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Household Allocations and Endogenous Information

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Abstract:
This paper tests for the endogeneity of one of the main elements separating different models of intrahousehold allocations, namely the household information set. Based on unusually rich data, I find that split migrant couples in the Nairobi slums invest considerable resources into information acquisition through visits, sibling and child monitoring, budget submissions, and marital search. I also find potentially substantial welfare losses when information acquisition becomes costly, not only through reduced remittances but more importantly as families opt for family migration into the slums. That households invest in information when there are welfare gains complements a large and growing literature that seeks to explain intrahousehold allocations through more complex modes of decision-making.

Keywords: Survey Methods, Household Production and Intrahousehold Allocation, Marriage, Family Structure, Migration

JEL Classification: C42, D13, J12, J41, O15

I Introduction

A large and growing literature seeks to explain the intrahousehold allocation of resources through more complex modes of decision-making than the standard unitary model, which supposes that aggregate household behavior follows from the maximization of a household or family utility function. A variety of different models have been proposed that can be broadly grouped under collective models (e.g. Chiappori, 1988), which assume efficiency but remain mostly agnostic about the precise process that gives rise to the distribution of bargaining power within the household; efficient cooperative Nash bargaining models with threat points (e.g. Manser and Brown, 1980; McElroy and Horney, 1981); non-cooperative models, which rely on self-enforcing mechanisms; or some combination as in Lundberg and Pollak's (1993) separate spheres model, whereby the marital threat points are determined by a non-cooperative Cournot-Nash equilibrium within marriage. Empirical tests to distinguish between the models are frequently difficult because different models may have observationally similar predictions (e.g. in Lundberg and Pollak's model, under certain conditions, a redistribution of income will not affect demand, even in non-cooperation) and because of data requirements on assignable consumption. A common test, and rejection, is the unitary model's hypothesis that household allocations do not depend on the distribution of income among household members (e.g. Browning et al. 1994; Thomas, 1990), while others have tested for efficiency of household behavior. For example, Dubois and Ligon (2003) find evidence of household inefficiencies based on food consumption expenditures among members of farm households in the Philippines, and Udry (1996) finds evidence of inefficiencies in agricultural production by members of farm households in Burkina Faso.

The main goal of this paper is to complement this literature by testing for the endogeneity of one of the main elements separating the different models of household allocations, namely the household information set. The particular information set - perfect or imperfect – is frequently considered critical in determining which type of household bargaining process is likely most appropriate in explaining allocations. Empirical tests to distinguish between models take this information set as given. For example, efficiency is reached in collective and cooperative bargaining models in the shadow of full and symmetric information. On the other hand, if household members' utility functions are characterized by the class of transferable utility, efficiency is reached through self-enforcing mechanisms without needing full and symmetric

information (Bergstrom, 1989)[1]. For other types of utility functions, imperfect information is generally assumed to lead to inefficient non-cooperative outcomes, although (more) cooperative outcomes can also be sustained as subgame perfect Nash equilibria in dynamic settings with premarital gift giving as commitment (Carmichael and MacLeod, 1997) or signaling devices (Camerer, 1988), or with altruism (e.g. Foster and Rosenzweig, 2001). Indeed, Ashraf (forthcoming) finds that experimentally varying the information set and degree of spousal communication significantly affects husbands' savings decisions. Yet, if more information has indeed large welfare benefits by allowing cooperative rather than non-cooperative outcomes, we should expect that household members (or different households in case of inter-household allocations) should be willing to invest in information acquisition – monitoring - , even if this is costly.

The assumption of full and symmetric information is arguably innocuous in many contexts of household decision making where couples have good information about each other. In the case of cooperative behavior around household public goods contributions such as child investments, information acquisition or monitoring for most couples will simply be a by-product of daily interactions. On the other hand, the reduction in levels of child support frequently observed among divorced couples are often explained in part by appealing to the notion that cooperative outcomes cannot be sustained if the non-custodial parent has very little information about the allocation of his/her financial support to the custodial parent (e.g. Weiss and Willis, 1985). However, if child investments are important to both parents, we should expect them to want to want to share information on each other`s expenditures so as to enable cooperative outcomes.

To investigate the endogeneity of the information set and its ramifications, this paper focuses on rural-to-urban migrant couples where the husband migrates but the wife and (most of the) children remain in the rural home. This is a common migration strategy in many agricultural societies that are urbanizing rapidly, and especially so in Kenya, where nearly half of migrant couples undertake this type of 'split' migration. Since the majority of migrants will find housing in one of the urban slums, the popularity of split migration can in part be motivated by the downside of joint migration. For example, most slums suffer from incredible amounts of litter

[1] Bergstrom (1989) shows that under the implicit assumption of conditional (on the actions by the members) transferable utility, the utility possibility frontier in a 2 person economy (u^h, u^w) is given by parallel straight lines, $u^h + u^w = c(a)$.

and waste; 71% of households either dispose of garbage in open public spaces and in the river (WB, 2008), and levels of common illnesses (fever, cough, diarrhea) are two to three times higher than among rural children (APHRC, 2002). Urban living is also expensive, including access to basic necessities such as water, toilets, and food, and education. Still, split migration presents its own challenges. In particular, except for the predictions by the unitary and transferable utility models, we should expect inefficient non-cooperative outcomes to arise as split migration naturally gives rise to imperfect information unless couples are willing to invest in monitoring and improve their information set.

The first goal of this paper is to test this hypothesis. Do split couples invest in information acquisition, and if so, how? The second goal of the paper is to look for evidence that inefficient allocations arise when information acquisition becomes costly due to exogenous variation in the price of monitoring or, conditional on the cost of information, when misaligned incentives between the spouses are more likely to give rise to conflict over the allocation of resources and time. And third, to test for the hypothesis put forward by Becker (1973) and others since that as long as people are forward looking, the allocation of resources within marriage should be an important determinant of marriage market behavior and vice versa. In this particular context, to test whether the information set within marriage is endogenous to marital search.

The findings in this paper are based on two sources of primary data collection: first, thirty detailed open-ended interviews were carried out in 2004 among married couples (split and joint) in the Nairobi slums and two rural areas. These aimed specifically to understand if and why spousal monitoring is needed in their particular context, how monitoring is done, and what inefficiencies, if any, arise when monitoring is difficult or costly. These interviews formed the basis of a survey which included 1514 married migrant men ('split' and 'joint' (living with their wives)) in the Nairobi slums. To the best of my knowledge, this is the first large scale survey that captures in such detail the monitoring strategies of couples, including detailed information on (monitoring by) non-householder siblings, and combines it with detailed information on marriage market behavior.

The survey data demonstrate that split couples indeed do not take the information set as given but invest considerable time and resources into monitoring, and thus suggest that neither the unitary model nor transferable utility adequately captures the behavior of these households. Split migrant men invest substantial resources and time monitoring their rural wives by making

(costly) short, frequent visits home, requiring their wives to submit budgets before remitting, and by directly involving their siblings in the process of monitoring. In return, monitoring siblings are more likely to receive support from the migrant husband than non-monitoring siblings. Rural wives also use visits to the urban area to monitor their husbands but rely neither on their siblings nor on networks of migrant people from the rural village who are living in the same slum as their husbands. Instead, older children, boys especially, will move to the urban area to monitor the husband's actions. Consistent with a simple model of costly monitoring, husbands substitute away from personal visits toward sibling monitoring and budget submissions and wives will substitute away from personal visits toward child sending when travel becomes costly. Still, the couple spends at least $119 annually on bus fares alone, which is nearly 25% of per capita GDP. Monitoring is similarly sensitive to the presence of sibling networks by the wife. For example, while husbands travel home less frequently when they have more siblings themselves who can monitor, they will travel home *more* frequently and are more likely to require their wives to submit budgets before remitting when their *wives* have more siblings. Hence, conditional on split migration, efficiency losses are being mitigated through costly monitoring (which, of course, is itself an efficiency loss relative to a situation of perfectly symmetric information).

However, the remittance evidence is consistent with the assumption that in the shadow of imperfect information, non-cooperative outcomes with reduced transfers do arise. The likelihood of sending any amount of cash decreases with travel time. Also, if split migrant husbands are the sole owners of the rural farm, they will increase the share of in-kind remittances relative to all other land ownership types (e.g. joint ownership). Much of the efficiency losses may, however, be borne on the extensive margin of split migration as couples opt for joint migration into the slums when monitoring becomes too costly: a comparison of transport time, for example, indicates that the rural homes of joint migrants are, on average, almost 25% further from Nairobi than those of split migrants.

Lastly, the paper also finds evidence consistent with the hypothesis that the marriage market is an important vehicle to enhance efficiency within marriage, both by enhancing the marital information set\ and through pre-marital transfers. Comparing marriage market information between split and joint migrants, the former are significantly more likely to have lived together and to have known each other before marriage. Split migration is also associated with fewer spousal siblings. The payment of in-kind brideprice is also significantly higher among

couples currently split and the families of wives in split couples were more likely to be poorer than the families of their husbands at the time of marriage.

This paper proceeds as follows. Section 2 highlights the implications of information on split household decision making in the context of three commonly used models (bargaining in the presence of public goods, the principal-agent moral hazard model, and altruism with transferable utility), and develops a simple model of costly monitoring. Section 3 describes the context in which split and joint migration take place in Kenya. Section 4 introduces the data and sample characteristics. Section 5 provides the empirical analysis. Section 6 concludes.

