Modeling and Measuring Information Asymmetry in the Context of Senegalese Migrants' Remittances

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Abstract

Much optimism has been invested in the developmental role of migrants' remittances. Altruism and frequent interactions should indeed make intra–household resource allocation efficient. But geographical dispersion may breed information asymmetry and jeopardize efficiency. We develop a model of transfers from the Senegalese diaspora based on socio–anthropological evidence of remittances earmarked by migrants for investments or expenditures by their households of origin, especially assets and housing. The model allows for information asymmetry and monitoring by the migrant. It shows that under some conditions it may be optimal for recipients to behave strategically and we may observe systematic discrepancies between recipients' and senders' reports of the goods to be financed by transfers. Novel matched data enable us to test and find support for the model's predictions.

Keywords: Asymmetric Information; International migration; Remittances; Senegal

JEL classification: D82, F22, F24

1 Introduction

Why migrants remit and how they determine the amounts they send has attracted both policy–makers' and scholars' interest. Over 70% of officially recorded remittances flow into low– or middle–income countries (World Bank, 2014b), totalling USD 404 billion in 2013, or three times the size of official development assistance (World Bank, 2014a), a manna that could be harnessed for economic development—see Maimbo and Ratha (2005), *inter alia*. Productive investment of remittances should moreover benefit from the altruism and close–knit relationships that characterize transnational households, facilitating coordination and the enforcement of agreements (Carling, 2008).

Remittances worldwide are nevertheless overwhelmingly spent on consumption and recurrent household needs. A major reason may be the pattern of control of household resources (Chimhowu et al., 2005), as migrants often initiate investment, deciding for instance to build a house and start a business out of a desire to return home, while recipients would rather continue allocating funds to consumption (ibid.).

Geographical dispersion is inherent in transnational households and communication costs are expected to be much higher than for co–resident members, aggravating the consequences of diverging preferences. This carries important implications as reducing control issues might stimulate remittances or help channel them towards more productive uses (Yang, 2011). Information asymmetry constitutes a relatively understudied aspect of this although it may lead to suboptimal remittance volumes, and would cast doubt on the efficiency of remittance allocation. Indeed, perfect and symmetric information is one of the main tenets of collective and cooperative models of intra–household resource allocation, and the efficiency that characterizes such models may no longer obtain if costly communication gives rise to coordination failures and strategic behavior.

The Senegalese diaspora offers a suitable setting for the study of information asymmetry in the context of international migration and remittances. Emigration has a long history there, both to neighboring African countries such as Mauritania and to distant Europe, and it is a major support of the Senegalese economy, 11.18% of its GDP

being accounted for by international remittances in 2011 (World Bank, 2014b). Senegalese emigration is also rooted in the household economy: 7 out of 10 Senegalese households have at least one emigrant (Some, 2009) and 76% of transfer receipts by households originate from family members (De Vreyer et al., 2008). Therefore, even if geographical dispersion is a hotbed of information asymmetry and manipulation, we would expect Senegalese transnational households to have developed all possible hedges against it.

This paper's discussion of information asymmetry and manipulation within Senegalese transnational households is grounded in qualitative evidence and empirical work. It relies on matched data on Senegalese migrants and their households of origin where a stylized fact emerges (presented in Section 5.2): Migrants systematically report a higher number of assets owned—refrigerators, DVD players, bicycles, cars, etc.—by their household of origin than the latter themselves. A similar finding obtains when one considers the quality of their dwelling. At first sight, these consistent discrepancies jar with what a reader attuned to the literature on the altruistic or insurance motives of remittances would expect: If asset ownership and housing quality proxy wealth and remittances decrease with the recipient's wealth, then a disingenuous recipient should try and delude the remitter into thinking that they have *less* than they actually do.

Our first contribution (Section 2) is thus to put the stylized fact back in the context of the Senegalese transnational household economy. The socio–anthropological literature and a semi–qualitative study of Senegalese migrants specifically designed to shed light on the stylized fact[1] provide evidence that migrants earmark some of their transfers, especially for real–estate investments, productive ventures, or the refurbishment or equipment of the family compound back home, and report information asymmetry

[1]Because it was not the sole focus of the matched data that we use for the empiricis (see Section 4), a short questionnaire was created in order to delve further into information asymmetry, and fielded in October 2012 in the Château Rouge area of Paris, which is densely populated by and attracts (from the rest of the conurbation) many Senegalese migrants. It tries and assesses whether information asymmetry is a concern for the migrant with questions on earmarking of transfers, suspicion, monitoring and sanctions. Furthermore, the interviewees were presented with the stylized fact identified in the matched data and asked to put forward the most plausible hypotheses. Great care was taken in letting the interviewees express themselves and in gathering qualitative information. Due to the qualitative dimension of the survey, 20 migrants were interviewed.

and manipulation issues. Section 2 then discusses evidence of information asymmetry between international remittance senders and recipients from economic papers, as well as their different modeling approaches.

The literature review shall lay the foundations for our second contribution (Section 3): a model of Senegalese migrants' remittances in an information–asymmetry framework. It determines, while explicitly taking monitoring into account, whether it may be optimal for remittance recipients to deviate from earmarking contracts, and under what conditions we may observe the stylized fact of systematic discrepancies between recipients' and senders' reports of the goods to be financed by transfers. Predictions are derived to complete the theoretical picture of the effects of information asymmetry on remittance behavior.

After a presentation of the data (Section 4), Section 5 provides evidence of the stylized fact, shows that it is consistent with theory and tests the model's predictions. Since the empirics mostly consist of comparing reports (from migrants and their households of origin of the latter's characteristics), we open Section 5 with a simple model of measurement error that guides the following econometrics. Section 6 deals with potential alternative interpretations and discusses identification issues. Section 7 concludes.

2 Literature review

2.1 Transfers and information in Senegalese transnational households

Family networks play a major financial role in Senegal and decisions to emigrate have often been described as a household strategy (Chort and Senne, 2013; Boltz–Laemmel and Villar, 2014, *inter alia*). The extended family also strongly influences the decision whether and where to migrate by the free board and lodging it is expected to offer migrants, which favors remittances to the household of origin (Boltz–Laemmel and Villar, 2014).

In spite of distance, Senegalese migrants remain closely linked to their "household of origin," as they themselves call the place where they were born, grew up and where their siblings and parents still live (ibid.). This is also where redistribution norms are inculcated and internalized (Platteau, 2012). Even for those born at destination, the link

to the household of origin, i.e. to the place where the *parents* (usually, the father) were born and raised, remains strong. Boltz–Laemmel and Villar (2014) report the story of a man born in the capital, Dakar, but building a house in Fatick, where his father was born and had returned, with the project of moving there someday too.

Building a house comes up repeatedly in studies of Senegalese migrants. Although most of their remittances are meant to finance daily expenses, real estate and the improvement and equipment of housing has become a growing concern for them (Fall, 2003). As Dia (2007) puts it: "It is fashionable among migrants nowadays to have a house built in the village [although the existing house might be large enough]. Oftimes, building does not suffice; the house must be adorned with all the attributes of 'modernity': a TV set, a VCR, a telephone, and electrification thanks to solar panels."[2] Expanding or refurbishing the family compound through remittances thus embodies migrants' desire to return to their household of origin and offers a tangible signal of their efforts to maintain ties (Boltz–Laemmel and Villar, 2014). Money is sent back home and then the onus is on relatives living in the household of origin to purchase the materials needed for construction or the equipments of the new building (Dia, 2007). More generally, the semi–qualitative survey showed that a third of respondents do not always give recipients a free hand as far as how transfers should be spent. They instead earmark remittances for particular purchases, through in–kind transfers or as investment funds.

A second rationale, well documented in the literature, is the desire to enhance the household's prestige by symbolically and visibly emphasizing the difference in status between them and the rest of the community (Boltz–Laemmel and Villar, 2014). Indeed, Dia (2007) notes: "Those new figures of success array themselves in new and incontestably conspicuous material attributes: handsome mansions, parabolic antennae, luxury cars, electrical domestic appliances". Such a taste for prestige may also be driven by migrants' fear of losing status when they return to Senegal (Marfaing, 2003).

Migrants' preferences over the use of remittances need not be in line with their

[2]Translation by the author.

relatives' back home. To the contrary, Dia (2007), based on "multi–sited" interviews of both migrants and households of origin, explains that migrants are often "accused of imposing decisions on the villagers and thus of abusing their new monetary power," while migrants fear that members of the household of origin rather keep the money, do not purchase all that is necessary or use up the transfers in a short time. Conflicts with relatives in Senegal over money, its use and the implementation of investment projects may thus emerge, so that remittances create a familial economy characterized by "a struggle for controlling the resources from migration" (Dia and Adamou, 2003).[3]

Different members of the transnational household may also be subjected to different emergencies or pressures. Most of the time, migrants are not directly solicited for financial assistance; but their left–behinds, first and foremost their spouses, are pressured into redistributing as requests from closer relatives are more difficult to turn down (Boltz–Laemmel and Villar, 2014).[4]

Conflict over the use of remittances is not the only instrument that recipients and senders can resort to in order to impose their views. It is worth noting here that, migrants may use private information about their earnings or their situation in the destination country to reduce the amounts they have to remit, despite the scrutiny of migrant associations, which foster the pressure to remit (Chort et al., 2012). In Boltz–Laemmel and Villar's terms, their attitude consists of "adhering to redistribution norms while trying to escape them".[5] Now, if the stylized fact we intend to explain is due to information manipulation, we would expect it to originate in *recipients'* behavior since it pertains to items that the literature tells us are likely to be promoted by migrants. We thus focus on information asymmetry about the household of origin's actions.

Invested funds are reported to be subject to taxation by those in charge in Senegal without the agreement of the migrants, who often "bemoan the lack of people worthy

[3] Translation by the author.

[4] Such pressures can have nefarious consequences. Dia (2007) mentions migrants too financially vulnerable to finish the houses they were building because of siblings' and more distant relatives' solicitations. Platteau (2012) similarly imputes the failure of Senegalese shopkeepers who had taken over from the Mauritanians expelled during the 1989 war on the obligation to grant credit and poorer customers' (mostly relatives and neighbors) "perceived right to consider the loan taken as a (forced) gift". In the semi–qualitative data, almost half of the respondents deemed the transfers they send a "hindrance to success in France".

[5] Translation by the author.

of trust among their kith and kin" (Fall, 2003) and of "reliable intermediaries" (ibid.) in general in the country of origin.[6] According to Marfaing (2003), the majority of migrants have experienced the failure of their own business projects in Senegal as business funds are regularly swallowed up in the event of emergencies. Social norms reinforce the possibility for one of the parties concerned to manipulate private information. Dia (2007) mentions a migrant who had invested to open a grocery store in Senegal with an elder cousin of his. The hierarchical relationship due to the age difference forbade the migrant from inquiring about the project he was financing, lest it sparked conflicts within the family. The migrant discreetly investigated during a trip to Senegal and realized that his cousin had given the money meant to set up the business to a sister who was facing an emergency. In order to save face or shun trouble, he did not tell his migrant cousin, who renounced investing in his home country after what he felt was a betrayal. Fall (2003) also highlights that "migrants choose to maximize the benefit of their stays back home by managing their own projects themselves".

Our semi–qualitative survey asked respondents to speculate on the stylized fact emerging from the matched data: Most maintained that the discrepancies were due to the household of origin lying to the migrant in order to extract more or secure transfers. This result is strongest for assets.[7] The most frequent story pertains to durable goods not being purchased, contrary to the migrant's wishes, or sold, if bought by the migrant directly. Respondents often mentioned fancy clothes or participation in "baby naming ceremonies" (*ngénte* in Wolof) as the destination of the embezzled transfers.

This is evidence of information asymmetry and manipulation, whereby relatives back home exploit private information about how remittances are spent to further their own interests. As one migrant in the semi–qualitative survey put it: "We only know what they tell us". Half the interviewees had doubts about the information received from their main transfer recipients and thought their earmarking was not followed or information was distorted in order to extract rents. It is interesting to note that although shocks such as increased solicitations or bouts of self–indulgence may induce recip-

[6] Translation by the author.

[7] 15 out of 20 indicted the household of origin for the observed discrepancies. 7 of those understood the question immediately and spontaneously answered without the interviewer listing possible options; 12 came up with an anecdote or an example to illustrate their answers.

ients to divert remittances from their agreed use, gaps between their preferences and the migrant's aggravate this effect: If the good favored by the migrant is much less of a concern for her recipients, most of the transfers, if regarded as fungible, will then be spent on some other good or service.

Migrants however do exert themselves to improve the information they receive. This may mean reducing the fungibility of transfers by sending them to shopkeepers so as to allocate them beforehand (Dia, 2007) or, as in the example mentioned above, monitoring transfer recipients through phone calls, visits to the household of origin and contacts with other migrants or neighbors from the same community. If information manipulation is detected, reputation seems the main leverage for punishment. In the semi–qualitative survey, respondents explained that they would threaten to cut remittances or would badmouth their households of origin to punish them for swerving from their instructions.

2.2 Information asymmetry in transnational households: Evidence from the economic literature

Evidence from a growing body of economic literature also supports the existence of information asymmetry and manipulation within transnational—usually, not Senegalese—households. Papers may study information about the migrant's or her household of origin's characteristics. We shall focus on the latter.

A first strand of the literature does not tackle the issue of information asymmetry and manipulation directly but adduces evidence that migrants seek to enhance their control over the money they send, a hint at diverging preferences. Ashraf et al. (2011) show that Salvadoran migrants in the U.S. increase the money they send home when offered savings accounts in El Salvador that allow greater control, varying the degree of joint ownership with the recipient.[8] Chin et al. (2010) study the impact of helping Mexican migrants open bank accounts in the United States on their savings and remittances. They point at heterogeneity in the take–up and treatment effect depending on

[8]Interestingly, migrants in their data reported that they would like recipients to save 21.2% of the remittance receipts, as against a preferred 2.6% on the recipients' side.

whether migrants report having no, shared or sole control over how transfers are spent.

