\mu^*)$, keeping in mind that κ varies across individuals

[23] Note that, in our model, $g(\mu)$ represents a marriage market matching function, not a reciprocity motive as discussed in Section 2. The formal effect is the same, however: it raises assets brought to marriage.

depending on the marriage market they face. Equation (4.4) can then be rewritten as:

$$\begin{aligned} \mu^* &= \frac{(1+\kappa)^\sigma \omega^\sigma \bar{\mu} - \beta + \kappa\mu^*}{1+\kappa+(1+\kappa)^\sigma\omega^\sigma} \\ &= \bar{\mu}\frac{(1+\kappa)^\sigma\omega^\sigma}{1+(1+\kappa)^\sigma\omega^\sigma} - \beta\frac{1}{1+(1+\kappa)^\sigma\omega^\sigma} \end{aligned} \tag{4.6}$$

which again is linear in $\bar{\mu}$ and β. The only difference is the presence of the $(1+\kappa)^\sigma$ term. When the matching function is steep and κ is large, parents can significantly improve their child's marriage prospect by giving more: the coefficient of $\bar{\mu}$ increases in κ while the coefficient of β decreases. Given an estimate of κ for each bride and each groom, we could potentially evaluate equation (4.6) using non-linear least squares. As it turns out, both $\frac{(1+\kappa)^\sigma\omega^\sigma}{1+(1+\kappa)^\sigma\omega^\sigma}$ and $\frac{1}{1+(1+\kappa)^\sigma\omega^\sigma}$ can easily be approximated by a log-linear function in κ.

To estimate (4.6), we need an individual-specific estimate of κ, the slope of the matching relationship. If parents of the groom form rational expectations, $E[\beta|\mu]$ is equal to the actual matching relationship. It is therefore possible to obtain an approximation to the slope of $E[\beta|\mu]$ from the empirical matching relationship. To implement this idea, we divide the data into sub-groups approximating the marriage market at a moment in time. This is achieved by dividing couples within each village into cohorts depending on the year in which marriage took place. Because of data limitations, we split cohorts by decade. A finer distinction would be better but we do not have a sufficient number of observations for this to be practical.[24] Decades are calculated from the time of the survey, 1997. So, marriages in village 1 taking place between 1988 and 1997 are regarded as belonging to one cohort; marriages in the same village taking place between 1978 and 1987 belong to another cohort, etc. A total of $15 \times 4 = 60$ cohorts are distinguished. For each cohort, we regress β on μ (in logs). The estimated coefficient of μ in this regression is our slope variable κ.[25] Since κ is the same for all grooms belonging to the same cohort, it is not correlated with μ and can be regarded as exogenous.[26]

[24] Unlike Foster (1998), we do not have a complete census of marriages which took place.

[25] We also experimented with individual-specific slopes by regressing β on μ non-parametrically. The slope parameter κ_j is then taken as the local slope of the non-parametric relationship in the vicity of μ_j. Because in this case κ_j ultimately depends on μ_j, there remains a possibility of endogeneity bias. We therefore instrumented the κ_j estimates themselves, but this approach is quite cumbersome and opaque. For these reasons we ultimately decided to abandon the approach. It is useful to note, however, that it yields results that are qualitatively very similar.

[26] The reader may worry that μ affects κ through the regression. Technically speaking, it would be possible to estimate κ_j by dropping the jth observation from the regression. In practice, because the number of observations in each cohort is

Estimation results for (4.6) using the estimated κ's are presented in Table 7. Results are quite different for brides and grooms. For grooms, the slope effect is negative and non-significant. The value of assets brought by the bride retains a positive and significant coefficient. In contrast, for brides the slope variable has a significant positive coefficient, while the coefficient on assets brought by the husband remains negative and nearly significant. These results indicate that strategic behavior is present only for brides.

Taken together, the evidence suggests that, contrary to the compensating transfer model presented in Section 2, the parents of grooms do not take marriage market outcomes into account when they determine the assets brought to marriage by their child. It is as if parents first decide how much to endow their child, and then look for a marriage prospect. As a result, the data reflect primarily assortative matching. This result is not altogether surprising given that grooms bring around ten times more assets than brides.

The picture is different for brides. In their case, the evidence suggests that parents give more if doing so improves the marriage prospect of their daughter, as predicted by our model with strategic behavior. We also find some evidence that parents reduce transfers to daughters at marriage if the groom brings more, but this evidence is only significant at the 15% level.