Section 2: Information, Household Decision Making, and Optimal Monitoring

From an economic point of view, marriage is a partnership for the purpose of joint production and joint consumption (Bergstrom, 1997). Reasons for marriage include increasing returns to joint production in the farm or household, sharing of household public goods (housing, children, etc), and risk sharing. These are extensively covered elsewhere (e.g. the surveys of Bergstrom, 1997, and Weiss, 1997). All these are likely important reasons for marriage in rural Kenya which is agricultural, livelihoods are subject to weather and illness shocks, and children provide an important source of pride, family labor, and insurance for retirement. From an economic point of view, the case of split migration can be represented as an intermediary case between two states: marriage and divorce. In split migration, the couple is still married but 'custody' lies with the rural wife while the urban husband provides transfers in the presence of imperfect information. An example from Weiss and Willis (1985) illustrates the benefits from the marriage state relative to the divorce state in the presence of expenditure decisions regarding children. For a predetermined number of children, the couple decides on child expenditures q, and the couple's private consumption c_w and c_h, respectively, and the maximization problem is given by:

$$v(u, y) = \max_{q,c_w,c_h} h(q, c_h) \quad s.t.\ w(q, c_w) \geq u \quad q + c_w + c_h = y$$

In this marriage state, the first order conditions satisfy Samuelson's condition for investments into public goods, namely that the sum of the marginal rates of substitution equals the price of the public good: $\frac{h_q}{h_c} + \frac{w_q}{w_c} = 1$

In the divorce state, if the wife is the custodian and controls the level of child expenditures, the (non-cooperative) allocation will satisfy: $\frac{w_q}{w_c} = 1$

Clearly, $\left.\frac{w_q}{w_c}\right|_{married} < \left.\frac{w_q}{w_c}\right|_{divorce}$ so $q_{\text{married}} > q_{\text{divorce}}$. This inefficiently low level of child expenditures arises because the custodian does not internalize the effect of child expenditures on the non-custodian. For example, if the custodial wife in the example has the following Klein-Rubin-Stone Geary utility: $w(q, c_w) = \alpha_w \log(c_w - c_w') + (1-\alpha_w)\log(q - q')$, then she will spend $(1-\alpha_w)\Delta t$ for each extra transfer Δt sent to the wife by the non-custodial husband. As Lundberg and Pollak (1995) point out, if the non-custodial parent is faced with such a 'tax' but also has the option to purchase the public good directly, then he will do so if the price of the public good faced by him is lower than the price when sending transfers to his wife. To attain Pareto efficiency in the divorce state, the transfers to the custodial wife would have to be conditioned on her child expenses; i.e. she would need to be presented with a Lindhal price to ensure she internalizes the impact of her expenditures on him (Weiss and Willis, 1985). But for this to be able to happen, one of the pre-conditions is that the couple must have full and symmetric information. In short, taken to the situation of split migrants, we should expect clear gains from cooperation, but the ability to sustain efficient outcomes will depend importantly on the information set.

Information is similarly valuable in a standard moral hazard model where remittances only serve the role of compensating the risk averse agent (i.e. a wage transfer). A well-known result of this model is that risk-sharing is being traded off with incentives to induce effort by the agent. The notation below follows the exposition by Dye (1986) and Holstrom (1979). The principal's (i.e. husband's) utility *G* is defined over *x* and private consumption *w-t*, where *w* is his wealth level and *t* are the transfers given to the agent (his rural wife). The agent's utility depends on the transfer received and on her action *a* ("effort") and is assumed to be separable: *U(t(x))-g(a)*. Suppose output $x=x(a,\theta)$ is a 'home good' that is determined by the agent's effort *a* and a shock θ. Output *x* could be farm output but may also include, for example, a measure of the urban husband's beliefs that his rural wife is remaining faithful, which is based on news that he receives from others in the village. This news (and thus his beliefs) is influenced by the wife's

actions *a*: if she socializes little with others in the village (but her marginal utility from socializing is positive) this may reduce village rumors and increase his belief she is faithful. But his beliefs can also be influenced by the action θ of someone else, which may be completely unrelated to *a*: e.g. someone decides to spread a false rumor about the wife's extra-marital affairs because of a personal dispute unrelated to *a*. Since only output *x* – the village news, agricultural output etc. - is observed, the principal cannot infer the agent's effort *a*. The contract can therefore be only conditioned on *x*.

Under the usual assumptions on *G,U,* and *g,* a well-known result is that the principal is strictly worse off if the agent's efforts are not perfectly observable (or deducible). The reason is that the principal must increase the average level of transfers to the risk averse agent to compensate her for the higher variance of transfers which are necessary to induce the optimal action while still providing her with the same reservation utility (Holmstrom, 1979; Prendergast, 1999). Holstrom (1979) defines a signal *s* to be *valuable* if both the principal and the agent can be made strictly better off with a contract of the form *t(x,s)* than they are with a contract of the form *t(x).* As shown in Grossman and Hart (1983), the optimal action can be implemented at less cost in the more informative model. Note that the moral hazard problem will generally be alleviated if the agent also derives positive utility form the production of *x,* i.e. *x* is a public good.

Multiple Signals and Costly Monitoring These two examples illustrate the importance of information and the difference information acquisition may make for split migrant couples. The model below provides a simple example of how information acquisition works if couples seek information as part of a utility maximization strategy. The example focuses on the husband monitoring but can be symmetric. Suppose that the husband has the option of obtaining a vector of signals $\boldsymbol{v} = [d, s]$. Signal *d,* "direct monitoring", is the signal he observes through occasional visits to the rural wife. Signal *s,* "sibling monitoring", is the signal he observes if his siblings follow the actions of his wife. Signals *d* and *s* are not observed freely, but can be purchased. m_d and m_s are the amounts of each of these monitoring technologies with prices p_d and p_s, respectively. The entire vector of signals $\boldsymbol{v} = [d, s]$ is revealed simultaneously at the end of the period. Thus unlike, for example, the set-up formulated by Dye (1986), the principal does not have the option for an 'investigation' and wait until some costless signal *x* is revealed before

deciding on purchasing additional signal(s) v_{-x}.[2] The pay-off for investing in monitoring technologies is the higher utility obtained from sustaining the cooperative equilibrium as in the public goods example or obtained through more 'valuable' information on the agent's action *a* (according to Holmstrom's definition) in the risk sharing example. This is the main assumption.

For simplicity, let $\sigma_\varepsilon^2 = \sigma_\varepsilon^2(m_d, m_s)$, the variance of the measurement error on the wife's effort *a*, be a sufficient statistic capturing how informative (noisy) the signal(s) received by the husband are. It is known to both. If no monitoring signals are purchased, $\sigma_\varepsilon^2 = \sigma_\varepsilon^2(0,0) = \overline{\sigma_\varepsilon^2}$, which is the upper bound on the variance. More informative signals will reduce this variance, $\partial\sigma_{\varepsilon_a}^2 / \partial m_i < 0$. The benefits from the contractual relation are given by $B(\sigma_\varepsilon^2) = B(m_d, m_s)$. The cost *C* of monitoring is given by $C = p_d * m_d + p_s * m_s = C(m_d, m_s)$. Hence the husband will choose m_d and m_s to maximize his expected savings *S*[3]:

$$\underset{m_d, m_s}{Max} \quad S = B(\sigma_\varepsilon^2(m_d, m_s)) - p_d * m_d + p_s * m_s \tag{1}$$

Two first order conditions:

$$\frac{\partial B}{\partial \sigma_{\varepsilon_a}^2} \frac{\partial \sigma_{\varepsilon_a}^2}{\partial m_i} = p_i \quad for\ i = d, s \tag{2}$$

Proposition 1 An increase in the price p_i of signal m_i will lead to a decrease in the amount m_i being purchased if $\partial^2\sigma_{\varepsilon_a}^2 / \partial m_i^2 > 0$ and under reasonable assumptions on the function $B(\sigma_\varepsilon^2)$ [4]:

$$\frac{dm_i}{dp_i} < 0 \quad for\ i = d, s \tag{3}$$

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[2]Notice that this additional constraint can make the principal worse off if there is a cost to obtaining the additional signal(s). For example, suppose there are two possible output levels, x_H (high) and x_L (low), two possible effort levels, a_H and a_L, and suppose that the probability of observing x_H conditional on a_H is greater than that of observing x_H conditional on a_L. Finally, suppose that the optimal effort level for the second best constrained optimum is a_H. Now, the state of nature is revealed and it turns out that the realization of $x = x_H$. At this point, the principal would be worse off obtaining a costly signal to verify whether the agent indeed put in a_H. Dye (1986) derives conditions under which principals pre-commit to 'lower-tailed' investigation strategies, which specify a number $\underline{x}$ such that if output exceeds (is less than) $\underline{x}$, the probability of investigation is zero (one).

[3] I assume the income constraint on purchasing monitoring inputs is not binding on the relevant margin.

[4] Details of the comparative statics for propositions 1 and 2 are in the appendix.

The 'concavity' condition that $\partial^2\sigma^2_{\varepsilon_a} \big/ \partial m_i^{\,2} > 0$ makes intuitively sense since one would expect that extra monitoring will increasingly reveal less extra information about the wife's actions. This proposition implies, for example, that a reduction in the price of sibling monitoring (by, for example, having more siblings available), should increase both the likelihood that one or more siblings is following the affairs of the wife and increase remittances to siblings (given by $p_s * m_s$).

Proposition 2 An increase in the price $p_{j\neq i}$ of signal $m_{j\neq i}$ will lead to an increase in the amount m_i being purchased:

$$\frac{dm_i}{dp_j} > 0 \tag{4}$$

This follows from the first order conditions, provided $\partial^2\sigma^2_{\varepsilon_a} \big/ \partial m_i \partial m_j > 0$. This latter condition is expected to hold since at higher levels of monitoring using one type of technology m_i, an increase in another monitoring technology $m_{j\neq i}$ will likely only lead to relatively small decreases in the variance of the measurement error. Intuitively, this comparative static implies that husbands whose rural homes are further away from Nairobi will rely more heavily on kinship monitoring by siblings m_s than travel home frequently m_d. Remittances $p_s * m_s$, to siblings should therefore *increase* with distance to the rural home.

Proposition 3 If the wife lives together with the migrant husband in the urban area, an increase in the price of traveling home (p_d) should not affect remittances to his siblings (m_s).

$$\left.\frac{dm_s}{dp_d}\right|_{jo\,\mathrm{int}\,migrant} = 0 \tag{5}$$

When the wife lives together with the migrant husband in the urban area, the effective price of direct monitoring, p_d, is zero, allowing the husband to observe *a* directly. Hence, distance to the rural home is no longer relevant as the husband is perfectly capable of monitoring his wife (and vice versa); the first-best outcome will be observed. Alternatively, the signal *s* is no longer *valuable*, ($\partial\sigma^2_{\varepsilon_a} \big/ \partial m_s \big|_{jo\,\mathrm{int}\,migrant} = 0$), so investing m_s no longer generates benefits.