A related set of papers study why migrants may find it attractive to remit in kind, document such a preference empirically and test the impact of offering the option of sending remittances in kind on total amounts transferred. The idea is that the migrant is paternalistic and willing to finance some goods that she favors but not other expenditures that she disapproves of, or she intends to finance only public goods. Torero and Viceisza (2013) gave Salvadoran migrants in the United States the chance to win high or low prizes that came as grocery vouchers or cash. Their model suggests ambiguous effects of the in–kind option on total transfers. The results show that migrants are indifferent between the two treatments at low, but clearly prefer cash at high stakes, an outcome they impute to the restrictive nature of the in–kind option. Batista et al. (2013) also show theoretically that the in–kind option (equivalently, the ability to wield more control on remittance use) has ambiguous effects on overall gift–giving. They implemented a lab–in–the–field experiment with internal migrants in Maputo, Mozambique. Participants were asked to choose how to share with recipients in their home towns potential prizes that could be awarded in cash or kind. Contrary to Torero and Viceisza (2013), they find evidence of the paternalistic model.

The control literature does not deal with information manipulation. A first window into this issue is to look at recipients' behavior through the incentive effect of remittances, especially under altruism and insurance motives. Azam and Gubert (2005) provide evidence of moral hazard on the transfer recipients' side thanks to data on agricultural output and remittance levels. Using aggregate data, Chami et al. (2005) also point at moral hazard as a culprit for the lower GDP growth associated with incoming international remittances.

A second avenue consists of studying how the agent's behavior changes when observability or monitoring by the principal varies. De Laat (2008) models remittances sent by internal migrant husbands in Nairobi, Kenya, as conditional on their wives' behavior and effort. He highlights that the migrants spend substantial time and resources in monitoring their spouses and shows that transfers are reduced when information de-

teriorates. Chen (2006, 2013) finds that the wives of Chinese internal migrants exhibit non–cooperative behavior more often for activities that are more difficult to monitor. Ambler (2012) models remittances as driven by a modified altruism whereby recipients are expected by contract to spend the money on specific goods and can be punished for noncompliance. Recipients in El Salvador were to state how they would spend a prize they may obtain thanks to the migrant participant in the U.S.. Half were told their choices would be revealed to the migrants, half that they would not. However, recipients' behavior does not seem influenced by the treatments in this setting.[9] Batista and Narciso (2013) varied the ease with which information circulates between migrants in greater Dublin, Ireland, and their networks by distributing international calling credit to a treatment group. Their main result suggests that increased information flows raise substantially the value of remittances sent.[10]

A final strand of the literature, to which this paper belongs, goes one step further by analyzing information gaps in the data, in order to see whether the reduced–form impact of changes in observability, which the papers mentioned above strove to identify, indeed goes through information manipulation.

Seshan and Yang (2012) look at the reports by Indian migrants living in Qatar of their wives' savings in Kerala, India, and compare them with the wives' own reports. They find that migrants in their control group tend to *under*estimate their wives savings in gold—the main form of savings—while the financial–education treatment led to a significant *increase* in the difference between migrants' and their wives' reports of the latter's savings in the low–baseline–savings group. The authors interpret this as a side–effect of the treatment, either through an updating of migrants' knowledge or as evidence of the wives' behaving non–cooperatively: Migrants would have encouraged

[9] Ambler (2012) also considers the case of migrants manipulating information about their earnings to remit less, thanks to a similar experiment. The results suggest that migrants do send more when their choices are revealed.

[10] Other papers provide evidence of information manipulation by migrants. Modeling migrant networks as both providers of services to migrants and a monitoring and punishment channel for households of origin, Chort et al. (2012) find that Senegalese migrants face stronger incentives to remit when they value network services more and when networks can exert more control. McKenzie et al. (2013) find that male Tongan applicants to emigration to New Zealand significantly underestimate the earnings they would get overseas. The authors argue this is evidence that migrants already living in New Zealand underreport their earnings to alleviate redistributive pressures.

their wives to save more, and their wives would have agreed but failed to do so.

De Weerdt et al. (2014) use data on Tanzanian households originating from an earlier sample. Each household was asked questions about the other split–off households, many of which have emigrated domestically. This design yields cross–reports on asset ownership, educational attainment and employment. This enables the authors to construct a measure of misperception of each other's consumption based on asset ownership and basic household (demographic, geographical and educational) characteristics. The authors provide a model with a donor and recipient, both with private information about own income. They find a lack of systematic misperceptions. However, their data lend credence to a model of pressure to give whereby donors give more when recipients significantly overestimate their financial means but lead to a rejection of the altruism motive.[11]

Seshan and Zubrickas (2014) rely on cross–reports by migrants living in Qatar and their wives in Kerala on the former's earnings. They construct a "reported earnings ratio" by dividing the wives' reports by their husbands'. The first result is that wives tend to underestimate their husbands' overseas earnings. They then develop a model where remittances are an increasing function of the migrants' earnings in order to motivate downward misreports. They investigate determinants of the earnings ratio and confounds of the information–asymmetry hypothesis and finally test (and find support for) the prediction that the more migrants' wives underestimate their husbands' earnings, the smaller the annual remittance sent home.[12]

[11] De Weerdt et al. (2014) also find support for a model in which the donor sends money in exchange for a service provided by the recipient, the price of which is determined by the recipient's bargaining power and the donor's ability to misrepresent her income.

[12] Other papers focus on information asymmetry between co–resident household members. Ashraf (2009) randomly assigns husbands and wives in the Philippines to receive a prize under different treatments that vary in terms of the observability of and communication about how the prizes are spent. When husbands have private information about money, they deposit it into private accounts. Castilla and Walker (2013) describe a field experiment in Ghana that awarded prizes either in public or private, and show that spouses commit their prizes to investments or uses that are difficult to monitor or reverse. Ziparo (2014) provides evidence that and explains theoretically why spouses in Cameroon both make positive transfers to finance household public goods and hide their income. In her model, she shows that information asymmetry increases the total provision of the public good and the utility of the spouse who enjoys private information.

2.3 Comparison of information sets and measurement error

Because it shall compare information sets by confronting remittance senders' and recipients' reports, this paper also draws on the measurement–error literature. Validation studies, which contrast survey responses on earnings to more accurate payroll data for instance, offer a useful template. Most of this literature focuses on the bias introduced by error–ridden independent variables[13]—see Bound et al. (2000) for a review. Conversely, we shall try and explain the "error" itself, i.e. the gap between two reports. Precedents include Bound and Krueger (1991) and Cameron et al. (2004), who analyze determinants of gaps between self–reported and administrative data on earnings and annual physician visits, respectively. Since, as Bound et al. (2000) emphasize it, the impact on measurement error on parameter estimates is model dependent, Section 5 contains a small model to investigate potential measurement–error concerns.

3 Theoretical framework

The review of the literature on remittance allocations within Senegalese transnational households has evidenced conflicts between senders and remitters, especially as migrants may earmark transfers for specific goods or services. Among these, housing and equipment of the house seem to take pride of place.

The literature further shows that information does not always circulate well within transnational households and may be used strategically. But different motives for remittances can lead to incompatible predictions about information manipulation. This is especially true of aggregate variables such as earnings or wealth, which we would expect the household of origin, should they behave strategically, to either play down or inflate depending on whether remitters are believed to be motivated by altruism or inheritance, respectively. The rest of the paper shall thus focus on asset ownership and housing quality, for which we can anticipate, based on a solid body of socio–anthropological evidence, in which direction disingenuous households of origin should bend the information they share with migrants.

This is already part of the explanation for the stylized fact observed in our data

[13] This is presumably because measurement error in the dependent variable can be argued to be innocuous under a much broader set of assumptions.

and presented in Section 5.2: The household of origin could take advantage of private information on the use of transfers to avoid sanctions. Nevertheless, systematic discrepancies in migrant's and households' reports would then mean that the former are deceived *on average*, i.e. that they are unable to fully integrate their relatives' strategic behavior into their expectations, which calls for modeling monitoring explicitly. The following model sets out the conditions under which such a situation can occur with rational individuals. Predictions are then derived.

3.1 Soft–information model

The framework delineated in this section can be traced back to Mookherjee and Png (1989). They develop a moral–hazard model inspired by Grossman and Hart (1983) but they allow the agents' utility to depend partly on what they report, thus creating an incentive for them to misrepresent their actions. To counter this, the principal can "audit" the information communicated.

In our remittance context, we assume the principal to be the migrant, denoted m, and the agent her household of origin, h. The migrant wants to increase the consumption of a good (X), enjoyed directly by h and indirectly by m. In the empirical section that follows, we shall focus on investment in durable goods and housing. The migrant may eventually move back to Senegal and live in the house she built and equipped, or invest with such a prospect in mind, but in the meantime her investments are realized by and benefit h. Examples of X are refrigerators or cars for durable assets and roof material or the number of rooms for housing. X may also serve a productive purpose, e.g. a refrigerator can be used to store refreshments for sale. However, the model is more general than what the data, presented in Section 4, enable us to test: It applies to any good or service X that m favors and finances relative to any private consumption good Y that she disapproves of or does not wish to promote. For instance, an alternative interpretation is that m is paternalistic and derives utility from h's consumption of some goods but not others.

Both m's and h's preferences are common knowledge thanks to a long and daily interaction prior to migration. The migrant thus knows what h would have done in

autarky, i.e. without her remittances.

In autarky, h maximize their utility subject to a budget ω from the consumption of X and Y, which have unit cost p_X and p_Y, respectively. We denote $X^*(\omega)$ the optimal consumption of X given ω. Earnings ω are assumed constant or varying only marginally so that m estimates them as well as h's optimal $X^*(\omega)$ accurately. However, h may be subject to some shock $\tau \in [0, 1]$ that reduces their disposable income to $\omega(1-\tau)$.[14]

τ can be some pressure that m does not feel or understand, e.g. from close relatives or friends of h's but not of hers, or some emergency she disapproves of. Alternative interpretations of τ are possible, e.g. h may suffer from a lack of self–control or bend the earmarking of the contract temporarily (see below), in response to some emergency, and prefer not to bother m, although they eventually fail to restore the contractual equilibrium. But the way this shock is modeled here (as a dent in disposable income) rather corresponds to the argument of social pressure to share put forward in the literature.

We assume for simplicity that τ can take on only two values and that these values are known in advance. But *which* level of τ will be realized is unknown *ex ante*: $\tau = 0$ occurs with probability π and $\tau > 0$ with probability $(1-\pi)$. This uncertainty may stem from random circumstances affecting h's network, e.g. a neighbor or distant relative accidentally falling ill. h can observe τ and their consumption decisions are determined by whether or not they are subject to it, as stated in Problem 1:

***h*'s problem in autarky:**

$$\max_{X,Y} W^h = u^h(Y) + v^h(X) \tag{1a}$$

$$\text{s.t.} \quad \omega(1-\tau) = p_X X + p_Y Y \tag{1b}$$

In autarky, m is unable to invest in X by definition; and h consume $X^*(\omega(1-\tau))$. We however assume that m has positive demand for X, so that if she is not satiated by

[14] The assumption of constant ω can be relaxed. If ω has a stochastic component but h may communicate about and misrepresent their earnings to m in order to extract more transfers (see below), misrepresentations about X are still possible, albeit of smaller magnitude.

h's autarky consumption level of X she would benefit from transferring resources to h to increase the quantity of X that they consume.

If m and h are no longer assumed to live in autarky, then X becomes a public good that is co–financed by m and h. They agree on a contract whereby m sends remittances t to finance X but only *over and above* h's contribution in autarky. The contract could specify that m finances all of X; this would however make little difference, except that m would thereby be acknowledging that a portion of t, corresponding to $p_X X^*(\omega)$ would be effectively fungible.

According to the contract, m sends remittances $t(\omega, X^{*m})$, where X^{*m} is the total X (autarky level *plus* what is financed through t) she targets, and h are supposed to spend it all on X so that $X_{hh} = X^*(\omega) + \frac{t}{p_X}$, where X_{hh} is the level of X chosen by h. This notation anticipates on the empirical section, which compares h's (X_{hh}) and m's (X_{hm}) reports of X. The issue is that X cannot be observed by m due to geographical distance so that strategic behavior can arise, whereby h regard t as fungible income that they can spend on either X or Y, thus consuming $X^*(\omega + t)$ instead of $X^*(\omega) + \frac{t}{p_X}$.

Let us note that since Problem 1 is known to m, she can predict h's attitude perfectly, except that, after t is sent, h is subject to the random shock τ that she cannot observe. The potential levels of τ are assumed to be known to m but she ignores in which state of the world h are: π or $(1 - \pi)$. For instance, m could know that h are subject to social pressure and expect a tax τ from neighbors with probability $(1 - \pi)$; but she does not know whether such a tax was indeed levied.

After X_{hh} is realized h report a message $\widehat{X_{hh}}$ to m. The actual X_{hh} is unobservable to, and $\widehat{X_{hh}}$ unverifiable by m. Although this information may be quantitative, it is verifiable only by the person who collected and produced it—here: the agent h. $\widehat{X_{hh}}$ therefore fits the definition of "soft" information found in the literature on finance and organizational form—see Petersen (2004), *inter alia*.

