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MIGRATION, REMITTANCES AND PUBLIC TRANSFERS: EVIDENCE FROM SOUTH AFRICA

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Migration, Remittances and Public Transfers: Evidence from South Africa*

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Abstract

What drives migration and remittance behaviour in South Africa, and what are the implications for public policy? This paper evaluates existing empirical evidence, posits a simple theoretical model and undertakes a fresh evaluation using longitudinal data spanning 1993 to 2004 from KwaZulu-Natal province. Findings generally accord with expectations if migration is a family income-optimising strategy, with remittances sustained by migrant altruism. The key policy-relevant result is that receipt of public transfer income raises the likelihood of migration (most likely because migration is costly and households face liquidity constraints) and hence crowds *in* private transfers on average.

1 Introduction

There is growing evidence that South Africa's largest public transfer, the state old age pension, affects household labour supply by changing migration behaviour. Broadly, this suggests that the organisation of households may respond to public transfers in ways that need to be understood if policy effects are to be properly evaluated. Specifically, it provides a policy-oriented motivation for examining the determinants and dynamics of labour migration in South Africa.

Temporary migrant labour, long a pivotal feature of South Africa's labour market, continues to be an important component of aggregate labour supply. In addition, remittances from migrants are a vital livelihood source for many rural households. These remittances provide a second policy-oriented rationale for investigating migration behaviour – to quantify the extent (if any) to which private transfers may be "crowded" in or out by public transfers such as the state pension.

This paper therefore aims to evaluate and contribute to existing evidence on the determinants of migration and remittances. The focus is on the temporary migration of family members rather than the wholesale mobility of entire households. After a review of the general and South Africa-focused literatures, I posit a simple model of migration and remittance behaviour and evaluate it using longitudinal data from KwaZulu-Natal province. Conclusions on the likely influence of policy on migration, and transfer incidence, are drawn.

2 Background

2.1 General Migration Theory

Modern migration theory begins with the famous contribution of Harris and Todaro (1970). In their model, migration occurs because risk-taking labour market participants respond to urban-rural wage differentials. More precisely, rural wages clear the rural labour market but the (higher) urban wage does not clear the formal urban labour market; permanent urban unemployment equilibrates expected urban-rural earnings and an urban informal sector absorbs the urban labour surplus.

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There can be little doubt that apparently high urban wages – and, more loosely, the "bright lights" of city life – are a lure to potential migrants. But the Harris-Todaro model does not explain why substantial migration is observed even when there is no urban-rural wage differential, nor does it seem well suited to explaining temporary labour migration (as opposed to permanent urban relocation).

The "new economics" of labour migration, associated with Oded Stark, seeks to enrich the Harris-Todaro framework.[1] In a review paper, Ghatak, Levine and Price (1996) summarise Stark's tenets succinctly: migration is often a collective (family), not a purely individualistic, decision. As such, migration might be the result of the family's effort to diversify its earnings in the face of local livelihood risks, notably including highly variable agricultural output.

This approach casts a new light on remittances. In the first wave of the migration literature, these tended to be interpreted as altruistically-motivated transfers from successful migrants whose migration decisions were private but who sought to share some of their gains with people they cared about. The new economics of labour migration, however, shifts remittances to centre stage. If migration is a family earnings strategy, then remittances are the visible outcomes of that strategy – the *ex post* flows that fulfill the family's *ex ante* aims, such as maximising collective income and smoothing consumption (Jensen 2003).

At this point, the study of migration and remittances must confront the question of economic decision-making in households. From this perspective, the physical separation of migrants and their households of origin, and the unique visibility of remittances as an intra-family resource transfer, provide a rare opportunity to shed light on what is normally (and particularly in developing country data) the "black box" of the household. This point was anticipated by Stark, who comments that he "...speculated that migration research could turn out to be a highly profitable way of studying the family" (Stark 1991).[2] There are numerous, competing conceptions of how household members make decisions over their economic activity and divide the fruits thereof. But the idea that migration needs to be thought of as an element of this decision-making process is now quite conventional.

Even if migration is actually a rather individualistic decision, migrants are often observed to retain close links with their families of origin. A range of migrant motivations to remit, beyond straightforward altruism, have thus also been explored. Remittances might be payments for educational and other implicit loans (including good nutrition) provided by families to promising children (Poirine 1997); investments by migrants seeking to retain economic ties to their home region or faced with poor investment opportunities in their place of migrant residence (Stark 1985); bribes for bequests contingent on good behaviour (Bernheim, Shleifer and Summers 1985, Hoddinott 1994); or payments for services provided to migrants by their home families, such as care of migrants' children (Cox 1987).