Proposition 4 The impact of increased monitoring on remittances following a reduction in p_d or p_s is ambiguous. Average remittances should decrease in the moral hazard model since more information enables the husband to make the remittance schedule less highly powered. On the other hand, if remittances are more motivated by public goods consumption, then more information should generally enable couples to more easily reach a cooperative efficient outcome with greater public goods expenditures paid for in part by higher levels of remittances[5]. Lastly, note that more information may also affect the type of transfer: the more informative situation should reduce public goods purchases done directly by the husband (e.g. sending the wife food rather than money for food) and instead higher transfers to the wife, provided the price she faces for the public good is lower and more information enables a more cooperative equilibrium in which she increases her marginal propensity to spend the remittances on public goods.

Altruism The analysis so far has been largely silent on the impact of altruism, which, after all, is commonly assumed to underlie inter- and intra-household transfers. We might also expect couples and their siblings to simply value spending time together. Because of this potential importance, I consider three types of altruism and evaluate whether these are likely to give rise to observationally similar outcomes as the propositions above: (1) altruism by the wife for the husband; (2) altruism by the husband for the wife; and, (3) altruism by the husband toward his siblings.

First, suppose that in either model above the wife is altruistic. Because she internalizes (part of) the negative externality imposed on her husband whenever she deviates from the first best action, such altruism will simply reduce the marginal benefit from monitoring; the effect of complete monitoring (i.e. full observability) results in $\sigma_\varepsilon^2 = 0$ under both the altruistic wife and non-altruistic wife scenario, but for any given level of *less than perfect* monitoring $\sigma_\varepsilon^2\big|_{Altruistic\ Wife} < \sigma_\varepsilon^2\big|_{Non-altruistic\ Wife}$. Hence, such altruism will reduce the (cross-) price effects of travel time and siblings on the level of monitoring toward zero.

[5] This does not necessarily hold: if the couple has transferable utility, they will reach a Pareto efficient solution with or without more information. However, if that's the case, there should be no monitoring taking place.

The reverse, altruism by the husband for his wife is not as straightforward. In one scenario, one may expect altruistic husbands to remit home generously. After all, any action that generates utility for the wife, including deviations from the first-best action in the absence of altruism, also generates utility to the altruistic husband, making monitoring again less necessary. If Becker's (1974) Rotten Kid Theorem applies to husband-wife relations, monitoring becomes unnecessary, but wives are *less,* not more, likely to deviate. Becker's Rotten Kid Theorem states that "*if a head* [an altruistic agent whose utility depends not only on his/her own consumption bundle but also on the utility of other members] *exists, other members also are motivated to maximize family income and consumption, even if their welfare depends on their consumption alone"*. Notice how this contrasts with the moral hazard results obtained above. As long as the altruistic head transfers positive amounts to (a) selfish member(s), it will be in the member(s) self-interest to maximize family income; the principal-agent problem disappears altogether.

A modified example from Bergstrom (1989) illustrates. Suppose both the rural wife and urban husband have transferable utility functions of the following quasi-linear form: $u^w(t^w, a^w) = t^w - (a^w)^2$ and $u^h(t^h, x) = t^h + x$, where $t^h + t^w = I$ The husband's overall utility taking into account his altruism toward his wife is given by $U^h(u^h, u^w) = u^h(u^w)^\alpha$. Output $x = (a^w + \theta)^{1/2}$ where θ is a random variable. As in the moral hazard model above, the husband's direct utility, u^h, depends positively on the wife's action a^w (which translates into output), whereas the wife's utility, u^w, depends negatively on a^w. The husband commits himself to allocating money income I between himself and his wife after observing output x. After substituting in this budget constraint, the expected value of the utility possibility frontier becomes $E[u^h + u^w] = I + E[(a^w + \theta)^{1/2}] - (a^w)^2$. Notice that changes in I, θ,and a^w will shift the (realized) frontier in- or outward. Given the husband's Cobb-Douglas function, he will commit to allocate money income (t^h, t^w) in such a way that for each θ, the distribution of utilities is $u^h = (1/1+\alpha) * \left(I + (a^w + \theta)^{1/2} - (a^w)^2\right)$ and $u^w = (\alpha/1+\alpha) * \left(I + (a^w + \theta)^{1/2} - (a^w)^2\right)$. Since for each θ, the wife's utility is proportional to $I + (a^w + \theta)^{1/2} - (a^w)^2$, she will choose a^w so as to maximize this expression. This is the Pareto optimal choice since it will also maximize the expression for u^h at each θ; the altruistic husband would have picked the same a^w had he controlled not only the allocation of money income I, but also a^w. Thus, under this "Rotten

Wives" scenario, there is no value in obtaining further signals on the wife's actions, $\partial\sigma^2_{\varepsilon_a} / \partial m_s \big|_{Rotten\ Kid\ Theorem} = 0$.

Extending the model above to include altruism toward siblings as well as valuing visits can lead to predictions that are *opposite* to *propositions 2 and 3*. Suppose, for example, that each sibling *i*'s utility is quasi-linear and defined over private consumption t_i^s and a public good *v*, which is the number of visits the urban husband makes to his rural home village (where, for simplicity, all siblings are assumed to be living)[6]: $u_i^s = t_i^s + v^{1/2}$ for *i = 1..N*. The (overall) husband's utility is defined in similar vein as before: $U^h(u^h, u^w, \Sigma_i u^s) = u^h((u^w)^\beta (\Sigma_i u_i^s)^{1-\beta})^\alpha$, where $\Sigma_i u_i^s = \Sigma_{i=1}^N (t_i^s + v^{1/2}) = \Sigma_{i=1}^N t_i^s + Nv^{1/2}$ is the sum of all the utilities of the *N* siblings. The budget constraint is given by $\Sigma_{i=1}^N t_i^s + t^h + t^w + p_v v = I$. The expected value of the utility possibility frontier is now given by $E[u^h + u^w + \Sigma_{i=1}^N u_{si}^s] = I - p_v v + E[(a^w + \theta)^{1/2}] - (a^w)^2 + Nv^{1/2}$. Again, utility of the siblings and the altruistic head (the urban husband), is proportional to this expression. Hence, it is in everybody's interest to choose *v* so as to maximize this expression for each θ: $v^* = (N/2p_v)^2$. Notice that an increase in the number of rural siblings *N* will *increase* the number of home visits. This contradicts *proposition 2* where non-observability induced an increase in the number of rural siblings to *decrease* visits home. Like *proposition* 2, however, an increase in the price of traveling home will *increase* transfers to siblings. To see this, note that by the Cobb-Douglas nature of the husband's utility function, it follows that $\Sigma_i u_i^s = \Sigma_{i=1}^N (t_i^s + v^{1/2}) = (\alpha/1+\alpha)(1-\beta) * (I - p_v v + Nv^{1/2} + (a^w + \theta)^{1/2} - (a^w)^2)$. Substituting $v^* = (N/2p_v)^2$ and solving for the combined transfers to all siblings, $\Sigma_{i=1}^N t_i^s = (\alpha/1+\alpha)(1-\beta) * (I - (N^2/4p_v) + (a^w + \theta)^{1/2} - (a^w)^2)$, which is strictly increasing in p_v.

In sum, a simple extension to include altruism toward the siblings and valuing visits generates the same result with regards to the travel time home – transfers to siblings relationship but opposite predictions with regards to the number of siblings – visits home relationship. Also, unlike the moral hazard case where siblings of joint migrants do not have *valuable* information

[6] The wife`s utility could similarly be defined.

on the wife, the positive relationship between travel time home and transfers to siblings should apply to both split and joint migrants if utility is defined as above.

Section 3: Divided Loyalties and Split Migration in Kenya

Kenya is a particularly suitable country to study the endogeneity of information in household decision making because there is good reason to believe that the utility gains from split migration with cooperation – which requires information in most models - are likely substantial relative to either split migration with a non-cooperative voluntary transfer equilibrium or a full(er) information joint migration outcome that requires moving the family into a Nairobi slum environment.

The population of Nairobi is estimated to double every ten years, making it one of the fastest growing urban areas in Africa. Much of the growth is a result of rural-urban migration into the city's sprawling slums, which by some estimates is home to more than 70% of urban residents (APHRC, 2002; UN, 2004). As mentioned above, the poor living conditions in the slums make it an undesirable place for many to raise their families, providing an incentive in favor of split migration. Further, according to the anthropological literature, romantic love and conjugality – a couple's personal relationship to each other – *in marriage* is only recently emerging, in particular among urban elites (e.g. Smith, 2001). This suggests that altruism is less likely to play a facilitating role in solving intra-household conflicts and couples must place more weight on information acquisition as a means to reach efficient outcomes. Further, because customary and legal law provide men with more rights to land and inheritance than women, rural husbands and wives have frequently different incentives over the allocation of time and resources. Marriage is usually patrilocal, and upon divorce/separation or death of the husband, it is not uncommon that wives are forced off the land, especially early on in the marriage (Human Rights Watch, 2003). And, as elsewhere in sub-Saharan Africa, it is not uncommon that men have more rights over the sales of cash crops such as tea while women have more rights over the use of subsistence crops. Hence, if there is a risk that a cooperative equilibrium will be difficult to sustain, married women will seek to insure themselves, for example by investing time and resources into good relations with their natal families whose assistance can be crucial in times of need.

These observations were supported by the informal interviews conducted prior to the survey. Women express concerned that husbands living alone in the city (although interestingly usually not *theirs*) have extra-marital affairs and forget their families. In general, however, women expressed little faith in being able to control the sexual behavior of men, although there did seem to be a social norm that husbands must provide resources for their children regardless. In the words of one informant: "Many of the husbands living separately from their wives end up finding a different woman. Having relatives around won't stop these men, no one can control them. In fact, I know someone who married two sisters. Provided the men still take care of their families, there is nothing wives can do about this". Women do, however, employ more indirect ways to circumvent conjugal conflicts. For example, Anderson and Baland (2002) argue that high ROSCA participation by women in a Nairobi slum enables them to protect savings from husbands' claims. Also, some men mentioned that women sometimes send a first born child to live with the father as a way to keep an eye on him.