Since such reports are costless claims that are not verifiable, they resemble "cheap talk". However, observability can be partly restored *ex post* through m's monitoring of h's consumption of X. This requires investing Q at a cost $l(Q)$, with $l'(Q) >$

0. Examples of monitoring activities include phone calls, physical visits to h, the collection of information from neighbors, relatives or fellow migrants from the same village, etc. $l(Q)$ also incorporates m's intrinsic ability to monitor h or elements of the environment, including geographical dispersion.[15]

A crucial feature is that m's monitoring technology is imperfect and $\widehat{X_{hh}} \neq X_{hh}$ is detected only with probability $0 \leq q(\widehat{X_{hh}} - X_{hh}; Q) \leq 1$, where Q increases the accuracy of the monitoring technology. False positives are assumed away: $q(0; Q) = 0$. After investigating, m thus becomes convinced either that $\widehat{X_{hh}} > X_{hh}$, with probability $q(\cdot)$, or that $\widehat{X_{hh}} = X_{hh}$, with probability $1 - q(\cdot)$. We denote m's belief after monitoring by $\alpha(q(\cdot))$, where the function $\alpha(\cdot)$ yields 1 with probability q and 0 with probability $1-q$. If $\widehat{X_{hh}} \neq X_{hh}$ is exposed, m metes out a utility cost F to h, the effect of which is to distort h's preferences towards the complete earmarking of t favored by m. Hence, we always have $\widehat{X_{hh}} = X^{*m}$ because if h deviate and acknowledge it, they are certain to incur F.

The model is a one–shot game. Although this simplification is introduced for tractability, investment in X may not be frequent enough that the migrant can avail herself of past experiences. Moreover, we saw that h is often the only or best intermediary back home and that migrants may not have credible future sanctions at hand. For instance, building a house requires several transfers, which calls for a repeated game. However, it can be construed as a one–shot game because deviations from the contract by h—see below—might lead to sanctions by m but can put an end neither to transfers nor to m and h's relationship: m's transfer behavior at time 1 is independent of h's behavior at time 0.

We assume for simplicity that there is no commitment problem: As long as $Q > 0$ is invested, monitoring is run; and m cannot but inflict punishment F on h if $X^{*m} \neq X_{hh}$ is detected.[16]

[15] A more complex understanding of the costs and benefits of monitoring is possible. Phone calls, for instance, may cut both ways: They enable m to monitor h but also give h the opportunity, in a model with transfers for other purposes than investment in X, to request more money. Such a risk would increase $l(Q)$.

[16] F has no cost in the model. Commitment would not hold if F harmed m too, unless m needs to prove her credibility for future, distinct games with h. The marginal cost of monitoring h, once Q has been sunk, may be close to 0. In effect, contacts and visits also signal affection or abidance by norms (unmodeled here) so that m may derive benefits while inquiring about her investments in X.

Figure 1 summarizes the sequence of the game.

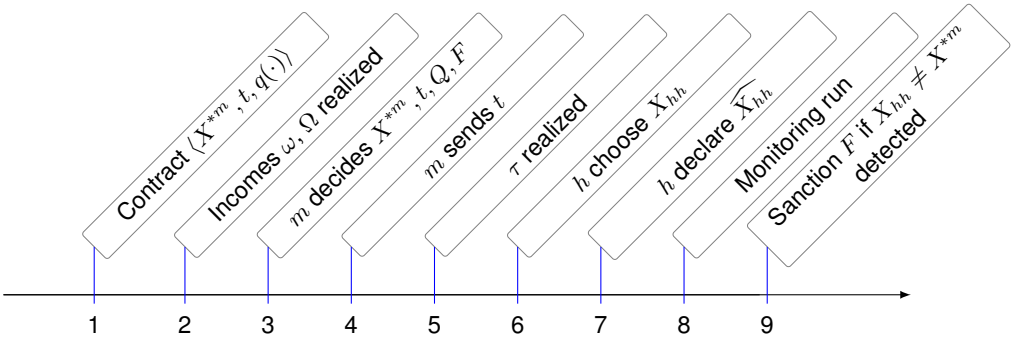

Figure 1: Sequence of the game

More formally, h solve Problem 2 last based on variables set by m (and singled out by stars). Problem 3 however takes into account, through backward induction, h's best reaction (also flagged by stars) to determine m's optimal transfer t (equivalently, her target X^{*m}) and other choice variables.

***h*'s problem:**

$$\max_{X,Y} W^h = u^h(Y) + v^h(X) - F^*\alpha(q(X^{*m} - X; Q^*)) \tag{2a}$$

$$\text{s.t.} \quad \omega(1-\tau) + t^* = p_X X + p_Y Y \tag{2b}$$

$$\text{and} \quad W \geq \underline{W} \tag{2c}$$

***m*'s problem:**

$$\begin{aligned}\max_{c,t,F,Q} W^m = {} & u^m(c) + \pi v^m(X^*(\omega + t; Q)) \\ & + (1-\pi)v^m(X^*(\omega(1-\tau) + t; Q))\end{aligned} \tag{3a}$$

$$\text{s.t.} \quad \Omega = c + p_t t + l(Q) \tag{3b}$$

Notation is as follows: Y (c) is h's (m's) private consumption good; $u^i(\cdot)$ and $v^i(\cdot)$, $i = h, m$, are concave and twice differentiable utility functions; p_t is what sending one

unit of t costs m, while the price of c is normalized to 1; $\underline{W}$ is the minimal level of utility that m must respect even when she inflicts F; and Ω is m's earnings. All prices are assumed positive definite and common knowledge.

It is important to note that although m increases the resources available to h through t, participation in the contract is not trivial for remittance recipients. In effect, since m ignores τ in the contract[17] and sets a target X^{*m} that h must meet lest they incur F with probability $q(\cdot)$, they are expected to consume *less* than $Y^*(\omega(1-\tau))$ when $\tau > 0$ in order to reach the target X^{*m}. This reallocation of resources is indeed the only way to abide by the contract when $\tau > 0$.

Let us model this reallocation as h consuming $Y^*(\omega(1-\tau-L))$ instead, where $L \geq 0$. L is determined so that $X^*(\omega) + \frac{t}{p_X}$ can be reached with $\omega(1-\tau)$. This is feasible as long as $L \leq 1-\tau$. Then h accept the contract if and only if:

***h*'s participation constraint:**

$$\begin{aligned}
&\text{Utility from participating when } \tau = 0 \left\{ \pi[u^h(Y^*(\omega)) + v^h(X^*(\omega) + \tfrac{t}{p_X})] \right. \\
&\text{Utility from participating when } \tau > 0 \left\{ \begin{array}{l} +(1-\pi)[u^h(Y^*(\omega(1-\tau-L))) \\ +v^h(X^*(\omega) + \frac{t}{p_X})] \end{array} \right. \\
&\qquad\qquad \geq \\
&\text{Utility from not participating when } \tau = 0 \left\{ \pi[u^h(Y^*(\omega)) + v^h(X^*(\omega))] \right. \\
&\text{Utility from not participating when } \tau > 0 \left\{ \begin{array}{l} +(1-\pi)[u^h(Y^*(\omega(1-\tau)) \\ +v^h(X^*(\omega(1-\tau)))] \end{array} \right.
\end{aligned}$$

Assuming $u^h(Y^*(\omega(1-\tau))) \neq 0$ and $\pi \neq 1$—in which cases participation obtains

[17] The alternative for m would be to base the contract on $\tau > 0$ and accept granting h a rent they can then spend as they please. If we relax this assumption and allow h to invoke $\tau > 0$ in order to obtain more remittances, the same result follows as from a stochastic ω: We still have $\widehat{X_{hh}} \geq X_{hh}$ but the two are more often equal.

trivially,—we have:

$$\frac{v^h(X^*(\omega)+\frac{t}{p_X})-[\pi v^h(X^*(\omega))+(1-\pi)v^h(X^*(\omega(1-\tau)))]}{(1-\pi)[u^h(Y^*(\omega(1-\tau)))-u^h(Y^*(\omega(1-\tau-L)))]}\geq 1 \tag{4}$$

As can be seen from Eq. 4, the participation constraint is not necessarily satisfied. We can however note that m can induce participation by raising t, which enters the numerator positively, provided $L \leq 1-\tau$.[18] The decrease in h's utility due to L implies that there are cases such that m can induce participation only by disconnecting t from X^{*m}, e.g. by increasing t but keeping the target level of X unchanged, or, which boils down to the same, by basing the contract on states where $\tau > 0$—then m implicitly accepts to finance some Y when $\tau = 0$.

Now, provided h find it worthwhile to participate, can it be optimal for them to strategically deviate? A strategic behavior in this context would consist of regarding t as fungible income that they can spend on either X or Y. Deviation benefits h if and only if:

***h*'s deviation constraint:**

$$\begin{aligned}
&\text{Gain from deviating when } \tau=0 \begin{cases} \pi[u^h(Y^*(\omega+t))+v^h(X^*(\omega+t)) \\ -u^h(Y^*(\omega))-v^h(X^*(\omega)+\frac{t}{p_X})] \end{cases} \\
&\text{Gain from deviating when } \tau>0 \begin{cases} +(1-\pi)[u^h(Y^*(\omega(1-\tau)+t)) \\ +v^h(X^*(\omega(1-\tau)+t)) \\ -u^h(Y^*(\omega(1-\tau-L)))-v^h(X^*(\omega)+\frac{t}{p_X})] \end{cases} \\
&\qquad\qquad \geq \qquad\qquad (5) \\
&\text{Cost of deviating} \begin{cases} F[\pi\alpha(q(X^*(\omega)+\frac{t}{p_X}-X^*(\omega+t);Q^*)) \\ +(1-\pi)\alpha(q(X^*(\omega)+\frac{t}{p_X} \\ -X^*(\omega(1-\tau)+t);Q^*))] \end{cases}
\end{aligned}$$

[18] We also expect the ratio on the left–hand side of Eq. 4 to increase with $\frac{p_X}{p_Y}$, h's preference for X relative to Y and their aversion to risk in their consumption of X relative to Y, all else equal. These elements are however beyond m's control.

Whether constraint 5 is satisfied depends on a number of factors. First, absent monitoring (right–hand side of the inequality) h always have an incentive to deviate, which is unambiguously strengthened by higher t—see Appendix A. This implies that any increase in t that m might contemplate must be checked by a concomitant improvement in her ability to detect and sanction deviations. Second, we can verify thanks to Eq. 5 that h's incentive to deviate is stronger (absent monitoring) when $\tau > 0$—see Appendix B.[19]

One of the questions motivating research interest in information asymmetry in transnational households pertains to the effect of imperfect information on the level of remittances. The First Order Conditions from Problem 3 yield:

Under complete information:

$$v^{m\prime}(X^*(\omega) + \frac{t}{p_X}) = p_X p_t u^{m\prime}(c) \tag{6}$$

Under incomplete information:

$$v^{m\prime}(X^*(\omega + t)) = \frac{1}{\frac{\partial X^*(\omega+t)}{\partial t}} p_t u^{m\prime}(c) \tag{7}$$

assuming $\frac{\partial X^*(\omega+t)}{\partial t} \neq 0$. Eq. 7 considers that $\tau = 0$ but the following argument would be the same for $\tau > 0$. We know that the price of one unit of X is $p_X > 0$. Now, it must be that $\frac{\partial X^*(\omega+t)}{\partial t} \leq \frac{1}{p_X}$. Subsequently, the marginal utility of transfers is higher, equivalently t is lower under incomplete than complete information. Besides, Eq. 6 and 7 also show, as expected, that t decreases with p_t, p_X and $u'(c)$. More interestingly, we see in Eq. 7 that t increases with $\frac{\partial X^*}{\partial t}$, i.e. the higher h's optimal increase in their consumption of X for a marginal increase in t, the higher the remittances.

Maximizing W^m with respect to t and Q, we obtain—see Appendix C:

$$\frac{\partial t}{\partial Q} = \frac{l'(Q)}{p_t} \tag{8}$$

[19] Interestingly, the introduction of monitoring renders the effect of τ on constraint 5 ambiguous because the higher τ, the larger the deviation all else equal, and thus the more likely it is that the deviation is detected.

Eq. 8 tells us that $\frac{\partial t}{\partial Q}$ is unambiguously positive. Moreover, we see that it increases with $l(Q)$: The more difficult or costly it is for m to monitor h, the stronger the (positive) correlation between t and Q. We would thus expect $\frac{\partial t}{\partial Q}$ to increase with geographical distance, although this effect might be attenuated by p_t. This positive covariance at the optimum between t and Q is consistent with what h's deviation constraint 5 led us to predict: Even though there may be heterogeneity in Q–t pairs, due to migrants' and households' having different structural parameters, at the equilibrium we expect Q and t to move in the same direction.

3.2 Discrepancies between migrant's and household's reports

Anticipating on the empirical Section 5, let us note that m's report available in survey data is *not* equal to the message $\widehat{X_{hh}}$ (equivalently, target X^{*m}), which remains unobserved to the econometrician. The model instead suggests we observe on average:

$$\mathrm{E}[\Delta] \equiv \mathrm{E}[X_{hm} - X_{hh}] = [1 - q]\mathrm{E}[(X^{*m} - X_{hh})] \geq 0, \tag{9}$$

where $\Delta \equiv X_{hm} - X_{hh}$ denotes the discrepancy between m's and h's reports of X.

We can see from Eq. 9 that the effect of Q on Δ is ambiguous: The higher Q, the lower the probability that misrepresentations are *not* detected by m, and therefore the lower Δ. On the other hand, we know from Eq. 8 that Q and t, and subsequently Q and X^{*m} are positively correlated, so that $\mathrm{E}[(X^{*m} - X_{hh})]$ may either increase or decrease with Q.

The process producing m's report X_{hm} when τ is unobservable is illustrated in Figure 2. Conversely, when τ is observable, h may still deviate, for instance if m cannot inflict the optimal F, but m would always know whether h have an incentive to deviate and by how much; therefore, we would always observe $\Delta = 0$ on average.