5. Conclusion

We have examined the determinants of assets brought to marriage. These determinants indeed shape the distribution of assets and incomes in agrarian societies characterized by widespread poverty – hence where it is difficult to accumulate. Assets at marriage also affect farm size distribution since newlyweds typically initiate their own, separate farming operations. Assets brought at marriage thus constitute the dominant form of start-up capital for new farms. Fafchamps and Quisumbing (2003) provide ample evidence of assortative matching in rural Ethiopia. They also show that assets brought to marriage depend on the wealth of the parents, particularly for first marriages, and the marriage histories of the bride and groom.

Using a simple model of parental transfers (inter vivos bequest) at marriage, we identified three separate processes that potentially determine assets brought to marriage. The first process is assortative

relatively large, this does not make any difference.

matching, that is, the tendency for wealthier brides to marry wealthier grooms. Assortative matching, possibly reinforced by reciprocal gifts, generates a positive correlation between assets brought to marriage by both spouses. The second process is compensating transfers, that is, the tendency for parents to reduce transfers at marriage if the spouse brings more. Compensating transfers generate a negative partial correlation between assets brought to marriage once we control for the individual's characteristics. The third process is what we called strategic behavior, that is, parents' attempt to improve the ranking of their child on the marriage market by transferring more assets to them at the time of marriage.

We investigated these three processes using detailed data from rural Ethiopia. Our results suggest that different processes drive assets brought to marriage by grooms and brides. We have already alluded to the importance of assortative matching, discussed in greater detail in Fafchamps and Quisumbing (2003). Regarding the two other processes, we find no evidence of compensating transfers or of strategic behavior for grooms. Parents appear to endow sons based purely on their own preferences and endowments, and then look for a bride. This is consistent with the fact that, in our sample, grooms bring on average ten times more assets to marriage than brides. In contrast, for brides we find some evidence of compensating transfers and strategic motives. Parents seem to increase what they give to their daughter if the groom brings less. They also tend to give more if doing so notably increases the quality of the match their daughter is able to secure in the marriage market.

These results make sense in the context of rural Ethiopia where grooms bring the lion's share of the new household's assets. Grooms do not act strategically because the outcome of the marriage market is not an important determinant of their future welfare and can more or less be ignored. For brides, however, much of their future welfare hinges on how they fare in the marriage market. It is therefore not surprising if we find evidence that parents seek to influence the process and to adjust what they give to their daughter as a function of marriage market outcomes. It remains to be seen whether similar behavior would obtain in other parts of the world. In particular, we suspect that outcomes would be very different in economies with more off-farm income earning opportunities for women. In this case, imparting an education or vocational skills to their daughters may be a more effective way for parents to influence their future welfare (Quisumbing, Estudillo and Otsuka 2003).[27] These issues deserve future investigation.

References

Alkan, A. and Gale, D. (1990). "The Core of the Matching Game.", *Games and Economic Behavior*, 2(3):203–12.

Barr, A. (2002), Cooperation and Shame. (mimeograph).

Becker, G. S. (1981), *A Treatise on the Family*, Harvard U.P., Cambridge, Mass.

Becker, G. S. and Tomes, N. (1986). "Human Capital and the Rise and Fall of Families.", *Journal of Labor Economics*, 4:S1–S39.

Behrman, J. R. (1997), Intrahousehold Distribution and the Family., *Handbook of Population and Family Economics*, Mark R. Rosenzweig and Oded Stark (eds.), North-Holland, Amsterdam, pp. 125–187.

Bergstrom, T. C. (1997), A Survey of Theories of the Family., *Handbook of Population and Family Economics*, Mark R. Rosenzweig and Oded Stark (eds.), North-Holland, Amsterdam, pp. 21–79.

Board, R. (1994). "Measuring the Instability in Two-Sided Matching Procedures.", *Economic Theory*, 4(4):561–77.

Boulier, B. L. and Rosenzweig, M. R. (1984). "Schooling, Search, and Spouse Selection: Testing Economic Theories of Marriage and Household Behavior.", *Journal of Political Economy*, 92(4):712–32.

Demange, G. and Gale, D. (1985). "The Strategy Structure of Two-Sided Matching Markets.", *Econometrica*, 53(4):873–88.

Fafchamps, M. and Quisumbing, A. R. (2002). "Control and Ownership of Assets Within Rural Ethiopian Households.", *Journal of Development Studies*, 38(2):47–82.