Conversely, men expressed worry about wives living in the rural area without their husbands. Men expressed fear that wives will get boyfriends, use part of the remittances on private goods such as nice clothes or divert them to their in-laws. Also, being a mostly patrilocal society, husbands may fear that their new wives simply lack intimate knowledge and experience to manage the local farm productively. This reluctance to just remit money home and leave the allocation to their wives is supported by various anthropological studies from Kenya. For example, in a study of a Luo community in Kenya's Nyanza Province, Francis (2000) notes: "Few migrants were willing to delegate financial responsibility and decision-making power to their wives. This reluctance stemmed from a deep-seated distrust of women's reliability". Not surprisingly, migrant men spoke of women's "divided loyalties". Similar patterns emerge from a review of several case studies from other parts of Kenya (Francis, 1998). And elsewhere, Ferguson (1997) notes in Lesotho: "[migrant] men […] accuse women of wasting money, of spending it indiscriminately, or even of giving it to their lovers."

Section 4: Data

The analysis below is based on a survey carried out in 2004 with a random sample of 1817 households with 'eligible household heads' in two Nairobi slums, Korogocho and

Viwandani[7]. The questionnaire for this survey was based on the 30 in-depth interviews which took place with households in one of Nairobi's largest informal settlements called Mathare, and in two rural areas. Eligible household heads were defined as having being *"ever married"* and between the ages of 24 and 56 years old; i.e. heads of households who were married and lived with their spouse together in the Nairobi informal settlement (858 in total or 57% of married men); heads of households who were married but lived split from their spouses (who usually live in the up-country village) (656 in total, or 43% of married men); as well as heads of households who were divorced or separated (153 in total), or widowed (150). There was no stratification by informal settlement area resulting in 60% of respondents from Viwandani and 40% from Korogocho. The population of eligible heads was identified using a sample frame developed by the African Population and Health Research Center (APHRC), which has been conducting a Demographic Surveillance System in these communities. Table 1 provides summary statistics on the sample of split migrants.

[Table 1: Summary Statistics]

As shown in table 1, the average split migrant is 36 years old, his rural wife is 30 years old, he has 9.3 years of education, about a year more than his rural wife, and the couple has 3.1 children. The vast majority, 92%, have access to farmland in their rural homes[8] which are on average just over 4 hours travel from Nairobi. Not shown in the table is the fact that practically none of the children to split migrants aged 0-5, and only 2 percent of children aged 6-14, and 7 percent of children aged 15-19 live with the husband in the urban area. The importance of the rural area is also underscored by the fact that virtually all migrants, 97% of split and 94 % of joint migrants, intends to retire in the rural home.

Yet, a clear downside is that the husband and wife will live apart, usually for years at end. At the time of the survey, the average split and joint migrant had lived in Nairobi for fourteen years, while the spouses of split migrants had only spent 1.8 years living in Nairobi at some point in their lives, compared to more than ten years for joint spouses.

Despite the long periods of separation, husbands are remitting relatively substantial amounts. The average split migrant remits approximately $23 every time he remits[9], and is estimated to do so on average 7.2 times per year – or $165, equivalent to 17% of his annual

[7]Korogocho location, Kasarani division, Nairobi District; Viwandani location, Makadara division, Nairobi district.
[8] 80% of joint households has access to farmland.
[9]Or Ksh 1,749 ($1 was approx. Ksh 76).

income.[10] A relatively inexpensive and safe way to remit would be the use of postal service money orders.[11] However, only 15% of split migrants uses this despite the wide coverage of the postal services, their common use in other contexts (for example to pay many public teachers), and low cost; remitting the average $23 costs only $2.40 for express delivery, which is the most expensive option but still a mere 27.8 % of the price of an average return trip to the rural home. Instead, the vast majority, 91% report traveling home to remit, while about half report using relatives (54%) or friends (44%).

Also consistent with non-unitary and non-transferable utility models of the household and consistent with the informal interviews, communication is important. Couples were reported to communicate in several ways. Among important means of communication, personal visits came first and were mentioned by 93% of respondents. In fact, the average split husband spends more than $92.4, or 9.5%, of his annual income on bus fares alone, traveling home at least 10.7 times per year. Women also visit their husbands but at not as often; they travel at least 3.1 times per year to Nairobi. Other forms of direct communication mentioned are "letters/email" (by 62%) and "(cell) phone" (39%). Indirect communication through kin is important too, with "siblings/relatives" (41%) mentioned slightly more often than "friends/neighbors" (39%). Lastly, at 7%, "children" are not mentioned as a common means of facilitating communication.

The survey also showed other ways in which husbands acquire information about the rural home. In particular, 74% of split migrants interviewed require their wives to submit budgets of intended expenditures before sending home remittances. Those that require their wives to submit budgets live considerably further away from their wives than those that do not; 4.31 hours travel instead of 3.58, a (significant) difference. Interestingly too, wives that are required to submit budgets have 0.31 more siblings than those who are not, a (significant) difference of 7.7%.[12]. Sometimes these budgets are verbal but often they are written, in the form of letters sent by the rural wife to the urban husband. In addition to visits and budgets, more than a third of the wives (34.5%) were reported to be monitored by one or more of the husbands' siblings. In fact, almost a quarter of all siblings (24.6%) were reported to *"follow the affairs of the home of the spouse, e.g. farm, activities, budget, etc."* Such monitoring is distinct from joint production.

[10] Respondents were asked to report the amount, month, and year of the last three times they remitted. The annual amount was estimated by extrapolating the frequency of remittances to cover the previous 1 year.
[11] Recently, sending small (or large) amounts through the MPESA mobile phone service has become hugely popular.
[12] P-values are 0.008 and 0.062 respectively, controlling for language group and clustering on district.

Only 1 in 10 of siblings reported to be following the wife's home affairs were also reported to assist the couple in farm or housework. Yet even with these strategies, information remains imperfect. Only 30% of split husbands claimed to know "exactly" how their rural spouses spend remittances. The vast majority, or 61%, claims to know it "somewhat", while a small minority, 9%, says "not to know it at all". The same holds for spouses, who have even slightly worse information about their husbands' expenditures with 12 percent of husbands indicating that their spouses know exactly their expenses, 57 percent somewhat, and 31 percent not at all.

Section 5: Empirics

I now turn to the multivariate analysis and first analyze how changes in the prices of monitoring technologies impact monitoring. I first explore monitoring by the husband and make use of the following reduced form specification:

$$y_i = \alpha_o + \beta_1 p_i^s + \beta_2 p_i^d + \gamma R_i + \varepsilon_{i,\eta} \quad (10)$$

where y_i is (a1) the number of visits home[13], (a2) whether or not at least one sibling is "following the affairs of the husband's rural wife", and (a3) whether the husband indicates that remittances depend on whether the wife has submitted a budget. Lastly, (b) y_i indicates whether or not urban husband *i* remits to his siblings. Variable p_i^s is the price of sibling monitoring measured by the number of siblings to the husband and p_i^d is the distance (in hours travel) to the rural home. R_i is a vector of variables that plausible affects the returns to monitoring; the number of siblings of the wife, years of education of both husband and wife, the wife's age, rural female unskilled wage (the local unskilled daily wage a woman living in the village could get when working on a neighboring farm – a common means to supplement farm incomes), and, since land markets are very illiquid, farm acreage. Controls for the three main language groups in Kenya (Bantu, Nilotic, Cushitic) are also included, as are the husband's earnings in the month prior[14]. Estimations 2, 4, and 7 in table 2 additionally control for ownership type of the rural farm and the number of children (0-5 and 6-18). The error term, $\varepsilon_{i,\eta}$ captures unobserved heterogeneity and is assumed to follow a normal distribution and to be independently distributed across

[13] The dependent variable asked "how often do you visit your rural home" and respondents could choose from (1) never, (2) at least once a year, (3) at least every 3 months, (4) at least once a month, (5) at least once a week, and (6) every day.

[14] The main findings are robust to exclusion of the husband`s earnings.

districts of origin but correlated within districts of origin[15]. The results in Table 2 are conform propositions 1 and 2 of the model[16].

[Table 2: Visits Home, Sibling Monitoring, and Submission of Budget by Wives]

Husbands Monitoring Wives First, the results show that monitoring takes place in ways that are consistent with the assumption of the cooperative bargaining and moral hazard models that information is valuable and worth investing in. In particular, the own-price effect on monitoring type is negative (*proposition 1*). Husbands whose rural homes are further away from Nairobi make significantly fewer visits home. At the mean travel time of 4.07 hours, an increase by 10% will reduce the number of home visits by 7.1% (column 1). Likewise, for each extra sibling to the husband (i.e. a reduction in the price of sibling monitoring), the likelihood that at least one of them monitors the wife's home affairs increases by 2.8% (column 3). Second, the cross-price effects are positive (*proposition 2).* Evaluated at the means, an increase in travel time of 10% will increase the likelihood of sibling monitoring by 0.86% (column 3), and an increase by 10% in the number of siblings (i.e. a decrease in the price of sibling monitoring) will reduce home visits by 0.97% (column 1). In other words, home visits and sibling monitoring are substitutes. Note that these reduced form coefficient estimates may be biased toward zero because of sample selection induced by marital matching. To see this, suppose that variation in search costs induces two types of marital matches: altruistic (*a*) and selfish (*s*). In rural areas close to Nairobi, couples of both types will engage in split migration since even if the match is of the *s* type, information is relatively inexpensive to obtain. In rural areas far from Nairobi, only couples in type *a* marriages will opt for split migration. Hence, altruism will be positively correlated with travel time. A similar argument can be made for selection on the number of husband siblings. Hence, even if costly information acquisition due to increased travel time or fewer siblings would reduce reliance on visits home and sibling monitoring, respectively, this marital selection induced selection on unobservables would mitigate these effects. In other words, these are lower bound estimates. For the third set of estimations, with regards to the budget requirement, it is not clear what the own price is. The price of sending a message with budget details through a friend, via mobile text, or via a letter is unlikely to vary with transport

[15] Kenya counts 69 districts.
[16] The sample is restricted to migrants only and excludes 15 percent of husbands who were born in Nairobi.

time. Consistent with proposition 2, columns 5-6 show that distance to the rural home increases the budget requirement, thus suggesting it substitutes for the reduction in visits home and complements increased sibling monitoring. More husband siblings, which enable more sibling monitoring and reduced home visits, does neither reduce nor increase budget requirements.