In effect, we may observe systematic discrepancies between m's and h's reports as in Eq. 9 only if there are two sources of uncertainty in the model: τ and $q(\cdot)$. We can distinguish three cases: (a) no random shock τ or τ observable, (b) τ unobservable

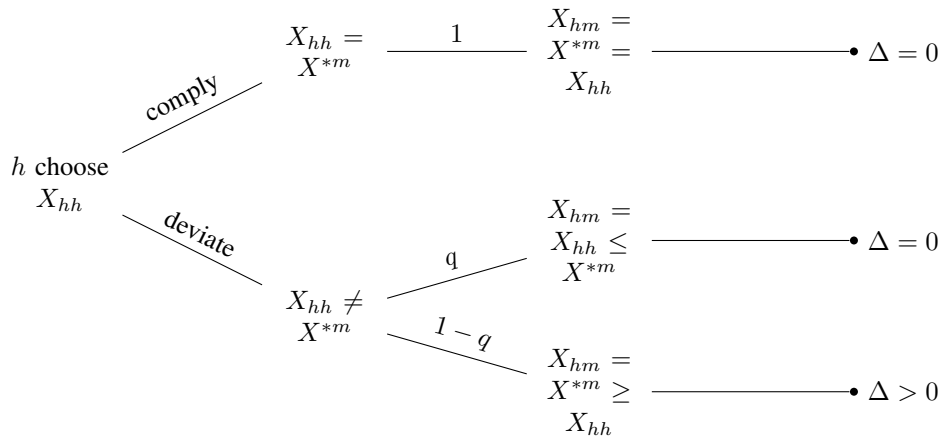

Figure 2: Process generating X_{hm} and Δ when τ is unobservable

but monitoring perfect, and (c) τ unobservable and monitoring imperfect. Since m knows ω and h's preferences, if τ were known to her as well—case (a),—she would always accurately estimate and report X. The utility cost F would merely act as a threat to ensure that $X_{hh} = X^{*m}$, provided that inequality 2c, which acts as a limited liability constraint, does not bind. Case (b) boils down to case (a): $X_{hh} < X^{*m}$ may obtain if constraint 2c binds, but we should always observe $\Delta = 0$ in the data. The only difference is that m may fail to incorporate the effect of τ in her report, so that Δ would be 0 only after perfect monitoring has been run. This may occur with a lag, because of the sequence of the game—see Figure 1.[20] Finally, if both $q(\cdot)$ is imperfect and τ unobservable, m wrongly reports $X_{hm} = \widehat{X_{hh}} > X_{hh}$ whenever she mistakenly concludes that $\widehat{X_{hh}} = X_{hh}$, which happens with probability $1 - q$—see Figure 2.

It is worth noting that Eq. 9 *under*estimates actual manipulation of information if the econometrician can only observe discrepancies in information sets *after* monitoring has occurred.[21]

3.3 Predictions of the model

A few main predictions result from the model.

[20] If monitoring were perfect but not always run, m could wrongly estimate X on a particular occasion but migrants' reports should be correct on average as m would know both the probability of running an "audit" (and therefore of detecting manipulation) and the distribution of τ (and thus the average size of undetected deviations).

[21] Conversely, it is possible that monitoring takes time and the econometrician overestimates post–monitoring information asymmetries. This concern is dealt with in the robustness checks (Section 6).

First, h may rationally deviate from the contract and because of the uncertainty inherent in their behavior (which is due to τ) and in m's monitoring, the migrant may systematically report $X_{hm} \geq X_{hh}$. Subsequently, the model predicts $\Delta \geq 0$. We may further note that if we relax the assumptions that ω is constant and that τ is ignored in the contract, $\Delta \geq 0$ remains possible but becomes theoretically less likely, which would in turn strengthen empirical evidence of misrepresentations.

Second, h's incentives to deviate from the contract are expected to be stronger when observability is lower. This would originate in a higher $l(Q)$, due to m's intrinsic characteristics or the environment of the relationship, such as geographical distance.

Third, Q and t should co–vary positively, and the lower the observability of h's actions, the stronger the correlation. Intuitively, this can be explained by the fact that higher t means larger benefits from deviations, which calls for improved monitoring.

Finally, we would expect the discrepancies Δ to be determined by the random τ. However, in the absence of obvious proxies for τ, the following empirics shall focus on the first three predictions.

4 Presentation of the data

In order to test the model's predictions, we draw on matched data from the MIDDAS project (2009–2010).[22] MIDDAS first contacted migrants in the host country, aspiring to be nationally representative of the Senegalese immigrant population in France, Italy and Mauritania.[23] The migrants were asked to put the survey team in touch with their households of origin, who were then interviewed in Senegal and presented with a thorough questionnaire that painstakingly describes and follows the complex structure of Senegalese households, made up of several subgroups or "cells".[24] Table 1 summarizes information about sample size and composition.

[22] "Migration and development in Senegal: an empirical analysis using matched data on Senegalese migrants and their origin households". For a detailed presentation of the project, see `http://www.dial.ird.fr/projets-de-recherche/projets-anr/middas` [in French; accessed Nov. 14, 2014].

[23] The same survey was implemented in Côte d'Ivoire but the corresponding data shall not be used here because no matching was carried out. For an overview of the sampling procedure, please refer to Chort et al. (2012).

[24] The household questionnaire was based on "Pauvreté et Structure Familiale" (PSF)—see De Vreyer et al. (2008) for a description.

It is worth noting that although not all migrants' households of origin could be matched, resulting in rather small sample sizes, sample selection seems rather mild—see Seror (2012) and Chort and Senne (2013) for econometric analyses. Moreover, information asymmetry is likely to be less of an issue in the matched than in the unmatched sample, as migrants and households of origin should exhibit stronger ties in the former. Evidence of information asymmetry and manipulation in Sections 5 and 6 should therefore be understood as a lower bound compared to the population.

Precedents in terms of matched data on international migrants include Osili (2004, 2007) and Mazzucato (2008, 2009)[25]. As for MIDDAS, the goal of using matched data was twofold: Taking into account the transnational nature of migrants' households and producing better–quality data by asking those most directly concerned about their own characteristics. Matched data shall serve a slightly different purpose in this paper: We can compare migrants' and households' reports (denoted X_{hm} and X_{hh}, respectively) of a set of household characteristics X, and thus *measure* discrepancies (Δ) that potentially coincide with gaps in m's and h's information sets. The variables available are characteristics of h's dwelling, which we tried and ordered by increasing quality, and the number of different assets they own, as stated by m and h.[26] The discussion in Section 2 gives us confidence that migrants earmark remittances to such goods and exhibit a higher preference for them than their households of origin.

5 Empirical test of the model's predictions

5.1 Linking theory to empirics: A small measurement–error model

Before we move to testing the predictions of the model, the link between the matched variables presented in Section 4 and the theoretical constructs they are supposed to embody deserves some discussion.

The first two predictions of the model suggest we look into $\Delta \equiv X_{hm} - X_{hh}$. However, the X_{hm} observed in the data is neither the target X^{*m} announced by h

[25] Other examples of data on remittance senders and recipients with matched survey items are exploited in Seshan and Yang (2012), De Weerdt et al. (2014) and Seshan and Zubrickas (2014).

[26] The surveys also allow us to match reports about h's ownership of traditional agricultural tools, such as plows and hoes. We choose not to study them here because (i) there are few agricultural households in the sample and therefore those variables exhibit little variation, and (ii) they are unlikely to belong to the superior goods favored by m.

Table 1: Sample size and composition by country

	France	Italy	Mauritania	Pooled
Stage 1: Migrant samples				
Number of surveyed migrants	302	303	327	932
...% of women	*24.2*	*22.8*	*36.4*	*28.1*
Stage 2: Origin household samples				
Matching rate (%)	*29.5*	*20.1*	*53.2*	*34.9*
Number of tracked households	89	61	174	324
...% in Dakar	*49.4*	*63.9*	*22.4*	*37.7*

nor the true X_{hh}. It is instead a mixture of those elements and measurement error. The household's report X_{hh} is also subject to measurement error but we argue that the issue is less severe than for migrant survey data. There are several reasons for this: First, the Xs are familiar objects that h live with daily; second, the household survey was carried out at h's home, where the enumerators could see the Xs or at least infer likely amounts of assets owned and thus double–check with the respondent if the quantity stated sounded outlandish. Nevertheless, the following conclusions remain valid if we allow for measurement error in X_{hh}, provided it is less severe than in X_{hm}.

It is worth noting at this stage that the structure of the error is more complex for housing quality than asset ownership variables in Equations 10 and 11. In effect, the former are meant to be ordinal but because m's quality ranking is unknown, we cannot exclude that further measurement error has been introduced. The latter on the other hand are ratio variables stated by m and h themselves. Moreover, the former are often bimodal, whereas the latter are strongly unimodal. Because of the more complex structure of the housing quality variables, Sections 5 and 6 shall focus on asset ownership. Corresponding evidence for housing quality is however provided in Appendix E.

With those elements in mind and ignoring classical measurement error in h's report, we assume:

$$\widetilde{X_{hh}} = X_{hh} \tag{10}$$

$$\widetilde{X_{hm}} = (1-c)(1+\zeta+\delta_A+\delta_O)X_{hh} + cr + \nu \tag{11}$$

where $\widetilde{X_{hi}}$ denotes the (potentially error–ridden) report of the true information X_{hi} held by $i = h, m$; $\zeta \in [-1, 0]$ captures a negative correlation between the report and the error–free variable, which Bound and Krueger (1991) call "mean–reverting measurement error" and is particularly likely for bounded variables such as X; $\delta_A \geq 0$ corresponds to the inflation in h's message to m possible under information asymmetry; $\delta_O \geq 0$ stands for factors leading to a systematic inflation of the migrant's report; and ν is such that $\mathrm{E}[\nu] = 0$ and $\mathrm{E}[X_{hh}\nu] = 0$.

Finally, it is possible that the migrant is "clueless" about X_{hh} and provides a systematic response r that bears no resemblance to the actual X_{hh}; c is a dummy variable equal to 1 if m provides the clueless answer r about asset X and 0 otherwise. Now, if r is on average larger (smaller) than X_{hh}, cluelessness can lead to artificially positive (negative) Δs.

We shall deal with cluelessness first and then discuss the impact of the other sources of measurement error.

Considering for simplicity that X_{hi} is a binary variable, i.e. equal to 1 if h owns at least one unit of X according to i and 0 otherwise, one could imagine that clueless migrants randomly answer 0 or 1 with equal probability. This would be denoted as $r = .5 * 0 + .5 * 1 = .5$. Other response rules are possible, for instance based on the migrant's knowledge of village or national averages, or past levels of X_{hh}, but we shall focus on $r = .5$ as it is intuitive and provides a conservative interpretation of our estimates of c. In effect, abstracting from other sources of measurement error, we have:

$$\widetilde{X_{hm}} = (1-c)X_{hh} + cr \tag{12}$$

$$\therefore \quad c = \frac{\widetilde{\Delta}}{r - X_{hh}} \tag{13}$$

which with binary X is minimized when $r = .5$.

In order to estimate c and thus gauge the meaningfulness of our test of Prediction 1 in Section 5.2, we need to assume either that c remains constant across assets, allowing it to differ by respondents, or to be constant across respondents while varying across assets. Table 2 provides for each asset the minimum share of migrants who would have to be clueless to account for the discrepancies highlighted in Section 5.2—see Table 4. The higher the estimated c, the more unlikely it is that the observed Δ can be attributed to cluelessness.

Table 2 shows that for all assets (except TV sets) one would have to assume a share of clueless migrants in excess of 50% to account for observed discrepancies in the European sample, which is unrealistic given the regular contacts between m and h as illustrated in Table 3 below. A similar picture obtains when one assumes instead that c is constant across assets, which suggests that migrants' cluelessness is an unlikely confound of Prediction 1. We thus abstract from cluelessness in the rest of the discussion of measurement error.

We get the following expression for the observed discrepancy between m's and h's reports:

$$\begin{aligned}\widetilde{\Delta} &= \widetilde{X_{hm}} - \widetilde{X_{hh}} = (1 + \zeta + \delta_A + \delta_O)X_{hh} - X_{hh} + \nu \\ &= \Delta + (\zeta + \delta_O)X_{hh} + \nu\end{aligned}$$

where $\Delta \equiv \delta_A X_{hh}$ represents the true discrepancy due to information asymmetry, which we intend to highlight empirically.[27]

[27]The results are robust to introducing information manipulation into Eq. 11 additively rather than as a fraction of X_{hh}, $\delta_A X_{hh}$, because they do not rely on the correlation between Δ and X_{hh}—see Appendix D.

Table 2: "Cluelessness" (c) necessary to account for observed discrepancies, by asset X

	fridge	freezer	tvset	dvd	radio	cd	fan	bike	car	moto
m in Mauritania	0.56	0.42	0.36	0.78	0.73	0.63	0.69	0.33	0.13	0.34
	[0.43,0.70]	[0.30,0.55]	[0.25,0.48]	[0.63,0.93]	[0.59,0.88]	[0.49,0.77]	[0.54,0.83]	[0.21,0.44]	[0.06,0.21]	[0.22,0.45]
m in Europe	0.66	0.75	0.28	0.80	0.66	0.91	0.60	0.79	0.73	0.58
	[0.51,0.81]	[0.60,0.91]	[0.17,0.39]	[0.64,0.96]	[0.51,0.81]	[0.75,1.07]	[0.45,0.74]	[0.64,0.95]	[0.58,0.89]	[0.44,0.73]
Observations	318	317	316	315	317	314	317	316	316	317

95% confidence intervals in brackets

The table displays lower–bound estimates of c (Eq. 11) for m in Europe and in Mauritania.

This expression tells us that Prediction 1 ($\Delta \geq 0$) can be tested with $\widetilde{\Delta}$ as long as $\delta_O = 0$. In effect, ζ being negative it can only bias our estimate of Δ downwards, even when we alow the effect of ζ to vary with distance—see Appendix D. Given our assumptions about ν, artificial support for Prediction 1 can only originate in the positive δ_O, to be studied in Section 6.