[27] In the Philippines, for example, where abundant nonfarm earnings opportunities exist and there are no barriers to women's employment in those activities, parents invest preferentially in girls' education. In Indonesia, female education has been increasing in tandem with the growth of nonfarm employment. However, in rural Ghana, where these opportunities for women are rare, returns to female schooling are low or even negative, and parents do not invest in their daughters' education (Quisumbing et al. 2003).

Fafchamps, M. and Quisumbing, A. R. (2003), Marriage and Assortative Matching in Rural Ethiopia. (mimeograph).

Foster, A. D. (1998), Marriage Market Selection and Human Capital Allocations in Rural Bangladesh. (mimeograph).

Gale, D. (2001). "The Two-Sided Matching Problem: Origin, Development, and Current Issues.", *International Game Theory Review*, 3(2-3):237–52.

Gale, D. and Shapley, L. (1962). "College Admissions and the Stability of Marriage.", *American Mathematical Monthly*, 69:9–15.

Gopal, G. and Salim, M. (1999), *Gender and Law: Eastern Africa Speaks*, The World Bank, Washington, D.C. Conference Organized by the World Bank and the Economic Commission for Africa.

Haddad, L., Hoddinott, J. and Alderman, H. (1997), *Intrahousehold Resource Allocation in Developing Countries: Models, Methods, and Policy*, Johns Hopkins University Press, Baltimore.

Hallman, K.-K. (1998), *The Demand for Child Health Care in a Developing Country: Estimates from the Philippines*, Department of Economics, Michigan State University, East Lansing. Unpublished PhD thesis.

Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., Gintis, H., McElreath, R., Alvard, M., Barr, A., Ensminger, J., Hill, K., Gil-White, F., Gurven, M., Marlowe, F., Patton, J. Q., Smith, N. and Tracer, D. (2002), 'Economic Man' in Cross Cultural Perspective: Behavioural Experiments in 15 Small-scale Societies. (mimeograph).

Jacoby, H. G. (1995). "The Economics of Polygyny in Sub-Saharan Africa: Female Productivity and the Demand for Wives in Côte d'Ivoire.", *J. Polit. Econ.*, 103(5):938–971.

Lucas, R. E. and Stark, O. (1985). "Motivations to Remit: Evidence from Botswana.", *J. Polit. Econ.*, 93 (5):901–918.

Mongell, S. and Roth, A. E. (1991). "Sorority Rush as a Two-Sided Matching Mechanism.", *American Economic Review*, 81(3):441–64.

Quisumbing, A. R. and de la Brière, B. (2000), Women's Assets and Intrahousehold Allocation in Rural Bangladesh: Testing Measures of Bargaining Power., *Technical report*, International Food Policy Research Institute, Washington DC. FCND Discussion Paper No. 86.

Quisumbing, A. R., Estudillo, J. and Otsuka, K. (2003), *Land and Schooling: Transferring Wealth Across Generations*, Johns Hopkins University Press for the International Food Policy Research Institute, Baltimore, MD. (forthcoming).

Quisumbing, A. R. and Maluccio, J. (2003). "Resources at Marriage and Intrahousehold Allocation: Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa.", *Oxford Bulleting of Economics and Statistics*, 65(3):283–327.

Rao, V. (1993). "The Rising Price of Husbands: A Hedonic Analysis of Dowry Increases in Rural India.", *Journal of Political Economy*, 101:666–677.

Rosenzweig, M. R. and Stark, O. (1989). "Consumption Smoothing, Migration, and Marriage: Evidence from Rural India.", *J. Polit. Econ.*, 97 (4):905–926.

Roth, A. E. (1991). "A Natural Experiment in the Organization of Entry-Level Labor Markets: Regional Markets for New Physicians and Surgeons in the United Kingdom.", *American Economic Review*, 81(3):415–30.

Roth, A. E. and Sotomayor, M. (1988). "Interior Points in the Core of Two-Sided Matching Markets.", *Journal of Economic Theory*, 45(1):85–101.

Roth, A. E. and VandeVate, J. H. (1990). "Random Paths to Stability in Two-Sided Matching.", *Econometrica*, 58(6):1475–80.

Roth, A. and Sotomayor, M. (1990), *Two-Sided Matching*, Cambridge University Press, Cambridge.

Shapley, L. and Shubik, M. (1972). "The Assignment Game I: The Core.", *International Journal of Game Theory*, 1(1):111–30.

Stark, O. and Lucas, R. E. (1988). "Migration, Remittances, and the Family.", *Economic Development and Cultural Change*, 36, no.3:465–481.