To understand what motivates such monitoring I next explore what non-price variables affect monitoring such as demographics and variables around land. Clearly, the coefficients on these variables in the home visits estimation must be interpreted with caution since they are not always marginal affects purely of 'monitoring', but may partly reflect other motivations for visiting.

First, concern about the wife's efforts or ability in child care does not seem to motivate monitoring. The presence of children in either age category has no significant effect on sibling monitoring or budget submissions, nor does the presence of young children increase home visits. In the context of the public goods model above, this may suggest that the wife's marginal propensity to spend resources and time on child related goods is high. The value of requiring budget submissions may lie more in restricting the allocation of non-child expenditures that come after the wife has met a certain threshold of expenditures on child goods. That the rural presence of children in the ages 6-17 does increase home visits (column 2) without affecting sibling monitoring or budgets suggest that these visits are unlikely to be motivated by monitoring. Perhaps the father simply wants to spend time with his children and/or there are complementarities between the mother's and father's time in raising teenage children.

Second, budget requirements are more likely for women who can earn higher daily casual wages in the rural area (e.g. by working on a neighbor's farm, a nearby factory etc.) without affecting visits home or sibling monitoring. This would be consistent with the idea that husbands are more likely to require justification (through budgets) for the need to remit if their wives can more easily earn independent incomes. It also suggests that siblings may not be able to monitor the wife's expenses well.

Third, older women are significantly less likely to be monitored by their husbands' siblings than younger women. This finding is consistent with a number of hypotheses. First, sample selection: if poor spousal matches lead to spousal separation, then older couples in the sample should be better matched, and thus require less monitoring than younger ones. Second, it is consistent with the hypothesis that husbands may have greater fears that their wives will

engage in extra-marital affairs when they are young. However, it is also consistent with the idea that her management (including her time allocations) of the farm is motivating such sibling monitoring, either because younger women spend relatively more time caring for crops over which they have more ownership as a way of insurance in a still risky split marriage, or because younger women are less experienced on the farm. The latter is also supported by the fact that the age of the wife does not affect budget submissions, since budgets are unlikely to be a good indicator of her farm management. Older women do not receive fewer home visits, but the reduced need for monitoring through home visits may well be confounded here with life cycle effects that increase home visits as the couple grows older. That concerns about farm management motivate monitoring is also supported by increased sibling monitoring and visits home as farm size increases. Farm size does not increase budget submissions but these are again unlikely to provide valuable information on farm management. Similarly, the coefficients on land ownership type further support the idea that husbands are concerned about farm management. Husbands are considerably more likely to engage in sibling monitoring if not they, but their wives own the farm (at 2%, a rare event), and significantly less likely to engage their siblings if landownership is joint. Joint land ownership (26% of couples) is also significantly less associated with the budget requirement. In situations where there is no rural farmland, the husband is similarly less likely to have siblings monitor or have remittances depend on budget submissions. He is, however, significantly more likely to visit.

Lastly, recall that the notion of 'divided loyalties' appealed both to differing incentives over land management as well as the need for the wife to invest in informal insurance arrangements through her own extended family as well as the extra demands for financial support that come with more in-laws. The impact of the latter is explored with the variable on the number of siblings to the wife, which is indeed associated with significant increases in the budget requirement. The presence of more in-laws does not raise husband sibling monitoring, but as mentioned above, sibling monitoring is unlikely to provide valuable information on her expenses. In fact, it is actually associated with a significant reduction in sibling monitoring. One possible explanation for this reduction points to the simultaneous increase in visits home as the number of siblings to the spouse increases. If husbands opt to visit home more frequently (and depend also more on budget submissions) in situations where the wife has more dependents, there is less need to rely for siblings to monitor, for example, farm affairs. A similar explanation,

supported by the regression evidence on remittances discussed below, is that migrants shift from remitting cash to remitting in kind goods (which are more difficult to transfer) when the number of siblings by the wife increases. If in-kind goods require more frequent visits home that could similarly reduce the need for sibling monitoring.

In sum, sibling monitoring and budgets are used more frequently when travel becomes costly. However, sibling monitoring seems more effective in monitoring her actions and budgets more effective in monitoring expenses. There is little evidence that concerns about child allocations are motivating monitoring. Rather, concerns about her farm allocations and possibly extra-marital affairs are more likely determinants.

Wives Monitoring Husbands The survey did not interview rural women and thus does not contain detailed information on, for example, sibling (to the wife) monitoring of the husband's actions. I am, however, able to explore whether visits to the husband are similarly inversely related to the size of her sibling network and whether women indeed ask older children to live with the husband as was suggested by some.

[Table 3: Visits by the Wife, Grown Boy/Girl Living with Father]

The results on urban visits by the wife show the opposite as rural visits by the husband: the number of her siblings, especially urban siblings, affects her urban visits positively rather than negatively. Distance to the urban area, on the other hand, does reduce urban visits. The husband was also asked to estimate how many people he knows from his rural village that have similarly migrated and now live nearby in the same slum. Column 2 controls for this and also shows that there is no indication that the presence of community members reduces the number of visits she makes. These findings suggest that neither siblings nor community members in the slum play an important role in monitoring. However, it does not imply that she does not use other monitoring strategies such as these visits themselves. Columns 3 and 4 test for the hypothesis that some women will send a first born child to live with the father to keep an eye on his actions, provided the child is old enough. Indeed, column 3 shows that boys in the ages 10-18 are significantly more likely to be living with their father in the urban area the further away the rural home. Thus for wives, this suggests that urban visits and having a grown boy in the urban area are substitutes. Column 4 shows that the same significant relationship between distance and the father's age does not hold for girls. The distance effect disappears also altogether for boys

and girls under the age of 10.[17] Lastly, column 3 also shows that conditional on the total number of boys 10-18, older fathers are less likely to be living in the urban area with a boy aged 10-18. This is consistent with the idea that the wife's need to monitor her husband's actions is less for couples who have managed to live split for longer periods.

Remittances to Siblings Migrants were also asked about their remittances to siblings. Indeed, remittances to monitoring siblings were more common; 45 percent of monitoring siblings received support from the migrant husband, compared to 30 percent of non-monitoring siblings, financial support especially. Table 4 investigates *proposition 3* of the model, which stated that if the wife lives together with the migrant husband in the urban area, siblings do not add "valuable" signals about the wife's actions, but they do in split migration. An increase in the price of traveling home (p_d) should therefore have no effect on remittances to his siblings among joints, but should among splits.

[Table 4: Remittances to Siblings; Split vs Joint]

The first regression limits the sample to split migrants, the second to joint migrants. Consistent with the monitoring model, it shows that conditional on the total number of siblings, an increase in travel time home increases the likelihood that the husband remits to his siblings. Also consistent (but inconsistent with the altruism model in which visits were valued for their own sake) is the reverse finding for joint migrants: the further away their rural home of origin, the less likely they are to remit to their siblings. If anything, this suggests joint migrants display 'sibling-avoidance'.

Remittances to the Wife As explained in *proposition 4*, the effect of remittances is ambiguous depending on what motivates remittances, how risk averse the husband and wife are, and the riskiness of home and farm production. In the moral hazard model, when remittances serve to compensate the rural wife, more information through increased monitoring will induce lower average remittances to the risk-averse wife. Instead, when public goods consumption motivates remittances, more information is likely to increase remittances. The following

[17] Results available on request

econometric specification explores the relation between (the cost of) information and remittances:

$$y_i = \alpha_o + \delta_1 \hat{m^s}_i(p^s_i) + \delta_2 \hat{m^d}_i(p^d_i) + \pi R_i + \varepsilon_{i,\eta} \quad (11)$$

where y_i is now (a) the amount of cash remittances (in Ksh) to the rural wife in the past four months by migrant *i*, (b) the value (in Ksh) of remittance made in-kind, and (c) the share of in-kind remittances in total remittances. Variables m_i^d and m_i^s are *visits home* and *sibling monitoring*, respectively, which were the dependent variables in the previous regressions. They are instrumented in each regression with the total number of siblings of the husband and distance to the rural home (incl. its square). This follows directly from the moral hazard model above. Again, R_i is the same vector of plausible variables that affect the returns to monitoring. The error term, $\varepsilon_{i,\eta}$, is defined as above. Table 5a shows the reduced form estimates and Table 5b shows the (GMM) estimates with sibling monitoring and visits home instrumented.

[Table 5a and b: Remittances to Wife]

The reduced form estimates in columns 1, 2, and 3 of table 5a indicate that there is no significant relationship between the cost of sibling monitoring and travel time on the one hand and the value of cash remittances, remittances in kind (valued by the respondents in Ksh), and the share of in-kind remittances in total remittances on the other hand. This is consistent with the ambiguity in the predictions, although the sample selection problem due to unobserved heterogeneity in the spousal match described above may also be biasing these results away from the prediction by the public goods model that increased information will generally increase remittances.

Columns 4a and 4b in Table 5a look at the extensive margin of remittances and predict whether husbands give any cash (column 4a) or in-kind (column 4b) remittances. The results show that the likelihood of sending any amount of cash does in fact decrease with travel time. Note also the significant coefficients on farm ownership type in these last two columns: migrants are more likely to send cash transfers to their wives if they (i.e. the husbands) are *not* the sole owners of the rural land. Column three similarly shows that relative to couples where the husband owns the land, the share of in-kind remittances is lower in all other land ownership types. This could either reflect the type of marital match, the risk that remittances will be diverted if the wife has more limited land rights, or some combination. In either case, this result

and the finding that cash remittances are less likely if monitoring becomes costly is consistent with the model above where husbands will opt to remit in ways that reduce the risk of diversion if information becomes costly.