Prediction 2 invites us to further develop this measurement–error model. It suggests proxying h's room for information manipulation, included in δ_A, by determinants of $l(Q)$, such as geographical distance. The issue is that measurement error may not only affect the point estimate but also lead us to reject the null hypothesis that the proxy for $l(Q)$ has no effect on $\widetilde{\Delta}$ too often. Based on the proxy used in Section 5.2, Appendix D shows that if anything ζ biases the estimate towards 0; it may even lead to a reversal in sign and thus offers a conservative test of Prediction 2. On the other hand, δ_O has the opposite effect and requires a more in–depth treatment—see Section 6.

5.2 Predictions 1 and 2: Positive discrepancies

The model predicts that *(i)* h might derive benefits from information manipulation, leading to a possible overestimation of X by m, and *(ii)* these benefits are reduced by m's monitoring. In turn, we expect geographical distance to increase the cost of monitoring $l(Q)$ and thus deepen the gaps in reports observed in the data. Table 3 shows that Senegalese migrants living in Mauritania are significantly more likely to visit or call h frequently, or to remit in kind, which can be construed as proxies for the frequency and ease of monitoring. Conversely, migrants' places of residence within Mauritania do not show much variation along these proxies—see Table E1. Therefore, we argue that a dummy variable equal to 1 if m lives in Mauritania rather than in Europe is a better proxy for geographical distance and variation in Q.

Table 4[28] illustrates our main stylized fact and tests the first two predictions of the model, i.e. that $\Delta \equiv X_{hm} - X_{hh} \geq 0$ and Δ decreases with observability. Table E2 does a similar exercise for characteristics of h's housing. Following evidence from Table 3, "m lives in Mauritania" is used as a proxy for higher observability. Col. 1

[28] Please note that as in all tables in the paper, robust standard errors are used.

Table 3: Correlation between migration destination and monitoring proxies

	(1) Nb of visits to *h* per year	(2) Days since last visit to *h*	(3) % of total remittances to *h* in kind
m in Mauritania	0.65***	-190.38***	8.90***
	(0.14)	(61.24)	(1.51)
Constant	0.82***	794.68***	2.49***
	(0.05)	(43.72)	(0.36)
Observations	895	711	757

Standard errors in parentheses

The constant corresponds to the European mean dependent variable. m in Mauritania captures the effect of m being in Mauritania instead of Europe.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

simply regresses the asset discrepancies on a constant and Col. 2 introduces the high–observability proxy. In most cases, the constant is positive and significant, while the slope coefficient is negative and significant.[29] These results support the predictions of the model.[30]

It must be noted that the results from Col. 2 do not lend themselves to a causal interpretation. In effect, migrants select into different host countries based on unobservable characteristics. We choose to keep the specifications used to investigate Δ as pared down as possible since inadequate control variables can exacerbate rather than cure omitted variable bias if they are correlated with the error term. Controls might also reduce the endogeneity in the variable of interest but at the cost of netting out some of its interesting effects in terms of information asymmetry. Endogeneity shall be further discussed in Section 6.

The model assumes, based on the literature on Senegalese migrants, that m wishes to finance assets and housing X and that h may face an incentive to divert the earmarked remittances to other uses. Table 5 explores this assumption tentatively by regressing Δ on a dummy equal to 1 if m reported having invested or being investing (either in a productive venture or in real estate) in Senegal thanks to h's help, and 0 otherwise. This variable is interacted with the Mauritania dummy. The proxy for in-

[29] TV set clearly comes across as an exception. Interestingly, this is the asset that the highest proportion of matched households own. Only 16% do not have any TV set, as against 30% for radios and 43% for fans, the second most commonly owned assets in the data.

[30] Migrants might have an accurate picture of h's asset ownership on average, the overestimation of some assets being exactly compensated by the underestimation of others, but for whatever reason overestimation would accumulate on some assets on the list. This concern can be easily dismissed thanks to positive and significant discrepancies *within* m–h pairs, *across* assets (available upon request), which corroborate the positive and significant discrepancies *across* m–h pairs, *within* assets displayed in Table 4.

Table 4: Discrepancies between m's and h's reports of the latter's asset ownership ($X_{hm} - X_{hh}$)

	fridge		freezer		tvset		dvd		radio		cd		fan		bike		car		moto	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Constant	0.18***	0.24***	0.21***	0.30***	-0.22**	-0.43***	0.37***	0.35***	0.23**	0.34*	0.27***	0.50***	-0.08	-0.07	0.41***	0.72***	0.14***	0.27***	0.22***	0.34***
	(0.04)	(0.07)	(0.03)	(0.06)	(0.08)	(0.12)	(0.06)	(0.10)	(0.12)	(0.20)	(0.07)	(0.10)	(0.14)	(0.25)	(0.07)	(0.14)	(0.04)	(0.07)	(0.05)	(0.09)
m in Mauritania		-0.11		-0.17**		0.41**		0.04		-0.22		-0.42***		-0.03		-0.59***		-0.24***		-0.22**
		(0.08)		(0.07)		(0.17)		(0.11)		(0.24)		(0.13)		(0.28)		(0.15)		(0.07)		(0.10)
Observations	318	318	317	317	316	316	315	315	317	317	314	314	317	317	316	316	316	316	317	317

Standard errors in parentheses

The constant in Col. 1 (2) corresponds to the (European) mean Δ. m in Mauritania captures the effect on Δ of m being in Mauritania instead of Europe.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

vestment is rather crude because the data do not enable us to distinguish between help from relatives (including h) and friends, we do not know whether transfers to or through h were involved, h may or may not enjoy X and thus may or may not declare it in the household survey, and only sizeable investments are likely to be reported. Moreover, we would expect m to engage in investments only if she is confident that her counterparts back home are trustworthy, which should bias coefficients toward 0. The results presented in the table are indeed seldom significant, but when they are the investment proxy (its interaction with the Mauritania dummy) tends to have the same sign as the constant (the Mauritania dummy). This suggests that the first two predictions of the model—a positive and significant Δ and smaller Δ when m lives in Mauritania—are if anything reinforced when m invests in Senegal.

5.3 Prediction 3: Covariance of transfers and monitoring

The third prediction of the model is that Q and t should co–vary positively. Testing this prediction is complicated by the obvious endogeneity of monitoring proxies and the fact that the remittances observed in the data cannot be unequivocally matched to expenses or consumption targets defined by the migrant.

The proxies used to approach Q are: the number of visits that m makes to h per year, the number of days since her last visit, the number of contacts per year with the first other emigrant from the same household of origin cited by m (a valuable source of information for m), the share of remittances that are received by h in kind (which help m impose a consumption pattern on h but suffer from transaction or transportation costs that increase with geographical distance) and the number of associations m belongs to (also sources of information about h).[31] An additional variable, the number of phone contacts between m and h per year, is available for the European sample only—see Table E4.

All these proxies might be determined by m's affection for members of h, which could also drive altruistic transfers. Another obvious omitted variable is m's income, since Q is costly. If transfers serve an insurance purpose, we might also expect m to

[31] Note that migrants who are members of at least one association disburse on average €117 per year per association in Europe as against €23 in Mauritania.

Table 5: Correlation between the asset discrepancies and m's investment behavior

	fridge		freezer		tvset		dvd		radio		cd		fan		bike		car		moto	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Constant	0.17***	0.22***	0.20***	0.29***	-0.14*	-0.37***	0.36***	0.34***	0.25**	0.34	0.29***	0.48***	-0.05	-0.07	0.39***	0.71***	0.12***	0.21***	0.22***	0.33***
	(0.04)	(0.07)	(0.04)	(0.06)	(0.09)	(0.14)	(0.06)	(0.10)	(0.12)	(0.23)	(0.06)	(0.11)	(0.14)	(0.28)	(0.08)	(0.15)	(0.04)	(0.07)	(0.05)	(0.10)
m has (is) invested (–ing) in Senegal with h's help	0.09	0.10	0.12	0.07	-0.73**	-0.35	0.16	0.10	-0.18	0.02	-0.16	0.08	-0.34	0.03	0.22	0.09	0.24	0.35**	0.04	0.07
	(0.14)	(0.18)	(0.10)	(0.13)	(0.35)	(0.29)	(0.24)	(0.30)	(0.39)	(0.40)	(0.42)	(0.31)	(0.59)	(0.66)	(0.31)	(0.39)	(0.17)	(0.17)	(0.22)	(0.26)
m in Mauritania		-0.09		-0.16**		0.41**		0.04		-0.17		-0.35***		0.04		-0.57***		-0.16**		-0.19*
		(0.09)		(0.08)		(0.17)		(0.12)		(0.26)		(0.12)		(0.30)		(0.16)		(0.08)		(0.11)
m has (is) invested (–ing) in Senegal with h's help * Mau.		-0.23		-0.03		-1.19		0.35		-1.36		-1.88		-1.83		-0.40		-0.90*		-0.54
		(0.19)		(0.20)		(1.43)		(0.41)		(1.31)		(1.58)		(1.63)		(0.42)		(0.49)		(0.40)
Observations	318	318	317	317	316	316	315	315	317	317	314	314	317	317	316	316	316	316	317	317

Standard errors in parentheses

The constant in Col. 1 (2) corresponds to the (European) mean Δ. m in Mauritania captures the effect on Δ of m being in Mauritania instead of Europe.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

both send more and be more keen on getting news from a vulnerable h, driving coefficients upwards. Besides those obvious sources of endogeneity, variables pertaining to m's last visit to h are likely influenced by whether m ever went back to Senegal to visit h, a dummy that captures emotional ties as well as early–migration situations where m cannot remit much and might be waiting for a residence permit before she can travel back home. All these potential omitted variables are controlled for in Tables 6 and 7.

The data show that Senegalese migrants' remittances are mostly meant to finance daily consumption—see Chort and Senne (2013). This means that if information asymmetry plays a role and h are able to manipulate information to divert monies meant to finance exceptional, large investments in assets and housing, they should find it even easier to spend remittances for daily consumption on whatever they please. Subsequently, regressing total t on proxies for Q should dilute the expected positive covariance rather than reinforce it.

Tables 6 and 7 first lend support to the model insofar as proxies that increase (decrease) with observability of h's actions, e.g. the number of visits to h (days since m's last visit), are positively (negatively) and mostly significantly associated with t. This is robust to various sets of controls, indicated by row titles. Second, the coefficients are larger and more often significant for the European (Table 7) than the Mauritanian sample (Table 6), which is also a prediction of the model.[32]

6 Robustness checks

6.1 Competing interpretations of the discrepancies

Going back to the measurement–error model that opens Section 5, the pattern of positive and significant Δs can be imputed to δ_A or to another systematic component δ_O. Although the model's predictions are borne out by the data and are not easily accounted for outside the framework of information asymmetry, competing explanations for $\Delta > 0$ relying on $\delta_O > 0$ rather than $\delta_A > 0$ need be investigated.

Tables 8 and 9 scrutinize the impact of confounding factors on the asset discrepancies—

[32] Tables 6 and 7 are based on migrant survey data. The results are robust to focusing on the matched sample instead, albeit at the cost of reduced precision due to the smaller number of observations.

Table 6: Covariance between remittances and monitoring—Mauritanian sample

	(1) Nb of visits to h per year	(2) Days since last visit to h	(3) Nb contacts per year with main other emigrant from h	(4) % of total remittances to h in kind	(5) Nb of associations m belongs to
No controls	7.41	-0.05	3.22	6.48***	-26.10
	(11.67)	(0.03)	(3.36)	(2.18)	(40.07)
m's total income (€)	8.29	-0.05*	1.92	5.10**	-51.49
	(11.02)	(0.03)	(2.54)	(2.09)	(38.87)
Spouse lives with h	-1.52	-0.03	3.13	5.49***	-37.71
	(11.51)	(0.03)	(3.80)	(2.10)	(36.94)
m has child in h	4.59	-0.04	3.68	5.43**	-32.00
	(11.89)	(0.03)	(3.88)	(2.24)	(39.89)
h's wealth index	6.95	-0.06*	3.38	5.38**	-26.68
	(11.20)	(0.03)	(3.72)	(2.20)	(39.72)
All controls	0.18	-0.04	1.32	3.92*	-53.79
	(10.59)	(0.03)	(3.24)	(2.08)	(36.23)

Standard errors in parentheses

The dependent variable is total remittances sent by m in the past 12 months (in kind included). Col. 1 and 2 additionally control for whether m ever went back to visit h. Col. 4 includes a quadratic term. The regressions are estimated on the whole sample thanks to interactions with migrant location dummies.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Covariance between remittances and monitoring—European sample

	(1) Nb of visits to h per year	(2) Days since last visit to h	(3) Nb contacts per year with main other emigrant from h	(4) % of total remittances to h in kind	(5) Nb of associations m belongs to
No controls	112.15	-0.25**	12.57**	77.60***	189.48*
	(99.43)	(0.11)	(5.67)	(25.96)	(106.86)
m's total income (€)	83.25	-0.24**	9.73*	61.68**	123.79
	(100.06)	(0.11)	(5.29)	(25.99)	(109.95)
Spouse lives with h	108.93	-0.14	10.56*	80.16***	160.12
	(98.63)	(0.11)	(5.47)	(25.25)	(105.81)
m has child in h	92.01	-0.15	11.75**	64.05**	137.53
	(102.45)	(0.10)	(5.44)	(26.37)	(107.36)
h's wealth index	109.95	-0.22**	12.71**	69.46***	187.90*
	(99.57)	(0.11)	(5.73)	(26.16)	(108.62)
All controls	54.41	-0.09	7.96	48.69*	66.00
	(102.94)	(0.11)	(4.92)	(26.46)	(110.67)

Standard errors in parentheses

The dependent variable is total remittances sent by m in the past 12 months (in kind included). Col. 1 and 2 additionally control for whether m ever went back to visit h. Col. 4 includes a quadratic term. The regressions are estimated on the whole sample thanks to interactions with migrant location dummies.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

see Table E5 for housing characteristics. Potential culprits are the following.