The World Bank (1998), *Implementing the Ethiopian National Policy for Women: Institutional and Regulatory Issues*, The World Bank and The Women's Affairs Office, Federal Democratic Republic of Ethiopia, Washington, D.C.

Thomas, D., Contreras, D. and Frankenberg, E. (1997), Child Health and the Distribution of Household Resources at Marriage. (mimeograph).

Webb, P., von Braun, J. and Yohannes, Y. (1992), Famine in Ethiopia: Policy Implications of Coping Failure at National and Household Levels., *IFPRI Research Report*, Vol. 92, International Food Policy Research Institute, Washington DC.

Weiss, Y. (1997), The Formation and Dissolution of Families: Why Marry? Who Marries Whom? And What Happens Upon Divorce?, *Handbook of Population and Family Economics*, Mark R. Rosenzweig and Oded Stark (eds.), North-Holland, Amsterdam, pp. 81–123.

Zhang, J. and Chan, W. (1999). "Dowry and Wife's Welfare: A Theoretical and Empirical Analysis.", *Journal of Political Economy*, 107(4):786–808.

Table 2. Composition of the sample by category of household

	Number	Percent	
Unmarried individuals	**Number**	**Percent**	
Single man living alone	72	5.1%	
Single woman living alone	239	16.8%	
Monogamous couples			21.9%
Monogamous couple living together	877	61.8%	
Monogamous couple, husband away	69	4.9%	
Monogamous couple, wife away	55	3.9%	
Polygamous households			70.5%
Polygamous household living together	81	5.7%	
Male headed part of a polygamous couple residing separately	21	1.5%	
Female headed part of a polygamous couple residing separately	6	0.4%	
			7.6%
Total	1420		

Table 3. Assets at marriage, Inheritance, Human Capital, and Parental Characteristics

	Groom's assets			Bride's assets		
Assets brought to marriage:	Mean	SD	Median	Mean	SD	Median
Land value	2056	5955	377	90	833	0
Livestock value	1337	2833	287	300	1790	0
Jewelry, clothes, linens, utensils and grain	877	1587	448	40	232	0
Total value of assets prior to marriage	4270	7433	1981	430	2035	0
Gifts at marriage (1)	234	761	0	401	885	0
Inheritance after marriage:						
Inherited land	2060	8452	0	75	657	0
Inherited livestock	260	1038	0	80	346	0
Total assets at marriage plus inheritance	6820	11848	3576	987	2395	342
Human capital						
Age at marriage	29.9	11.7	27.3	19.3	8.1	18.3
Literate (2)	33%		0%	13%		0%
At least some primary education	25%		0%	10%		0%
At least some secondary education	7%		0%	2%		0%
Years of farming experience	11.7	10.3	10.0	3.7	5.8	1.0
Years of wage work experience	0.7	2.5	0.0	0.1	0.7	0.0
Years of self-employment experience	0.8	2.9	0.0	0.3	1.5	0.0
Parental characteristics						
Father's land (in hectares)	6.5	74.0	0.6	1.9	9.9	0.4
Father went to school (yes=1)	7%		0%	7%		0%
No. of observations	1179					

All unions included. All values expressed in 1997 Ethiopian Birr.

(1) Gifts made to bride and groom only. A few gifts given to both jointly are divided equally for the purpose of this table.

(2) Either some formal education or some literacy or religious education.

Table 4. Assets brought to marriage

(estimator is tobit; dependent variable in log)		Groom		Bride	
Assets brought by spouse	Unit	**Coef.**	**t-stat.**	**Coef.**	**t-stat.**
Value of assets brought by spouse	log	0.234	**6.93**	0.433	**5.23**
Determinants of parental and personal wealth					
Parent's wealth ranking	rank 1-5	0.267	**2.56**	0.389	**1.65**
Land of father (*)	log	0.132	1.28	0.475	**2.04**
Years of education of father	years	-0.180	-0.55	-0.244	-0.34
Age at marriage	years	0.005	0.55	0.023	1.12
Number of previous marriages	# times	0.078	0.91	0.238	0.92
Years of schooling	years	0.018	0.45	-0.023	-0.14
Years of farming experience	log	0.412	**3.72**	-0.216	-1.00
Years of wage work experience	log	-0.352	**-2.52**	0.963	1.16
Years of self-employment exper.	log	0.162	1.21	0.869	**1.90**
Widowhood	# times	0.180	0.84	1.914	**3.78**
Children from previous marriage(s)	number			0.393	**4.94**
Born in village		(omitted category)			
Born in district	yes=1	-0.308	-1.13	-0.609	-1.24
Born in province	yes=1	-0.470	-1.23	-0.152	-0.24
Born in another rural area	yes=1	-0.859	**-2.42**	-1.889	**-2.45**
Born in a town or city	yes=1	2.894	1.13	3.594	**3.06**
Village dummies		included but not shown			
Intercept		3.286	**5.30**	-3.523	**-2.90**
Pseudo R-squared		0.036		0.139	
Number of observations		971		1102	
of which censored		86		676	
of which uncensored		885		426	