Lastly, the estimations in table 5b replicate those in table 5a except that travel time home and the number of siblings are now used to instrument the number of visits home and sibling monitoring. Except for the finding that more visits to the spouse increase in-kind remittances, the other coefficients are not significant. Again, this could reflect the ambiguous prediction, but the estimation itself is also likely problematic since the first stage F statistic for sibling monitoring is 5.64, which suggests the instruments are weak. Finally, column 3 indicates that an increase in the number of siblings to the wife increases the share of in-kind remittances in overall remittances.

Information and Efficiency In sum, these monitoring and remittance findings underscore the importance of information for family decision-making in a context where spousal conflict over the allocation of marital resources is likely to arise. The findings indicate several efficiency losses caused by costly information acquisition. First, there are the direct costs of monitoring, including bus fares, remittances to monitoring siblings, and adolescent children moving to Nairobi to live with the father. As mentioned above, split couples spend $119, or 12% of the husband's annual urban income (and nearly a quarter of per capita GDP), on bus fares alone. Of course, some of these visits would take place even if information was perfect, but even modest reductions in the frequency of visits (perhaps even compensated for by longer duration) would generate substantial savings. Second, the remittance results suggest that despite the monitoring, husbands do not always remit in ways that are consistent with efficient family decision making. For example, the fact that husbands are less likely to remit cash if the rural home is far suggests efficiency losses. Similarly, the coefficients on landownership indicate that husbands reduce remittances or switch to in-kind remittances whenever conflict over farm allocations is likely to arise. And third, there may be negative welfare consequences for some of the teenage boys who move to the urban slum to live with the husband when distance makes personal travel costly. But the results also show ways in which households manage to mitigate efficiency losses: for example, by shifting toward in-kind remittances rather than cash. In fact, the observation that households invest substantially in monitoring itself indicates that the welfare gains from doing so must be large.

Most of the efficiency losses from costly information acquisition may not be happening on the intensive margin (among split migrants), but rather on the extensive margin as increases in the cost of monitoring reduce the benefits of split migration relative to no- and joint migration. A comparison of travel time indicates that the rural homes of joint migrants are, on average, almost 25% further from Nairobi than those of split migrants (five hours instead of four). In other words, costly monitoring may be pushing families to move into the Nairobi slums, despite its bad living conditions which leave especially young children at much higher health risks; still, a cooperative joint migration outcome in a bad living environment may be preferred to a non-cooperative split migration outcome in a better environment.

Household Allocations and the Marriage Market As emphasized by Becker (1973) and others since, as long as people are forward looking, the allocation of resources within marriage should be an important determinant of marriage market behavior and vice versa. Given the welfare gains for some of cooperative behavior in split migration over (i) non-cooperative behavior in split marriages and over (ii) joint (or no-) migration, and the fact that cooperative behavior in split marriages becomes more difficult to enforce in an environment of imperfect information, we should expect that men and women seeking to undertake split migration will be willing to make substantial investments into marital search that enriches their marital information set. This hypothesis is explored in the first two columns of table 6, which provides a comparison of marriage market outcomes between split and joint migrants: (1) whether the couple co-habited before marriage; and, (2) the length of time couples have known each other at the time of marriage.

[Table 6: Marriage Market Characteristics]

Indeed, controlling for cohort and language group effects and clustering on district of origin, couples undertaking split migration are 8.8 percentage points more likely than joint migrants to have co-habited before marriage, 55% compared to 46%. They have also known each other a bit longer before marriage, although this result is not quite significant (p-value is 0.123). Column (4) also indicates that wives in split households have significantly fewer sibling (0.6) than wives in joint households. This is consistent with idea that in-laws make split migration risky (recall that in-laws increase home visits, the budget requirement, and there is some evidence that they increase the share of remittances in kind). Hence, having fewer in-laws would

facilitate cooperative outcomes in split marriages. Column 4 further shows that the husband's family was 19 percentage points more likely to be richer than the wife's (prior to marriage) in split than joint couples. One similar explanation could be that her poorer relatives provide a less attractive insurance opportunity, thus providing her with fewer incentives to divert resources toward her own relatives and invest more relations with her wealthier in-laws, thus adding to the benefits of split migration.

Finally, columns 5 and 6 show that wives in split marriages are 30 percentage points more likely to receive in-kind bride price. Such pre-marital transfers may serve various functions consistent with the idea that entering into a split migration relationship is risky, especially for women. It can simply serve as insurance to the wife; for example, a cow which can provide a source of income even if the husband is not remitting. It could also serve as a costly signaling device where potential husbands "willing" to undertake cooperative behavior signal to potential spouses and differentiate themselves from "unwilling" types (Camerer, 1988) or as a commitment device as in Carmichael and MacLeod (1997), who develop a model which shows that a social convention requiring the use of certain types of "inefficient" gifts at the beginning of the relationship can support long-term cooperation by making it costly for a partner to undertake a strategy of playing non-cooperatively in the current marriage when the spouse behaves cooperatively, switching marriage partners, and repeating this.

In short, consistent with Becker's prediction, these comparisons of marriage market characteristics suggest that the information set within marriage is crucial and thus becomes endogenous to marital search.

Section 6: Conclusion

The evidence presented in this paper supports the assumption that access to information on the actions of others has important implications for household decision making. In the context of Kenya, it helps explain sibling relations, residential locations of household members such as the teenage boys moving to the urban area, and can help explain the co-existence of split and joint migration. It would be interesting to see if several recent developments in Kenya (and countries with similar migration patterns) interact with these in ways consistent with these empirical observations. For example, the new Kenyan constitution (which was rejected in a

referendum) included clauses that gave more equal rights to land and inheritance for women. Would this lead to more split migration and reduce marital search? Or, the rapid increase in mobile phone ownership, observed not just in Kenya but throughout the developing world, which according to data from APHRC rose from 9% of households in 2003 to 47% in 2006 in these same slums. Does this enable more cooperative and thus efficient outcomes? Similarly, the evidence in this paper may explain the rise of websites aimed international migrants wishing to send in-kind goods rather than cash. For example, one such website for Kenya[18], allows people to pay directly for school fees, electricity bills, phone vouchers, fuel vouchers, etc. Will such websites stimulate more remittances to Kenya and other countries? More generally, the evidence in this paper supports not only the common assumption that the information set is a critical determinant of household behavior, but also that members of households will seek to enrich this information set whenever the gains from doing so will be large, both through monitoring and the marriage market. As such, it adds an important dimension to our understanding of household decision making processes.

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Apendix: Figures and Tables

Table 1: Split Migrant Characteristics

	Variable	Mean	St. Deviation	N
Demographic	Age husband	36.45	7.76	508
	Age wife	29.83	7.21	502
	Years of schooling husband	9.34	2.61	510
	Years of schooling wife	8.11	2.45	510
	Last month's earnings (67 Ksh = 1USD) husband	6177.35	3220.88	469
	Number of children	3.08	1.91	507
	No. of children <6 in rural home	1.04	0.86	510
	No. of children 6-17 in rural home	1.47	1.44	510
	No. siblings head	4.75	2.44	510
	No. siblings spouse	4.31	2.45	510
Rural home	Women daily casual wage (Ksh) in rural home	84.22	35.94	510
	Acres of farm land- access by wife	4.57	7.40	510
	Husband owns farm (prop.)	0.28	0.45	509
	Wife owns farm (prop.)	0.02	0.13	509
	Joint owners farm (prop.)	0.26	0.44	509
	Other owns farm (prop.)	0.36	0.48	509
	No farm (prop.)	0.08	0.27	509
	Transport time (hours) to rural home	4.07	2.59	510
Visits, monitoring, remittances	No. annual visits home husband (lower bound)	10.65	11.23	507
	No. annual visits urban area wife (lower bound)	3.08	3.92	507
	Husbands w/ at least one sibling following wife affairs (prop.)	0.35	0.48	510
	Wife submits budget before husband remits (prop.)	0.74	0.44	502
	Husbands remits to siblings (prop.)	0.41	0.49	510
	Cash remittances (Ksh) to wife past 4 months	4444.48	4220.01	510
	Inkind remittances (Ksh) to wife past 4 months	1347.92	2533.20	510
Marriage market	Couple lived together before marriage (prop.)	0.56	0.50	509
	Years know each other before marriage	2.31	2.45	505
	Brideprice cash (Ksh)	6066.80	11777.03	488
	Brideprice included in-kind gifts (prop.)	0.66	0.47	488
	Wife's family richer before marriage (prop.)	0.16	0.37	505
	Equal wealth before marriage (prop.)	0.51	0.50	505
	Husband's family richer before marriage (prop.)	0.33	0.47	505

Table 2: Visits Home, Sibling Monitoring, and Submission of Budgets by Wives

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Visits Home	Visits Home	Sibling Monitoring	Sibling Monitoring	Wife Submits Budget	Wife Submits Budget	Wife Submits Budget
No. siblings head	-0.021**	-0.020**	0.029***	0.036***	0.008	0.008	0.007
	(0.009)	(0.009)	(0.010)	(0.011)	(0.008)	(0.008)	(0.008)
No. siblings spouse	0.039***	0.039***	-0.011**	-0.018**	0.011**	0.011**	0.012**
	(0.010)	(0.010)	(0.006)	(0.007)	(0.005)	(0.005)	(0.005)
Transport time to home/spouse	-0.301***	-0.299***	0.070**	0.078**	0.031	0.026***	0.027***
	(0.046)	(0.050)	(0.029)	(0.032)	(0.036)	(0.009)	(0.009)
Transport time home squared	0.015***	0.015***	-0.006***	-0.006**	-0.000		
	(0.004)	(0.005)	(0.002)	(0.003)	(0.003)		
Years of schooling husband	0.021	0.015	0.006	-0.011	-0.003	-0.003	-0.001
	(0.013)	(0.022)	(0.010)	(0.010)	(0.012)	(0.012)	(0.011)
Years of schooling wife	0.017	0.020	-0.014	0.007	-0.003	-0.003	-0.004
	(0.021)	(0.013)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)
Women daily casual wage	-0.000	-0.000	0.000	0.001	0.001*	0.001**	0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Acres of land- access by spouse	0.004*	0.004**	0.006***	0.004***	0.003	0.003	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)
Monthly income (log) husband	0.140***	0.162***	0.002	0.006	0.073*	0.073*	0.066
	(0.047)	(0.046)	(0.029)	(0.026)	(0.042)	(0.042)	(0.041)
Age wife	0.003	-0.002	-0.006	-0.005*	-0.001	-0.001	0.002
	(0.004)	(0.006)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Wife owns farm (leftout = husband owner)		-0.175		0.466***			-0.060
		(0.280)		(0.170)			(0.199)
Joint owners farm (leftout = husband owner)		-0.040		-0.284***			-0.103*
		(0.071)		(0.074)			(0.056)
Other owns farm (leftout = husband owner)		0.030		0.019			0.001
		(0.084)		(0.065)			(0.047)
No farm (leftout = husband owner)		0.209*		-0.197***			-0.197***
		(0.118)		(0.052)			(0.070)
Number of rural children between 0-5		-0.032		-0.007			0.008
		(0.035)		(0.024)			(0.026)
Number of rural children between 6-17		0.042*		0.000			-0.017
		(0.020)		(0.020)			(0.015)
Language group controls (Bantu, Nilotic, Cushitic)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	496	495	496	495	491	491	490
R-squared	0.3501	0.3625	0.0460	0.1270	0.0489	0.0489	0.0652
	OLS	OLS	Probit	Probit	Probit	Probit	Probit