First, the migrant and household surveys were implemented on average 4, 5 and 8 months apart for the French, Mauritanian and Italian samples, respectively. Although a negative economic shock large enough that migrants' households divested and a drop in X is observed seems unlikely, the role of the time gap must be taken to the test as it shall provide us information on the case (b) discussed in Section 3.2: If monitoring is perfect but m does not incorporate the mean τ in her pre–monitoring reports, she will update X_{hm} with a delay. We use the exogenous time gap between the two surveys, standardized on the basis of m's and h's places of residence.

Second, social desirability is a serious concern if either of m or h is more sensitive to it or if they react to different norms.[33] Insofar as social–desirability bias in survey response is a product of the interaction with an enumerator, we can control for this issue thanks to a dummy for whether m's enumerator was Senegalese or of Senegalese origin and another for whether m and her enumerator were of the same sex. Since enumerators were randomly assigned to interviewees, these variables are well identified.

Third, because of the structure of the household questionnaire, the respondent for h may have been asked to review the possessions of each "cell" of h, and some might have been more easily overlooked than in the migrant survey. If such were the case, we would however expect the number of members in h to be trimmed in a similar way in h's report. Hence, we use the discrepancy in the size of h as a control.

Fourth, h might have assumed a more restrictive definition of "h's ownership of X" than m, especially as X may belong to m although it is used by h. Transfer discrepancies raise a similar issue and can act as a robustness check: Whereas the migrant questionnaire seems to include investment funds from m to h in t, h was apparently asked about remittances the final consumers of which are the members of h. Tables 10 and 11 use Δt, a proxy (albeit endogenous) for inconsistencies in the delimitation of ownership—see Table E6 for housing characteristics.[34] Δt can also be regarded as a proxy for m's tendency to exaggerate her generosity and thus for social

[33] Indeed, some interviewees of the semi–qualitative survey deemed plausible that m exaggerated her role in improving h's living standard, and subsequently X.

[34] Unfortunately, the transfers received and reported by h can be unambiguously attributed to m only in the French sample.

desirability.

Tables 8 and 9 show that the proxies for confounding factors usually have the expected signs when significant. "Δ h size" and "Enumerator Senegalese" seem the most serious confounds. As expected, a large gap in reported h sizes corresponds to a large ΔX and migrants faced with a Senegalese enumerator may have been tempted to overstate the benefits brought to h by their transfers, reacting to strong remitting norms[35] and competition for prestige in the Senegalese diaspora. Compared to Table 4 we see that the confounds are seldom strong enough to knock the constant and Mauritania dummy out of significance. Finally, Tables 10 and 11 do not display significant results, which could be blamed on very small sample sizes.

Other potential confounds, such as delays in information transmission and m's underestimating living costs in Senegal, were studied but found not to play a role—see Seror (2012).

6.2 Dealing with endogeneity in the high–observability proxy

Although the previous tables lend little credence to alternative explanations for $\Delta > 0$, the second prediction of the model still needs to be buttressed as the significant and robust effect of the Mauritania dummy could be due to a host of unobservables.

Table 12 summarizes potential channels through which the Mauritania dummy may affect the discrepancies and the direction of the effect. Since we are interested in the sign and significance of the high–observability proxy rather than its point estimate, an omitted variable threatens the results if the bias it induces is of the same sign as that predicted by the model, i.e. if it is negative. This means that factors such as prospective migrants' dreading information manipulation by h and thus selecting into migration to Mauritania are not serious concerns since they bias the coefficient of interest toward 0. Conversely, if migrants who are less educated than h are both more likely to go to Mauritania than Europe and not to detect misrepresentations, then a negative bias obtains. Similarly, we would expect mutual affection between m and h to both lead them to favor nearby Mauritania as m's destination country and reduce the likelihood

[35] In the semi–qualitative survey, 12 out of 20 feel it is a "moral obligation" to remit to the household of origin; *all* declare remitting to relatives in Senegal, 15 of them on a regular basis.

Table 8: Impact of confounding factors on estimated asset discrepancies (1/2)

	fridge				freezer				tvset				dvd				radio			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Constant	0.18***	0.22***	0.24***	0.29***	0.21***	0.32***	0.30***	0.38***	-0.22**	-0.35**	-0.43***	-0.54***	0.37***	0.12	0.35***	0.09	0.23**	0.20	0.34*	0.22
	(0.04)	(0.07)	(0.07)	(0.09)	(0.03)	(0.06)	(0.06)	(0.07)	(0.08)	(0.15)	(0.12)	(0.16)	(0.06)	(0.09)	(0.10)	(0.11)	(0.12)	(0.17)	(0.20)	(0.23)
m in Mauritania			-0.11	-0.14			-0.17**	-0.15*			0.41**	0.44**			0.04	0.06			-0.22	-0.05
			(0.08)	(0.09)			(0.07)	(0.09)			(0.17)	(0.21)			(0.11)	(0.12)			(0.24)	(0.30)
Standardized time gap		0.09*		0.09*		-0.04		-0.04		-0.12		-0.12		-0.01		-0.00		0.13		0.13
		(0.05)		(0.05)		(0.04)		(0.04)		(0.10)		(0.09)		(0.06)		(0.06)		(0.14)		(0.14)
Enumerator and interviewee same sex		-0.04		-0.01		-0.20***		-0.16**		0.22		0.12		0.22*		0.20*		-0.14		-0.12
		(0.09)		(0.09)		(0.08)		(0.08)		(0.18)		(0.20)		(0.12)		(0.12)		(0.22)		(0.24)
Enumerator Senegalese		-0.09		-0.07		0.01		0.04		0.16		0.09		0.46***		0.45***		0.37		0.38
		(0.09)		(0.09)		(0.10)		(0.10)		(0.18)		(0.18)		(0.14)		(0.14)		(0.30)		(0.31)
Δ h size		0.00		0.00		0.00		0.00		0.03***		0.04***		0.01*		0.01**		0.05***		0.05***
		(0.00)		(0.00)		(0.00)		(0.00)		(0.01)		(0.01)		(0.01)		(0.01)		(0.02)		(0.02)
Observations	318	275	318	275	317	274	317	274	316	273	316	273	315	272	315	272	317	274	317	274
F all confounds = 0		1.21		0.99		2.03		1.29		4.12		4.91		3.79		3.56		3.29		3.16
p–value		0.31		0.42		0.09		0.27		0.00		0.00		0.01		0.01		0.01		0.01

Standard errors in parentheses

The constant in Col. 1–2 (3–4) corresponds to the (European) mean Δ. m in Mauritania captures the effect on Δ of m being in Mauritania instead of Europe.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Impact of confounding factors on estimated asset discrepancies (2/2)

	cd				fan				bike				car				moto			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Constant	0.27***	0.20**	0.50***	0.41***	-0.08	-0.25	-0.07	-0.24	0.41***	0.56***	0.72***	0.81***	0.14***	0.17***	0.27***	0.26***	0.22***	0.27***	0.34***	0.39***
	(0.07)	(0.09)	(0.10)	(0.12)	(0.14)	(0.20)	(0.25)	(0.27)	(0.07)	(0.13)	(0.14)	(0.17)	(0.04)	(0.06)	(0.07)	(0.07)	(0.05)	(0.09)	(0.09)	(0.12)
m in Mauritania			-0.42***	-0.49***			-0.03	-0.03			-0.59***	-0.60***			-0.24***	-0.19**			-0.22**	-0.29**
			(0.13)	(0.15)			(0.28)	(0.33)			(0.15)	(0.14)			(0.07)	(0.09)			(0.10)	(0.13)
Standardized time gap		0.02		0.02		0.21		0.21		-0.07		-0.07		-0.01		-0.01		-0.03		-0.03
		(0.08)		(0.08)		(0.17)		(0.17)		(0.10)		(0.09)		(0.04)		(0.04)		(0.05)		(0.05)
Enumerator and interviewee same sex		-0.12		-0.02		0.09		0.10		-0.28**		-0.14		-0.06		-0.02		-0.24**		-0.18*
		(0.14)		(0.14)		(0.27)		(0.29)		(0.14)		(0.12)		(0.09)		(0.09)		(0.11)		(0.11)
Enumerator Senegalese		0.45***		0.51***		0.51*		0.52*		-0.00		0.09		-0.05		-0.02		0.39**		0.43***
		(0.16)		(0.16)		(0.30)		(0.30)		(0.17)		(0.16)		(0.09)		(0.09)		(0.15)		(0.16)
Δ h size		0.02**		0.01*		0.04**		0.04**		0.02**		0.02*		0.01*		0.01*		0.00		-0.00
		(0.01)		(0.01)		(0.02)		(0.02)		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)
Observations	314	271	314	271	317	274	317	274	316	273	316	273	316	273	316	273	317	274	317	274
F all confounds = 0		3.21		3.60		2.19		2.19		1.90		1.07		1.55		0.98		4.22		4.11
p–value		0.01		0.01		0.07		0.07		0.11		0.37		0.19		0.42		0.00		0.00

Standard errors in parentheses

The constant in Col. 1–2 (3–4) corresponds to the (European) mean Δ. m in Mauritania captures the effect on Δ of m being in Mauritania instead of Europe.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Impact of discrepancies in remittance reports (Δt) on estimated asset discrepancies (ΔX)—French sample only (1/2)

	fridge				freezer				tvset				dvd				radio			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Constant	0.09	0.15	0.03	-0.16	0.21**	0.26	0.19**	0.33*	-0.68***	-0.89***	-0.58***	-0.63**	0.04	0.10	0.07	0.16	-0.37	-0.04	-0.30	-0.25
	(0.07)	(0.16)	(0.08)	(0.18)	(0.09)	(0.21)	(0.08)	(0.19)	(0.16)	(0.31)	(0.14)	(0.25)	(0.16)	(0.29)	(0.13)	(0.22)	(0.27)	(0.45)	(0.26)	(0.35)
Δt (€1000)	0.04	0.05	0.01	-0.01	0.04*	0.04	0.02	0.03	0.01	-0.01	0.01	0.01	0.00	0.01	-0.01	0.00	0.04	0.09	0.02	0.02
	(0.02)	(0.04)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.05)	(0.08)	(0.04)	(0.06)	(0.05)	(0.05)	(0.04)	(0.04)	(0.09)	(0.14)	(0.09)	(0.11)
m's total income (incl. social benefits)		-0.00		0.00		-0.00		-0.00		0.00		0.00		-0.00		-0.00		-0.00		-0.00
		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
Observations	50	49	75	72	50	49	75	72	50	49	75	72	50	49	75	72	50	49	75	72

Standard errors in parentheses

For each variable ΔX, Col. 1–2 (3–4) define Δt as missing (0) when no transfer by m was reported by h.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Impact of discrepancies in remittance reports (Δt) on estimated asset discrepancies (ΔX)—French sample only (2/2)

	cd				fan				bike				car				moto			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Constant	0.28*	0.35	0.26**	0.15	-0.96***	-0.81	-0.58*	-0.38	0.74***	0.87**	0.55***	0.28	0.16*	0.21	0.10	0.15	0.24	-0.04	0.17	0.06
	(0.14)	(0.26)	(0.12)	(0.20)	(0.25)	(0.49)	(0.31)	(0.48)	(0.23)	(0.43)	(0.19)	(0.36)	(0.08)	(0.18)	(0.07)	(0.13)	(0.15)	(0.32)	(0.13)	(0.26)
Δt (€1000)	0.01	0.02	-0.00	-0.02	0.09	0.10	0.05	0.07	0.09	0.10	0.07	0.04	-0.01	-0.00	-0.01	-0.00	-0.00	-0.04	0.06	0.04
	(0.03)	(0.04)	(0.03)	(0.04)	(0.09)	(0.11)	(0.08)	(0.08)	(0.08)	(0.10)	(0.07)	(0.08)	(0.03)	(0.02)	(0.02)	(0.02)	(0.05)	(0.06)	(0.06)	(0.07)
m's total income (incl. social benefits)		-0.00		0.00		-0.00		-0.00		-0.00		0.00		-0.00		-0.00		0.00		0.00
		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
Observations	50	49	75	72	50	49	75	72	50	49	75	72	50	49	75	72	50	49	75	72

Standard errors in parentheses

For each variable ΔX, Col. 1–2 (3–4) define Δt as missing (0) when no transfer by m was reported by h.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

of nonzero Δ. Finally, it is also plausible that poorer households are less likely to be able to send migrants to distant Europe and perhaps more inclined to diverge from m in terms of preferences, inducing a negative bias.

It is important to note that a well–identified Mauritania dummy would still lump together two different determinants of $\Delta > 0$: Living just across the Senegal river means that monitoring is cheaper but also that remitting capacity and transfer embezzlement are more constrained. Both channels operate through h's strategic behavior: *ex post* through the monitoring of h's actions and *ex ante* since m knows that higher transfers mean stronger incentives to deviate from the contract, respectively. Subsequently, this does not jeopardize the information–asymmetry hypothesis per se but it does mean that the only way to isolate the *monitoring* channel is to control for remitting capacity directly.

Table 12: Effect of MAU on Δ: Potential channels of impact

Channel	Sign
Monitoring cost	–
Remitting capacity	–
m less educated than h	–
Info. asymm. problems likely	+
h's wealth	–
Mutual affection	–

In the absence of exogenous instruments, Table 13 revisits evidence on Prediction 2 with controls for obvious confounds. Unfortunately, these controls cannot be argued to be well identified. As a consequence, the results should be taken with a pinch of salt and are merely presented here to scrutinize the robustness of the effect of the high–observability proxy.