Table 5. Testing sibling effects

(estimator is tobit; dependent variable in log)		**Groom**		**Bride**	
Assets brought by spouse	Unit	**Coef.**	**t-stat.**	**Coef.**	**t-stat.**
Value of assets brought by spouse	log	0.274	**4.87**	0.577	**3.70**
Determinants of parental and personal wealth					
Parent's wealth ranking	rank 1-5	0.270	**2.59**	0.400	**1.71**
Land of father (*)	log	-0.071	-0.43	-0.413	-0.94
Years of education of father	years	-0.161	-0.49	-0.252	-0.36
Age at marriage	years	0.006	0.65	0.022	1.06
Number of previous marriages	# times	0.084	0.98	0.246	0.96
Years of schooling	years	0.016	0.38	-0.025	-0.15
Years of farming experience	log	0.401	**3.61**	-0.202	-0.94
Years of wage work experience	log	-0.368	**-2.62**	1.054	1.27
Years of self-employment exper.	log	0.156	1.17	0.858	**1.89**
Widowhood	# times	0.175	0.82	1.921	**3.81**
Children from previous marriage(s)	number			0.390	**4.93**
Born in village		(omitted category)			
Born in district	yes=1	-0.332	-1.22	-0.584	-1.20
Born in province	yes=1	-0.453	-1.18	-0.058	-0.09
Born in another rural area	yes=1	-0.848	**-2.39**	-1.707	**-2.22**
Born in a town or city	yes=1	2.804	1.09	3.745	**3.20**
Village dummies		included but not shown			
Sibling effects					
Number of brothers	log	-0.098	-0.53	0.525	0.47
Log(# of brothers) x log(land of father)		0.213	1.55	1.014	**2.39**
Log(# of brothers) x log(assets brought by spouse)		-0.044	-0.92	-0.167	-1.15
Intercept		3.360	**5.21**	-3.967	**-2.49**
Pseudo R-squared		0.036		0.142	
Number of observations		971		1101	
of which censored		86		675	
of which uncensored		885		426	
Test whether sibling effects jointly significant		**F-stat**	**p-value**	**F-stat**	**p-value**
		0.94	0.4196	2.38	0.0684

Table 6. Instrumenting assets brought by the spouse
(estimator is tobit; dependent variable in log)

		Groom		Bride	
Assets brought by spouse	Unit	**Coef.**	**t-stat.**	**Coef.**	**t-stat.**
Value of assets brought by spouse	log	0.582	**2.58**	-1.476	-1.53
Residuals from instrumenting equation		-0.349	-1.53	1.922	**1.99**
Determinants of parental and personal wealth					
Parent's wealth ranking	rank 1-5	0.249	**2.38**	0.447	**1.89**
Land of father (*)	log	0.101	0.93	0.419	**1.80**
Years of education of father	years	-0.234	-0.71	0.272	0.36
Age at marriage	years	0.012	1.22	0.002	0.08
Number of previous marriages	# times	0.037	0.42	0.234	0.92
Years of schooling	years	0.018	0.44	-0.102	-0.62
Years of farming experience	log	0.444	**3.99**	-0.066	-0.29
Years of wage work experience	log	-0.429	**-2.71**	1.420	1.65
Years of self-employment exper.	log	0.130	0.96	0.957	**2.09**
Widowhood	# times	0.208	0.97	1.869	**3.71**
Children from previous marriage(s)	number			0.325	**3.80**
Born in village		(omitted category)			
Born in district	yes=1	-0.308	-1.11	0.072	0.12
Born in province	yes=1	-0.349	-0.89	0.408	0.59
Born in another rural area	yes=1	-0.773	**-2.11**	-1.675	**-2.16**
Born in a town or city	yes=1	3.508	1.36	6.590	**3.42**
Village dummies		included but not shown			
Intercept		1.915	**1.89**	8.052	1.36
Pseudo R-squared		0.038		0.141	
Number of observations		943		1101	
of which censored		83		675	
of which uncensored		860		426	
		Wald	**p-value**	**Wald**	**p-value**
Testing over-identifying restrictions		0.46	0.796	0.46	0.499
Degrees of freedom		2		1	
		Wald	**p-value**	**Wald**	**p-value**
Hausman test of endogeneity		2.65	0.104	2.60	0.107