Robust standard errors (cluster on district of origin) in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Probit: marginal probabilities (dprobit) reported

The number of home visits was also estimated Poisson regressions – the significance of the coefficients is nearly the same[19]

[19] Poisson results are available upon request

Table 3: Urban Visits by Rural Wife and Children Living with Husband

	(1)	(2)	(3)	(4)
	Urban Visits by Wife	Urban Visits by Wife	Boys 10-18 w/ husband	Girls 10-18 w/ husband
No. siblings head	0.001	0.005	-0.001	0.000
	(0.011)	(0.010)	(0.003)	(0.001)
No. siblings spouse	0.031*			
	(0.016)			
No. urban siblings spouse		0.071**	0.006	0.014
		(0.028)	(0.016)	(0.016)
Transport time to home/spouse	-0.038	-0.033*	0.028*	0.011
	(0.046)	(0.016)	(0.014)	(0.008)
Transport time home squared	0.000		-0.002*	-0.001
	(0.004)		(0.001)	(0.000)
Years of schooling husband	-0.013	-0.010	0.005	0.001
	(0.012)	(0.012)	(0.004)	(0.002)
Years of schooling wife	0.037**	0.031*	-0.005	0.002
	(0.015)	(0.015)	(0.005)	(0.002)
Women daily casual wage	0.001	0.001	-0.000	-0.000
	(0.001)	(0.001)	(0.000)	(0.000)
Acres of land- access by spouse	0.008***	0.007***	-0.001	-0.000
	(0.003)	(0.002)	(0.001)	(0.001)
Monthly income (log) husband	0.219***	0.218***	-0.004	0.004
	(0.050)	(0.052)	(0.019)	(0.007)
Age husband	0.004	0.006	-0.003**	-0.000
	(0.005)	(0.005)	(0.001)	(0.000)
Wife owns farm (leftout = husband owner)	-0.450*	-0.425*	0.072	0.005
	(0.248)	(0.239)	(0.108)	(0.011)
Joint owners farm (leftout = husband owner)	-0.022	-0.008	-0.028	-0.009
	(0.099)	(0.106)	(0.022)	(0.008)
Other owns farm (leftout = husband owner)	0.105	0.121	0.031	-0.006
	(0.099)	(0.099)	(0.028)	(0.007)
No farm (leftout = husband owner)	-0.168	-0.144	0.021	0.019
	(0.143)	(0.148)	(0.056)	(0.025)
Number of rural children between 0-5	-0.054	-0.049		
	(0.050)	(0.051)		
Number of rural children between 6-17	-0.008	-0.009		
	(0.017)	(0.017)		
Total no. of boys between 10-18 years			0.080***	0.011
			(0.024)	(0.010)
Total no. of girls between 10-18 years			0.031*	0.010
			(0.016)	(0.009)
Knowing # people from origin community in		-0.022	0.019	0.016
urban slum: 1-10 (leftout = 0)		(0.145)	(0.040)	(0.011)
Knowing # people from origin community in		-0.047	-0.011	-0.002
urban slum: 11-30 (leftout = 0)		(0.175)	(0.032)	(0.004)
Knowing # people from origin community in		0.157	-0.003	0.002
urban slum: 31-50 (leftout = 0)		(0.153)	(0.038)	(0.010)
Knowing # people from origin community in		0.092	-0.007	-0.006
urban slum: 50+ (leftout = 0)		(0.131)	(0.038)	(0.009)
Head consumes alcohol		0.042	-0.012	-0.007
		(0.069)	(0.019)	(0.007)
Language group controls (Bantu, Nilotic, Cus	Yes	Yes	Yes	Yes
N	500	495	498	498
R-squared	0.1046	0.1162	0.1098	0.0844
	OLS	OLS	OLS	OLS

Robust standard errors (cluster on district of origin) in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Remitting to Siblings (Split versus Joint Migrants)

	(1)	(2)
	Remit to husband siblings (Split)	Remit to husband siblings (Joint)
No. siblings head	0.021***	0.020***
	(0.007)	(0.006)
No. siblings spouse	0.014	0.010
	(0.015)	(0.008)
Transport time to home/spouse	0.102***	-0.029**
	(0.035)	(0.013)
Transport time home squared	-0.007***	0.002
	(0.003)	(0.001)
Years of schooling husband	-0.012	0.020*
	(0.010)	(0.012)
Years of schooling wife	0.030***	0.007
	(0.008)	(0.009)
Women daily casual wage	0.000	-0.000
	(0.001)	(0.001)
Acres of land- access by spouse	-0.000	-0.004
	(0.002)	(0.003)
Monthly income (log) husband	0.185***	0.110***
	(0.033)	(0.039)
Age wife	-0.007***	-0.004
	(0.002)	(0.004)
Language group controls (Bantu, Nilotic, Cushitic)	Yes	Yes
N	496	564
R-squared	0.0885	0.0615
	Probit	Probit

Robust standard errors (cluster on district of origin) in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Probit: marginal probabilities (dprobit) reported

Table 5a: Remittances to the Rural Wife – reduced form

	(1)	(2)	(3)	(4a)	(4b)
	Cash (Ksh) Remittances to Wife	In-kind (Ksh) Remittances to Wife	Share In-kind Remittances	Positive Cash Remittances to Wife	Positive In-kind Remittances to Wife
No. siblings head	-58.165	15.121	0.003	-0.004	-0.008
	(66.915)	(26.288)	(0.005)	(0.009)	(0.006)
No. siblings spouse	-4.229	24.942	0.005	0.001	0.019**
	(57.271)	(19.606)	(0.003)	(0.007)	(0.008)
Transport time to home/spouse	-69.440	11.793	0.005	-0.035*	0.002
	(287.012)	(147.884)	(0.018)	(0.020)	(0.031)
Transport time home squared	10.672	-6.824	-0.001	0.004**	-0.000
	(22.730)	(12.069)	(0.001)	(0.002)	(0.003)
Years of schooling husband	56.065	16.906	0.010*	-0.006	0.020***
	(86.861)	(81.247)	(0.006)	(0.007)	(0.007)
Years of schooling wife	15.268	30.177	-0.005	0.000	-0.009
	(109.962)	(79.887)	(0.007)	(0.007)	(0.012)
Women daily casual wage	0.535	-4.089	-0.000	0.000	-0.001
	(3.548)	(4.288)	(0.001)	(0.000)	(0.001)
Acres of land- access by spouse	-1.685	4.491	0.001	-0.002	0.001
	(13.612)	(11.182)	(0.001)	(0.001)	(0.002)
Monthly income (log) husband	1,935.845***	711.184***	0.012	0.030*	0.126**
	(283.382)	(162.502)	(0.032)	(0.018)	(0.056)
Age wife	65.097**	-14.612	-0.005***	0.000	-0.007**
	(29.668)	(14.476)	(0.002)	(0.003)	(0.003)
Wife owns farm (leftout = husband owner)	1,037.135	-1,904.886***	-0.326***	0.091***	-0.250
	(1,315.691)	(334.855)	(0.048)	(0.028)	(0.218)
Joint owners farm (leftout = husband owner)	1,773.891***	-1,110.772***	-0.169***	0.145***	0.182***
	(607.150)	(275.528)	(0.033)	(0.020)	(0.067)
Other owns farm (leftout = husband owner)	1,041.027*	-1,452.483***	-0.226***	0.182***	-0.015
	(530.334)	(274.744)	(0.037)	(0.022)	(0.075)
No farm (leftout = husband owner)	445.641	-1,325.436***	-0.242***	0.088***	-0.139*
	(563.570)	(201.753)	(0.039)	(0.029)	(0.084)
Number of rural children between 0-5	-140.052	-108.257	-0.010	0.026	0.055**
	(182.578)	(91.709)	(0.011)	(0.020)	(0.023)
Number of rural children between 6-17	-36.223	69.959	0.004	0.007	-0.000
	(150.702)	(85.541)	(0.011)	(0.008)	(0.017)
Language group controls (Bantu, Nilotic, Cushitic)	Yes	Yes	Yes	Yes	Yes
N	495	495	463	492	495
R-squared	0.1437	0.1334	0.1310	0.1982	0.0984
	OLS	OLS	OLS	Probit	Probit

Robust standard errors (cluster on district of origin) in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Marginal probabilities reported in columns 4a and 4b