Table 13 regresses the discrepancies for each asset variable[36] on the Mauritania dummy and different controls (as indicated by row titles), all interacted with the high–observability proxy. The controls are the following: A variable equal to 1 if the migrant

[36] Although the Mauritania dummy was not found to be a significant determinant of housing quality discrepancies, Table E7 provides similar evidence on housing characteristics.

received some schooling while the head of her household of origin did not, 0 when they have the same level of education and -1 when the migrant is less educated than h's head; a dummy equal to 1 if the migrant's spouse lives with h; a dummy equal to 1 when m has at least one child living with h; and an index of h's wealth, constructed thanks to principal component analysis—two versions of the index are tested, one based on asset ownership at the time of the survey and the other five years before, to alleviate part of reverse causality concerns, albeit at the cost of reduced sample size (275 instead of 310). Migrant's income is finally controlled for to try and disentangle the monitoring and remitting capacity channels, although this approach entails a risk of netting both effects out, since monitoring is costly.

We can see from Table 13 that when significant the Mauritania dummy remains robustly negative.[37] Besides, the controls do not lead to statistically significantly different point estimates, even though they often enter the regressions significantly (especially the wealth index and proxies for affective ties) and with the expected negative sign.

7 Conclusion

The thread of this paper is a stylized fact emerging from matched data on Senegalese migrants interviewed in France, Italy and Mauritania and their households of origin in Senegal: Migrants tend to systematically overestimate or overstate the number of assets owned by their household of origin, as well as the quality of their dwelling. This pattern fits nicely into the picture of the Senegalese diaspora painted in the socio–anthropological literature. In effect, Senegalese migrants are keen on sending remittances to invest in real estate or productive endeavors back home, or simply refurbish or equip their household's compound. Transfer recipients on the other hand may have different preferences and be subjected to stronger pressures to share or spend, thereby causing conflicts and strategic behavior over the use of remittances.

Based on socio–anthropological evidence and the economic literature, we modeled Senegalese migrants' transfer behavior in an information–asymmetry framework. We established that even if much of the two parties' maximization problems are common

[37] The only exception is TV sets, as in previous tables.

Table 13: Impact of geographical distance on the discrepancies between m's and h's reports of the latter's asset ownership ($X_{hm} - X_{hh}$), controlling for likely confounding factors

	(1) fridge	(2) freezer	(3) tvset	(4) dvd	(5) radio	(6) cd	(7) fan	(8) bike	(9) car	(10) moto
No controls	-0.11	-0.17**	0.41**	0.04	-0.22	-0.42***	-0.03	-0.59***	-0.24***	-0.22**
	(0.08)	(0.07)	(0.17)	(0.11)	(0.24)	(0.13)	(0.28)	(0.15)	(0.07)	(0.10)
m more educated than h's head	-0.18**	-0.17**	0.22	0.05	-0.29	-0.46***	-0.13	-0.50***	-0.20**	-0.23**
	(0.09)	(0.07)	(0.21)	(0.13)	(0.26)	(0.17)	(0.33)	(0.14)	(0.08)	(0.10)
Spouse resident in household of origin	-0.15	-0.13	0.42**	0.01	-0.12	-0.27**	-0.03	-0.64***	-0.23***	-0.18*
	(0.10)	(0.08)	(0.19)	(0.13)	(0.26)	(0.13)	(0.31)	(0.17)	(0.09)	(0.11)
At least one child lives in household of origin	-0.15	-0.13	0.41*	0.03	-0.26	-0.28*	0.02	-0.68***	-0.25**	-0.22*
	(0.11)	(0.09)	(0.21)	(0.15)	(0.28)	(0.15)	(0.34)	(0.19)	(0.10)	(0.12)
h's wealth index, h's report	-0.10	-0.19***	0.40***	0.02	-0.26	-0.44***	-0.11	-0.62***	-0.25***	-0.24**
	(0.08)	(0.07)	(0.14)	(0.12)	(0.22)	(0.12)	(0.25)	(0.15)	(0.07)	(0.10)
h's wealth index (5 y. bef. survey), h's report	-0.03	-0.15**	0.51***	0.05	-0.19	-0.37***	-0.09	-0.60***	-0.25***	-0.28***
	(0.08)	(0.07)	(0.16)	(0.13)	(0.23)	(0.14)	(0.30)	(0.17)	(0.08)	(0.11)
All controls but income	-0.24**	-0.15*	0.15	0.02	-0.40	-0.30*	-0.20	-0.61***	-0.25**	-0.28**
	(0.11)	(0.09)	(0.24)	(0.15)	(0.28)	(0.15)	(0.35)	(0.16)	(0.11)	(0.13)
m's total income (€)	0.01	-0.08	0.74***	-0.01	-0.07	-0.21	0.02	-0.43*	-0.34***	-0.11
	(0.14)	(0.12)	(0.28)	(0.20)	(0.33)	(0.18)	(0.47)	(0.23)	(0.12)	(0.17)
All controls	-0.05	-0.07	0.66**	0.03	-0.05	-0.01	0.09	-0.52**	-0.39**	-0.27
	(0.17)	(0.15)	(0.32)	(0.24)	(0.38)	(0.21)	(0.50)	(0.25)	(0.16)	(0.20)

Standard errors in parentheses

The table displays the Mauritania dummy coefficients, controlling for different factors in each row. Interactions between the Mauritania dummy and the controls are not reported.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

knowledge, and allowing for monitoring, remittance recipients may still find it optimal to divert targeted funds and we may observe on average gaps between transfer senders' and recipients' information sets. For this to hold, there should be two sources of uncertainty in the implementation of the contract. In our model, these are the partial unpredictability of the recipient's incentive to deviate from the earmarking contract and the imperfection of the monitoring technology used by the sender.

The empirical part of the paper establishes the stylized fact and tests additional predictions that are difficult to explain outside the information–asymmetry framework, providing evidence of increased information manipulation by remittance recipients when observability is lower.

Such evidence questions the methodology underpinning the "transfer regressions" common in the literature, whereby remittances are explained by proxies for different remittance motives. Seror (2012) suggests that such regressions are biased if strategic behavior is an issue but that using the reports of those most directly concerned, e.g. the migrant's for her own characteristics, should help improve identification. A more general derivation of the bias would however provide more precise guidelines.

Besides, the review of the literature on the Senegalese diaspora inspires caution when studying gaps between remittance senders' and recipients' reports in matched datasets. We argue that focusing on variables for which relative demands are well documented should be preferred to income or wealth as these are less tightly linked to the context under study and discrepancies may reflect contradictory remittance motives.

A theoretical conclusion can finally be drawn: Even when monitoring is allowed to partially restore observability, the unitary and collective household frameworks may not be relevant empirically. Since transfer recipients may extract rents from senders thanks to private information they can manipulate, the assumption or prediction (based on altruism) that migrants and their non–migrant relatives should arrive at efficient intra–household allocations that benefit the group as a whole is unwarranted.

But one should not be too hasty in drawing policy recommendations. Whether improving migrants' information about remittance use is beneficial to the transnational

household and development in general remains an open question. In effect, the developmental cost of information asymmetry in the remittance context hinges on a comparison of the impacts of senders' and recipients' preferred uses of the remittance manna. Even though the investments in durable assets (and housing quality) studied in this paper may serve a productive purpose (trigger positive multiplier effects), conspicuous consumption also plays a part in them and we cannot exclude the possibility that recipients' strategic use of the transfers should be promoted.

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Appendices

A Impact of remittances on h's incentive to deviate

The first derivative of constraint 5 with respect to t is:

$$\begin{aligned}
&\pi[u^{h\prime}(Y^*(\omega+t))\frac{\partial Y^*(\omega+t)}{\partial t}+v^{h\prime}(X^*(\omega+t))\frac{\partial X^*(\omega+t)}{\partial t}\\
&-\frac{1}{p_X}v^{h\prime}(X^*(\omega)+\frac{t}{p_X})]\\
&+(1-\pi)[u^{h\prime}(Y^*(\omega(1-\tau)+t))\frac{\partial Y^*(\omega(1-\tau)+t)}{\partial t}\\
&+v^{h\prime}(X^*(\omega(1-\tau)+t))\frac{\partial X^*(\omega(1-\tau)+t)}{\partial t}\\
&-\frac{1}{p_X}v^{h\prime}(X^*(\omega)+\frac{t}{p_X})]\\
&-\pi F\alpha'(\cdot)q'(X^*(\omega)+\frac{t}{p_X}-X^*(\omega+t);Q^*)[\frac{1}{p_X}-\frac{\partial X^*(\omega+t)}{\partial t}]\\
&-(1-\pi)F\alpha'(\cdot)q'(X^*(\omega)+\frac{t}{p_X}-X^*(\omega(1-\tau)+t);Q^*)[\frac{1}{p_X}-\frac{\partial X^*(\omega(1-\tau)+t)}{\partial t}]
\end{aligned} \tag{14}$$

The argument being symmetric for $\tau = 0$ and $\tau > 0$, let us focus on the former. We have:

$$\begin{aligned}
&+u^{h\prime}(Y^*(\omega+t))\frac{\partial Y^*(\omega+t)}{\partial t}+v^{h\prime}(X^*(\omega+t))\frac{\partial X^*(\omega+t)}{\partial t}\\
&-\frac{1}{p_X}v^{h\prime}(X^*(\omega)+\frac{t}{p_X})\\
&-F\alpha'(\cdot)q'(X^*(\omega)+\frac{t}{p_X}-X^*(\omega+t);Q^*)[\frac{1}{p_X}-\frac{\partial X^*(\omega+t)}{\partial t}]
\end{aligned} \tag{15}$$

Now, since a fungible t necessarily increases consumption of both X and Y and therefore h's utility, the first two components in this sum are positive. Note that $v^{h\prime}(X^*(\omega+t))\frac{\partial X^*(\omega+t)}{\partial t} \geq \frac{1}{p_X}v^{h\prime}(X^*(\omega)+\frac{t}{p_X})$, since h should always prefer an interior solution to the corner solution imposed by the contract. Therefore, absent monitoring (the last term of the sum) we see that h always has an incentive to deviate

and that this incentive is stronger, the larger the remittances.

B Impact of τ on h's incentive to deviate

The first derivative of constraint 5 with respect to τ is:

$$\begin{aligned}(1-\pi)[u^{h\prime}(Y^*\omega(1-\tau-L))\frac{\partial Y^*(\omega(1-\tau-L))}{\partial\omega(1-\tau-L)}(1+L'(\tau))\\ -u^{h\prime}(Y^*(\omega(1-\tau)+t))\frac{\partial Y^*(\omega(1-\tau)+t)}{\partial\omega(1-\tau)+t}\\ -v^{h\prime}(X^*(\omega(1-\tau)+t))\frac{\partial X^*(\omega(1-\tau)+t)}{\partial\omega(1-\tau)+t}\\ -F\alpha'(\cdot)q'(X^*(\omega)+\frac{t}{p_X}-X^*(\omega(1-\tau)+t);Q^*)\frac{\partial X^*(\omega(1-\tau)+t)}{\partial\omega(1-\tau)+t}] \qquad (16)\end{aligned}$$

If we abstract from monitoring, we can see that the derivative of constraint 5 with respect to τ is equivalent to: $(1-\pi)[\frac{\partial W^h}{\partial\tau}$ when h abide by the contract $-\frac{\partial W^h}{\partial\tau}$ when h deviate], where obviously $\frac{\partial W^h}{\partial\tau}<0$. Now, since the contract pushes h into a corner solution and moreover h need to reduce their consumption of Y when $\tau>0$ in order to meet the target X^{*m}, we know that $\frac{\partial W^h}{\partial\tau}$ is larger in absolute value when h are compliant. Therefore, absent monitoring h are more likely to deviate when $\tau>0$ than when $\tau=0$.

C Covariance of t and Q

From the F.O.C.s of Problem 3 , we have:

$$t: \quad v'(\cdot)\frac{\partial X^*}{\partial t}-\lambda p_t=0 \qquad (17)$$

$$Q: \quad v'(\cdot)\frac{\partial X^*}{\partial Q}-\lambda l'(Q)=0 \qquad (18)$$

Since $l'(Q)>0$ and assuming that $\frac{\partial X^*}{\partial Q}\neq 0$, we have:

$$\frac{p_t}{l'(Q)} = \frac{\frac{\partial X^*}{\partial t}}{\frac{\partial X^*}{\partial Q}} \tag{19}$$

$$\therefore \quad \frac{p_t}{l'(Q)} \frac{\partial X^*}{\partial Q} = \frac{\partial X^*}{\partial t} \tag{20}$$

Assuming $t(Q)$ differentiable, by the Chain Rule we get:

$$\frac{p_t}{l'(Q)} \frac{\partial X^*}{\partial t} \frac{\partial t}{\partial Q} = \frac{\partial X^*}{\partial t} \tag{21}$$

Assuming that $\frac{\partial X^*}{\partial t} \neq 0$ and since $p_t > 0$:

$$\frac{p_t}{l'(Q)} \frac{\partial t}{\partial Q} = 1 \tag{22}$$

$$\therefore \quad \frac{\partial t}{\partial Q} = \frac{l'(Q)}{p_t} > 0$$

D Measurement error in the test of Prediction 2

D.1 Focusing on ζ

Taking up the notation of Section 5, we have $\widetilde{\Delta} = \Delta + \zeta X_{hh} + \nu$ and we want to estimate $\Delta = \beta MAU + \epsilon$, where MAU is a dummy variable equal to 1 if m is in Mauritania and 0 if she lives in Europe, and ϵ is assumed to be uncorrelated with MAU and to have zero expectation. Since being in Mauritania both increases observability and reduces potential transfers, which leads to a decrease in Δ—see Section 6,—we expect $\beta \leq 0$.