Whenever remittances are payments for services previously rendered in an implicit contract and migrants' preferences differ from those of home family members, migrants' physical separation from the family may tempt them to renege. Altruism may then be the mechanism that enables contract commitment problems to be overcome. To the extent that altruism is more likely amongst kin, this helps explain the pre-eminence of the family as an economic network for the maximisation of individual welfare.

2.2 Migration and Risk

The possibility that migration is partly a household income diversification strategy suggests that analysis needs to be embedded in the broader context of risk and development. This has two main dimensions. First, why should within-household migration be the risk mitigation strategy of choice? Second, once

[1] This section draws on Stark (1991).

[2] Posel (1999) has previously noted this use of remittance data in the South African context.

risk mitigation strategies are identified (potentially including migration) how is risk shared within households?

In principle, households should have a number of ways of smoothing consumption in the face of income variation, so it is not immediately obvious why migration – basically spatial labour income diversification in this context – should be the strategy of choice. For example, (even autarkic) households may be able to engage in precautionary saving by investing during good times in assets whose returns are largely uncorrelated with other income (Deaton 1997). We might also expect that some informal ("social"), or perhaps formal, insurance for household income shocks would be available, particularly if events are idiosyncratic to the household rather than systemic. Indeed, if there was perfect risk-sharing at the community level this would de-couple household income from consumption, freeing households from the need to pursue potentially costly household-level risk mitigation strategies, including migration (Bardhan and Udry 1999).

In fact, a burgeoning literature explores why intertemporal risk mitigation strategies and informal insurance systems may fail or at best be incomplete, leaving poor households exposed to large fluctuations in consumption. Explanations focus on pervasive asset, credit and insurance market failures in poor communities. For example, investable assets may be lumpy and hence inaccessible to the poor, asset markets may be localised (and hence asset returns strongly correlated with income), information asymmetries may trigger credit rationing and cause insurance markets to unravel, and insurance networks may be localised and hence incapable of safe-guarding against all but highly idiosyncratic shocks (surveys include Dercon (2002) and Fafchamps (2003)).

Attempts by households to self-insure by diversifying income, or even sacrifice relatively high expected income activities that also have high variance in favour of safer, lower income activities ("income skewing"), are well-documented (Dercon 2002). In these contexts, insurance motivations may be an important dimension of labour supply choice in general (Kochar 1995), and income diversification is certainly a plausible motivation for migration in particular. Nevertheless, resultant remittances may be just one strand in a web of private transfers amongst individuals and households that serves to dampen risk and redistribute welfare.

Understanding risk management strategies is not quite enough for a comprehensive evaluation of the welfare consequences of risk and potential policy responses. How the risk burden is divided within households may be endogenous to household strategies towards risk, and could plausibly be a key determinant of realised, individual welfare. Data limitations have constrained this literature, but there is growing international evidence that risk-pooling within households is imperfect (Dercon 2000, Doss 2001). This takes us back squarely to the unresolved intrahousehold welfare allocation question.

2.3 Transfer Incidence and Policy Relevance

The determinants of remittances are key to uncovering the welfare incidence of public transfers when migration is common. For example, if remittances are motivated by migrants seeking to increase their inheritance claims, then the relatively large South African state pension could crowd in remittances (by boosting potentially-inheritable household wealth). But if remittances are motivated by altruism, or occur only to equalise *per capita* consumption when individual incomes vary, then the pension will be expected to crowd out private transfers, with remitters capturing some of the pension's benefits. The likelihood of remittance motivations playing a role in how what has been called the "moral economy" adapts to the injection of public transfers (i.e. that policy "cannot be assumed to be exogenous to household behavior and networks" (Dercon 2002)) motivates the need for this analysis from a policy perspective.

3 Existing Evidence for South Africa

3.1 Macro Migration Trends

The economic and social importance of internal, black migration in pre-democratic South Africa is well-known (see, for example, Wilson (1972) and Rogerson (1995)). Black, urban labour, notably in mining, fueled the apartheid economy, and provided a vital source of income for rural households.[3] But "influx control" residential regulations severely constrained permanent black urbanisation, resulting in a pattern of cyclical (or "oscillating") rural-urban migration.