Table 5b: Remittances to the Rural Wife

	(1)	(2)	(3)
	Cash (Ksh) Remittances to Wife	In-kind (Ksh) Remittances to Wife	Share In-kind Remittances
Is there a sibling monitoring wife	-2,468.650	410.552	0.116
	(1,878.053)	(724.275)	(0.179)
Visits head to spouse	-532.186	477.655**	0.027
	(470.366)	(239.509)	(0.033)
No. siblings spouse	-26.012	19.173	0.006*
	(58.490)	(21.530)	(0.004)
Years of schooling husband	48.298	41.972	0.011
	(82.289)	(69.000)	(0.007)
Years of schooling wife	46.426	6.242	-0.006
	(114.138)	(73.504)	(0.009)
Women daily casual wage	1.570	-6.399*	-0.000
	(3.298)	(3.730)	(0.001)
Acres of land- access by spouse	9.443	7.085	0.000
	(16.747)	(10.121)	(0.002)
Monthly income (log) husband	2,010.883***	581.622***	0.005
	(276.154)	(132.400)	(0.030)
Age wife	51.275*	-14.962	-0.004*
	(28.451)	(15.320)	(0.002)
Wife owns farm (leftout = husband owner)	1,986.825*	-1,865.248***	-0.354***
	(1,197.167)	(467.943)	(0.095)
Joint owners farm (leftout = husband owner)	1,085.024	-934.257***	-0.137***
	(789.832)	(203.676)	(0.044)
Other owns farm (leftout = husband owner)	1,124.445**	-1,392.953***	-0.226***
	(548.428)	(258.501)	(0.041)
No farm (leftout = husband owner)	34.898	-1,366.074***	-0.223***
	(638.882)	(252.313)	(0.055)
Number of rural children between 0-5	-175.164	-98.571	-0.007
	(165.662)	(97.882)	(0.011)
Number of rural children between 6-17	-13.830	53.229	0.001
	(169.576)	(80.846)	(0.012)
Language group controls (Bantu, Nilotic, Cushitic)	Yes	Yes	Yes
N	495	495	463
R-squared	0.0836	0.1170	0.0717
	GMM	GMM	GMM
P-value Hansen J-statistic overid test	0.7771	0.2666	0.6529

Robust standard errors (cluster on district of origin) in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

First stage F-statistic (weak instruments): (1) Is there a sibling monitoring the wife = 5.64

First stage F-statistic (weak instruments): (2) Visits head to spouse = 44.71

Estimations 4, 5, and 6: Sibling monitoring and visits to rural spouse are instrumented with No. of siblings head, Travel time, and Travel time squared

Table 6: Marriage Market Characteristics

	(1) Lived together before marriage	(2) Years known before marriage	(3) Number of siblings spouse	(4) Husband's family richer before marriage	(5) Cash amount brideprice	(6) Paid inkind brideprice
Split household	0.088***	0.246~	-0.599***	0.191***	233.365	0.298***
	(0.032)	(0.154)	(0.121)	(0.048)	(572.020)	(0.032)
Language group controls (Bantu, Nilotic, Cushitic)	Yes	Yes	Yes	Yes	Yes	Yes
Cohort controls	Yes	Yes	Yes	Yes	Yes	Yes
N	1061	1045	1066	1054	955	955
R-squared	0.0159	0.0254	0.0373	0.0065	0.0238	0.0804
	Probit	OLS	OLS	Ordered Probit	OLS	Probit

Robust standard errors (cluster on district of origin) in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
~ p-value: 0.123
Probit: marginal probabilities (dprobit) reported

Appendix: Comparative Statics:

Proposition 1 An increase in the price p_i of signal m_i will lead to a decrease in the amount m_i being purchased if $\partial^2\sigma^2_{\varepsilon_a} \big/ \partial m_i{}^2 > 0$: $\dfrac{dm_i}{dp_i} < 0 \;\; for \;\; i = d, s$

The comparative static is given by:

Numerator: $\overbrace{\left(\dfrac{\partial^2 B}{\partial\left(\sigma^2_{\varepsilon_a}\right)^2}\right)}^{+/0/-}\overbrace{\left(\dfrac{\partial\sigma^2_{\varepsilon_a}}{\partial m_j}\right)^2}^{+} + \overbrace{\left(\dfrac{\partial B}{\partial\left(\sigma^2_{\varepsilon_a}\right)}\right)}^{-}\overbrace{\left(\dfrac{\partial^2\sigma^2_{\varepsilon_a}}{\partial m_j{}^2}\right)}^{+} < 0$ if $\left(\dfrac{\partial^2\sigma^2_{\varepsilon_a}}{\partial m_j{}^2}\right)$ is sufficiently large.

Notice that the sign of the first term above, $\overbrace{\left(\dfrac{\partial^2 B}{\partial\left(\sigma^2_{\varepsilon_a}\right)^2}\right)}^{+/0/-}$, is not entirely clear. A reduction in the variance of the measurement error will increase benefits by reducing the expected transfer level. Whether a reduction in the variance leads to a relatively large reduction in the expected transfer level (and thus a large increase in the expected benefits) when the variance is large (causing the second derivative of the benefit function to be negative) or vice versa, is not clear. Allowing for this second derivate to be positive implies that $\left(\dfrac{\partial^2\sigma^2_{\varepsilon_a}}{\partial m_j{}^2}\right)$ must be sufficiently positive for the numerator to be negative.

Denominator: The denominator is given by:

$$\overbrace{\left(\frac{\partial B}{\partial\sigma^2_{\varepsilon_a}}\right)}^{-}\overbrace{\left(\frac{\partial^2 B}{\partial\left(\sigma^2_{\varepsilon_a}\right)^2}\right)}^{+/0/-} * \overbrace{\left\{\overbrace{\left(\frac{\partial\sigma^2_{\varepsilon_a}}{\partial m_j}\right)^2}^{+}\overbrace{\left(\frac{\partial^2\sigma^2_{\varepsilon_a}}{\partial m_i{}^2}\right)}^{+} + \overbrace{\left(\frac{\partial\sigma^2_{\varepsilon_a}}{\partial m_i}\right)^2}^{+}\overbrace{\left(\frac{\partial^2\sigma^2_{\varepsilon_a}}{\partial m_j{}^2}\right)}^{+} - 2\overbrace{\left(\frac{\partial\sigma^2_{\varepsilon_a}}{\partial m_i}\right)}^{-}\overbrace{\left(\frac{\partial\sigma^2_{\varepsilon_a}}{\partial m_j}\right)}^{-}\overbrace{\left(\frac{\partial^2\sigma^2_{\varepsilon_a}}{\partial m_i\partial m_j}\right)}^{+}\right\}}^{+} +$$

$\overbrace{\left(\frac{\partial B}{\partial \sigma_{\varepsilon_a}^2}\right)^2}^{+}\left\{\overbrace{\left(\frac{\partial^2 \sigma_{\varepsilon_a}^2}{\partial m_i{}^2}\right)}^{+}\overbrace{\left(\frac{\partial^2 \sigma_{\varepsilon_a}^2}{\partial m_j{}^2}\right)}^{+} - \overbrace{\left(\frac{\partial^2 \sigma_{\varepsilon_a}^2}{\partial m_i \partial m_j}\right)^2}^{+}\right\} > 0$ if $\overbrace{\left(\frac{\partial^2 \sigma_{\varepsilon_a}^2}{\partial m_i{}^2}\right)}^{+}\overbrace{\left(\frac{\partial^2 \sigma_{\varepsilon_a}^2}{\partial m_j{}^2}\right)}^{+}$ is large relative to $\overbrace{\left(\frac{\partial^2 \sigma_{\varepsilon_a}^2}{\partial m_i \partial m_j}\right)^2}^{+}$;

again smaller values of $\overbrace{\left(\frac{\partial^2 B}{\partial\left(\sigma_{\varepsilon_a}^2\right)^2}\right)}^{+/0/-}$ increase the likelihood that the denominator will be > 0.

Proposition 2 An increase in the price $p_{j\neq i}$ of signal $m_{j\neq i}$ will lead to an increase in the amount m_i being purchased: $\frac{dm_i}{dp_j} > 0$

The comparative static is given by: **Numerator:**

$-\left\{\overbrace{\left(\frac{\partial^2 B}{\partial\left(\sigma_{\varepsilon_a}^2\right)^2}\right)}^{+/0/-}\overbrace{\left(\frac{\partial \sigma_{\varepsilon_a}^2}{\partial m_i}\right)}^{+}\overbrace{\left(\frac{\partial \sigma_{\varepsilon_a}^2}{\partial m_j}\right)}^{+} + \overbrace{\left(\frac{\partial B}{\partial\left(\sigma_{\varepsilon_a}^2\right)}\right)}^{-}\overbrace{\left(\frac{\partial^2 \sigma_{\varepsilon_a}^2}{\partial m_i \partial m_j}\right)}^{+}\right\} > 0$ provided $\left(\frac{\partial^2 \sigma_{\varepsilon_a}^2}{\partial m_i \partial m_j}\right) > 0$ and $\left(\frac{\partial^2 \sigma_{\varepsilon_a}^2}{\partial m_i \partial m_j}\right)$

large relative to $\left(\frac{\partial^2 B}{\partial\left(\sigma_{\varepsilon_a}^2\right)^2}\right)$ whenever the latter is positive.

Denominator: Same as above.

Appendix: Survey Description

A total of 37 household heads (2 %) refused to participate in the survey. All the members of the survey team were from these two informal settlement areas, many of them being university students. All 20 field officers received six days of intensive training during which they were tested on their knowledge of the survey on multiple occasions. The training also gave them a chance to improve the survey by changing the order and wording of certain questions. Prior to the survey, the field officers selected four schools and one orphanage in the two slum areas, which were given support in the form of books, materials, and maize. Individual respondents were not compensated.

The sub-sample of split migrants used in the analysis is smaller than the original 656 interviewed. 28 observations were omitted because the reported age of the head fell outside the

24-56 interval stipulated by the initial sample frame. 16 observations were omitted because they were born in Nairobi. 91 observations were omitted that had one or more missing observations in nine key variables used in the analysis. The means in the samples with and without these 91 observations were almost identical[20]. Also, 3 observations whose home district was missing were omitted. Finally, twelve outlier observations were omitted whose rural homes were either listed as being more than 25 hours travel away, whose farm acreage was more than 100 acres, or for whom the female unskilled wage was listed as being greater than 200Ksh per day (an unrealistically high amount) – the final sample consists of 507 split migrants.

[20] The lowest p-value in a two-sided mean comparison t-test was 0.5384, while the average p-value across the nine variables was 0.8462.