Table 7. Including slope effects

		Groom		Bride	
Assets brought by spouse	Unit	**Coef.**	**t-stat.**	**Coef.**	**t-stat.**
Value of assets brought by spouse	log	0.540	**2.26**	-1.520	-1.58
Residuals from instrumenting equation		-0.306	-1.27	1.953	**2.03**
Slope of marriage market (*)		-0.193	-0.60	2.266	**2.41**
Determinants of parental and personal wealth					
Parent's wealth ranking	rank 1-5	0.257	**2.35**	0.426	**1.80**
Land of father (*)	log	0.170	1.45	0.428	**1.84**
Years of education of father	years	-0.188	-0.53	0.307	0.41
Age at marriage	years	0.009	0.87	0.004	0.18
Number of previous marriages	# times	0.024	0.27	0.253	0.99
Years of schooling	years	-0.000	0.00	-0.090	-0.55
Years of farming experience	log	0.418	**3.61**	-0.079	-0.35
Years of wage work experience	log	-0.348	**-2.08**	1.489	**1.72**
Years of self-employment exper.	log	0.112	0.77	0.995	**2.18**
Widowhood	# times	0.338	1.50	1.859	**3.70**
Children from previous marriage(s)	number			0.318	**3.72**
Born in village					
Born in district	yes=1	-0.252	-0.83	0.079	0.13
Born in province	yes=1	-0.038	-0.09	0.412	0.60
Born in another rural area	yes=1	-0.954	**-2.34**	-1.686	**-2.18**
Born in a town or city	yes=1	3.490	1.32	6.563	**3.42**
Village dummies					
Intercept		2.187	**2.11**	8.155	1.38
Pseudo R-squared		0.040		0.142	
Number of observations		876		1101	
of which censored		80		675	
of which uncensored		796		426	
		Wald	**p-value**	**Wald**	**p-value**
Testing over-identifying restrictions		0.93	0.629	0.69	0.406
Degrees of freedom		2		1	
		Wald	**p-value**	**Wald**	**p-value**
Hausman test of endogeneity		1.80	0.180	2.60	0.107

(*) See text for details.

Appendix: Instrumenting equations

		Groom		Bride	
Exogenous variables		**Coef.**	**t-stat.**	**Coef.**	**t-stat.**
Parent's wealth ranking	rank 1-5	-0.035	-0.35	0.025	0.26
Land of father (*)	log	0.112	1.11	-0.015	-0.14
Years of education of father	years	-0.025	-0.08	0.258	0.86
Age at marriage	years	-0.025	**-2.74**	-0.011	-1.18
Number of previous marriages	# times	-0.048	-0.55	0.007	0.06
Years of schooling	years	0.024	0.59	-0.040	-0.64
Years of farming experience	log	0.003	0.03	0.063	0.70
Years of wage work experience	log	0.309	**2.26**	0.220	0.63
Years of self-employment exper.	log	0.049	0.38	0.058	0.30
Widowhood	# times	-0.241	-1.12	0.009	0.04
Children from previous marriage(s)	number			-0.041	-1.12
Born in village		(omitted category)			
Born in district	yes=1	0.198	0.75	0.364	**1.79**
Born in province	yes=1	-0.365	-0.99	0.343	1.32
Born in another rural area	yes=1	-0.324	-0.95	0.145	0.47
Born in a town or city	yes=1	-1.430	-0.58	1.567	**2.93**
Village dummies		included but not shown			
Instruments					
Children from previous marriage(s)	number	0.141	**4.51**		
Number of brothers	number	0.044	0.94	0.124	**2.50**
Number of sisters	number	-0.033	-0.69	-0.077	-1.48
Intercept		3.595	**5.92**	5.998	**12.49**
R-squared		0.347		0.089	
Nobs		943		1101	
		F-stat	**p-value**	**F-stat**	**p-value**
Joint F-test of the instruments		7.08	0.0001	3.4	0.0336