Using OLS, we obtain:

$$\widehat{\beta} = \frac{\text{cov}(MAU, \widetilde{\Delta})}{\text{var}(MAU)} = \frac{\text{cov}(MAU, \Delta + \zeta X_{hh} + \nu)}{\text{var}(MAU)} \tag{23}$$

$$= \frac{\text{cov}(MAU, \beta MAU + \zeta X_{hh} + \nu + \epsilon)}{\text{var}(MAU)} = \frac{\beta \sigma^2_{MAU} + \zeta \sigma_{MAU, X_{hh}}}{\sigma^2_{MAU}} \tag{24}$$

$$= \beta + \zeta \beta_{X_{hh}, MAU} \geq \beta \tag{25}$$

where $\beta_{X_{hh}, MAU}$ denotes the coefficient on MAU in a regression with X_{hh} as the dependent variable. Given the lower living standard in Mauritania than in Europe, $\beta_{X_{hh}, MAU}$ is expected to be negative and the data support this conjecture. Therefore, $\widehat{\beta}$ *over*estimates β, which goes counter to Prediction 2.

What about the effect of ζ on the significance of $\widehat{\beta}$? From Eq. 25, we have:

$$\text{plim}\widehat{\beta} - \beta = \zeta \beta_{X_{hh}, MAU} \tag{26}$$

and

$$\widehat{\epsilon} = \widetilde{\Delta} - \widehat{\beta} MAU = \Delta + \zeta X_{hh} + \nu - \widehat{\beta} MAU \tag{27}$$

$$= \epsilon - (\Delta - \beta MAU) + \Delta + \zeta X_{hh} + \nu - \widehat{\beta} MAU \tag{28}$$

$$= \epsilon - (\beta - \widehat{\beta}) MAU + \zeta X_{hh} + \nu \tag{29}$$

Calling σ^2_ϵ the variance of ϵ and $\widehat{\sigma^2_\epsilon}$ its estimator (and using a similar notation for ν), we have:

$$\text{plim}\widehat{\sigma_\epsilon^2} = \sigma_\epsilon^2 + \zeta^2\beta_{X_{hh},MAU}^2\sigma_{MAU}^2 + \zeta^2\sigma_{X_{hh}}^2 + \sigma_\nu^2 + \zeta^2\beta_{X_{hh},MAU}\sigma_{X_{hh},MAU}$$

(30)

$$\therefore \text{plim}\widehat{s} \equiv \text{plim}\frac{\widehat{\sigma_\epsilon^2}}{\widehat{\sigma_{MAU}^2}}$$

$$= \frac{\sigma_\epsilon^2 + \zeta^2\beta_{X_{hh},MAU}^2\sigma_{MAU}^2 + \zeta^2\sigma_{X_{hh}}^2 + \sigma_\nu^2 + \zeta^2\beta_{X_{hh},MAU}\sigma_{X_{hh},MAU}}{\sigma_{MAU}^2} \tag{31}$$

$$= s + \zeta^2\beta_{X_{hh},MAU}^2 + \zeta^2\frac{\sigma_{X_{hh}}^2}{\sigma_{MAU}^2} + \frac{\sigma_\nu^2}{\sigma_{MAU}^2} + \zeta^2\beta_{X_{hh},MAU}^2 \tag{32}$$

$$= s + 2\zeta^2\beta_{X_{hh},MAU}^2 + \zeta^2\frac{\sigma_{X_{hh}}^2}{\sigma_{MAU}^2} + \frac{\sigma_\nu^2}{\sigma_{MAU}^2} \tag{33}$$

$$\therefore \frac{\text{plim}t}{\sqrt{n}} = \frac{\text{plim}\widehat{\beta}}{\text{plim}\sqrt{\widehat{s}}} = \frac{\beta + \zeta\beta_{X_{hh},MAU}}{\sqrt{s + 2\zeta^2\beta_{X_{hh},MAU}^2 + \zeta^2\frac{\sigma_{X_{hh}}^2}{\sigma_{MAU}^2} + \frac{\sigma_\nu^2}{\sigma_{MAU}^2}}} \tag{34}$$

$$\therefore \left|\frac{\text{plim}t}{\sqrt{n}}\right| \leq \left|\frac{\beta}{\sqrt{s}}\right| \tag{35}$$

Since the numerator in Eq. 34 is greater than β and β is expected to be negative, ζ biases our t–statistics towards 0 (and may even yield the wrong sign on β). The denominator is clearly greater than $\sqrt{s}$, which also biases also t–statistics downwards.

D.2 Allowing mean–reverting measurement error to be exacerbated by distance

It is likely that the element in $\widetilde{X_{hm}}$ that is negatively correlated with X_{hh} increases with the geographical distance between m and h. We model this as follows:

$$\widetilde{\Delta} = \Delta + \zeta(1 - \eta MAU)X_{hh} + \nu$$

where $\eta \in [0; 1]$.

Adapting Eq. 23 yields:

$$\widehat{\beta} = \frac{\text{cov}(MAU, \Delta + \zeta(1 - \eta MAU)X_{hh} + \nu)}{\text{var}(MAU)} \tag{36}$$

$$= \frac{\text{cov}(MAU, \beta MAU + \zeta(1 - \eta MAU)X_{hh} + \nu + \epsilon)}{\text{var}(MAU)} \tag{37}$$

$$= \frac{\beta\sigma^2_{MAU} + \zeta\sigma_{MAU,X_{hh}} - \zeta\eta\sigma_{MAU,X_{hh}MAU}}{\sigma^2_{MAU}} \tag{38}$$

$$= \beta + \zeta\frac{\sigma_{MAU,X_{hh}} - \eta\sigma_{MAU,X_{hh}MAU}}{\sigma^2_{MAU}} \tag{39}$$

Based on the binary nature of MAU, it can be shown that $\sigma_{MAU,X_{hh}MAU} \geq 0$. Since $\zeta \leq 0$, $\eta \geq 0$ and $\sigma_{X_{hh},MAU} \leq 0$, it still holds that $\widehat{\beta} \geq \beta$.

D.3 Focusing on δ_O

Focusing on δ_O, we now have:

$$\widehat{\beta} = \beta + \delta_O\beta_{X_{hh},MAU} \leq \beta \leq 0 \tag{40}$$

because $\delta_O \geq 0$ and $\beta_{X_{hh},MAU} \leq 0$. δ_O therefore represents a serious confound in the test of Prediction 2, considered in Section 6.

E Additional empirical evidence

Table E1: Correlation between migration destination (within Mauritania) and monitoring proxies

	(1) Nb of visits to *h* per year	(2) Days since last visit to *h*	(3) % of total remittances to *h* in kind
m in Rosso, Mau.	1.02**	-269.62***	8.75*
	(0.44)	(98.12)	(5.06)
m in Nouakchott, Mau.	0.56***	-172.30**	9.75***
	(0.15)	(68.04)	(1.78)
m in Nouadhibou, Mau.	0.78*	-211.01*	4.80*
	(0.42)	(123.74)	(2.83)
Constant	0.82***	794.68***	2.49***
	(0.05)	(43.78)	(0.36)
Observations	895	711	757
m in Rosso = m in Nouakchott	0.99	0.91	0.04
p–value	0.32	0.34	0.85
m in Rosso = m in Nouadhibou	0.15	0.16	0.47
p–value	0.70	0.69	0.50

Standard errors in parentheses

The constant corresponds to the European mean dependent variable. The regressors capture the effect of m being in different Mauritanian locations instead of Europe.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E2: Discrepancies between m's and h's reports of the latter's housing characteristics ($X_{hm} - X_{hh}$)

	(1) House type (quality)	(2) Nb of rooms	(3) Roof material (quality)	(4) *h* own their dwelling
Constant	0.22*	2.16***	0.15*	0.10***
	(0.12)	(0.48)	(0.08)	(0.03)
m in Mauritania	0.00	-0.52	0.02	-0.00
	(0.15)	(0.81)	(0.11)	(0.04)
Observations	316	304	308	319

Standard errors in parentheses

The constant corresponds to the European mean Δ. m in Mauritania captures the effect on Δ of m being in Mauritania instead of Europe.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E3: Correlation between the housing discrepancies and m's investment behavior

	(1) House type (quality)	(2) Nb of rooms	(3) Roof material (quality)	(4) h own their dwelling
Constant	0.20	2.00***	0.18**	0.10***
	(0.13)	(0.53)	(0.09)	(0.03)
m has (is) invested (–ing) in Senegal with h's help	0.13	0.96	-0.23	0.02
	(0.33)	(1.26)	(0.19)	(0.09)
m in Mauritania	0.04	-0.21	-0.03	0.00
	(0.15)	(0.84)	(0.12)	(0.04)
m has (is) invested (–ing) in Senegal with h's help * Mau.	-0.54	-5.25	0.57	-0.12
	(0.44)	(3.80)	(0.38)	(0.09)
Observations	316	304	308	319

Standard errors in parentheses

The constant corresponds to the European mean Δ. m in Mauritania captures the effect on Δ of m being in Mauritania instead of Europe.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E4: Covariance between remittances and the number of phone calls between m and h—European sample only

	(1) Nb phone calls to h per year
No controls	23.90***
	(4.13)
m's total income (€)	22.04***
	(4.15)
Spouse lives with *h*	20.35***
	(4.21)
m has child in h	18.61***
	(4.24)
h's wealth index	23.32***
	(4.08)
All controls	15.55***
	(4.27)

Standard errors in parentheses

The dependent variable is total remittances sent by m in the past 12 months (in kind included). The regressor of interest is the number of phone calls between m and h per year.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E5: Impact of confounding factors on estimated housing discrepancies

	(1) House type (quality)	(2) Nb of rooms	(3) Roof material (quality)	(4) h owns their dwelling
Constant	0.22	1.55**	0.09	0.11***
	(0.16)	(0.66)	(0.10)	(0.04)
m in Mauritania	-0.02	0.43	-0.04	0.02
	(0.17)	(0.81)	(0.12)	(0.04)
Standardized time gap	-0.02	-0.02	0.02	0.03*
	(0.10)	(0.32)	(0.06)	(0.02)
Enumerator and interviewee same sex	0.08	-0.19	0.09	-0.06
	(0.17)	(0.77)	(0.12)	(0.04)
Enumerator Senegalese	-0.13	-0.21	0.19	0.06
	(0.18)	(0.85)	(0.15)	(0.05)
Δ h size	0.00	0.22***	-0.01	0.00*
	(0.01)	(0.04)	(0.01)	(0.00)
Observations	272	266	268	275
F all confounds = 0	0.20	7.60	1.58	2.28
p–value	0.94	0.00	0.18	0.06

Standard errors in parentheses

The constant corresponds to the European mean Δ. m in Mauritania captures the effect on Δ of m being in Mauritania instead of Europe.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E6: Impact of discrepancies in remittance reports (Δt) on estimated housing discrepancies (ΔX)—French sample only

	House type (quality)				Nb of rooms				Roof material (quality)				h own their dwelling			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Constant	0.24	0.14	0.30*	0.35	3.28***	-0.51	2.98***	1.33	0.23	-0.14	0.26*	-0.11	0.10**	0.13	0.10***	0.19*
	(0.21)	(0.53)	(0.17)	(0.38)	(0.93)	(1.75)	(0.71)	(1.63)	(0.17)	(0.32)	(0.14)	(0.25)	(0.04)	(0.11)	(0.04)	(0.10)
Δt (€1000)	-0.10	-0.12	-0.07	-0.07	0.27	-0.21	0.21	0.03	0.04	-0.01	0.02	-0.03	-0.01	-0.01	0.01	0.01
	(0.06)	(0.07)	(0.06)	(0.06)	(0.44)	(0.38)	(0.32)	(0.28)	(0.05)	(0.06)	(0.05)	(0.05)	(0.02)	(0.01)	(0.02)	(0.02)
m's total income (incl. social benefits)		0.00		0.00		0.00*		0.00		0.00		0.00**		-0.00		-0.00
		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
Observations	50	49	74	71	44	43	68	65	48	47	71	68	50	49	75	72

Standard errors in parentheses

For each variable ΔX, Col. 1–2 (3–4) define Δt as missing (0) when no transfer by m was reported by h.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E7: Impact of geographical distance on the discrepancies between m's and h's reports of the latter's housing characteristics ($X_{hm} - X_{hh}$), controlling for likely confounding factors

	(1) House type (quality)	(2) Nb of rooms	(3) Roof material (quality)	(4) h owns their dwelling
No controls	0.00	-0.52	0.02	-0.00
	(0.15)	(0.81)	(0.11)	(0.04)
m more educated than h's head	0.22	-0.71	0.06	-0.02
	(0.17)	(0.88)	(0.12)	(0.05)
Spouse resident in household of origin	0.03	-0.99	0.05	-0.00
	(0.16)	(0.84)	(0.13)	(0.04)
At least one child lives in household of origin	-0.02	-1.07	0.11	0.02
	(0.17)	(0.95)	(0.15)	(0.05)
h's wealth index, h's report	-0.01	-0.41	-0.03	-0.00
	(0.15)	(0.80)	(0.11)	(0.04)
h's wealth index (5 y. bef. survey), h's report	-0.03	-0.67	-0.08	0.00
	(0.16)	(0.86)	(0.12)	(0.04)
All controls but income	0.18	-1.30	0.04	0.01
	(0.19)	(0.92)	(0.15)	(0.06)
m's total income (€)	0.06	0.49	0.24	0.00
	(0.26)	(1.53)	(0.19)	(0.07)
All controls	0.20	0.24	0.18	0.01
	(0.33)	(1.64)	(0.21)	(0.09)

Standard errors in parentheses

The table displays the Mauritania dummy coefficients, controlling for different factors in each row. Interactions between the Mauritania dummy and the controls are not reported.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$