Posel and Casale (2003) examine whether the lifting of influx control restrictions in the early 1990s altered migration patterns. *Contra* to expectations, they find that within-household migration in fact increased during the 1990s, with women accounting for the majority of new migrants, and migrant remittances growing in importance to rural livelihoods. Continued cycling – rather than permanent, urban relocation – is attributed to the "safety net" role played by rural areas in the context of rapid social and economic change (including employment insecurity, AIDS and high levels of urban crime and violence). Anecdotal evidence also suggests that migrants value maintaining links with their place of ancestral origin, commonly with an eye to retirement (Sagner and Mtati 1999).

Kok, O'Donovan, Bouare and van Zyl (2003) emphasise the difficulty of distinguishing between labour migration and other forms of spatial mobility. Using national census data, they point to significant youth out-migration from rural areas in the years since apartheid. The continued dominance of male migration (in some contrast to Posel and Casale (2003)) is held to be responsible for a growing number of *de facto* female-headed rural households, in turn associated with rising economic vulnerability. Urban-urban migration accounts for a significant proportion of total labour migration and much migration remains temporary.

3.2 Micro Determinants of Migration

Micro evidence on post-apartheid migration and remittance determinants (see below) is much scarcer than that on macro migration patterns.

Rich but very localised data from the Agincourt district (in rural Limpopo Province) support the conclusion that temporary labour migration remains a pivotal rural survival strategy and that women are increasingly likely to migrate (Collinson, Tollman, Kahn and Clark 2003).

Posel (1999) questions whether modeling migration as a straightforward household utility-maximising strategy is appropriate. She finds that men "over-migrate" relative to the optimal level of migration predicted by a unitary migration model (in which aggregate utility is maximised). A competing explanation of migration is located in a "patriarchal" model of household decision-making, in which men with decision-making power sacrifice some aggregate household utility by migrating in order to secure a greater personal share of income.

3.3 Remittances

While the importance of migrant remittances to rural livelihoods is widely recognised, data availability has tended to constrain detailed descriptive work on the size and determinants of these flows.

Using Botswanan data, Stark and Lucas (1988) provide an early empirical contribution for southern Africa. They find that remittance patterns accord with a cooperative agreement between migrants and their families to split the gains from migration (a boost to earnings through higher investment by the

[3] Policy dating back to colonial times aimed to coerce black men into providing wage labour. Poll taxes induced demand for cash earnings, and rural black homelands were purposefully designed to be resource-poor and overcrowded (Posel 2001a).

family for migrants, and higher income and lower income variability through remittances for families). Contrary to the implications of pure altruism as a remittance motivation, remittances tend to be positively associated with non-remittance household income (though the authors are unable to discount the possibility that the positive impact of past remittances on current household earnings drives this result, a kind of intertemporal endogeneity that can only be addressed with longitudinal data). There is also evidence that migrants' aspirations to inherit their parents' wealth play a significant role.

Posel (2001b) finds that migrants' children and parents are the most common recipients of remittances in her 1998, KwaZulu-Natal province sample. Partners are somewhat less likely to be recipients, but receive larger than average amounts when they are. Posel (1999) describes the evolution of norms of kin support and examines remittances in this light using 1993 data. She finds that remittances are based on a combination of "selective altruism" (strongly influenced by kinship) as well as self-regarding motives on the part of migrants. Women are more generous remitters than men, relative to earnings.

Expanding on the kin support theme, Bowles and Posel (2005) find that relatedness as measured by "inclusive fitness" (indicating relatives' likely contribution to own-genome reproduction) has significant explanatory power over remittances from South African migrant workers to their families in 1993. Their comprehensive measure of the biological fitness benefits and costs of remittances explains perhaps one-third of the variation in observed remittances.

The relative importance of these transfers to rural households is highlighted by Woolard and Klasen (2004), who find that changes in remittance income alone accounted for around 10% of household transitions into and out of poverty in KwaZulu-Natal province between 1993 and 1998.

Two-thirds of employed migrants from the Agincourt demographic surveillance district remit money, with married men remitting the most. Logit estimates of the probability of a migrant remitting suggest a negative relationship between "time elapsed since last communication with home", but a positive relationship between migrancy duration and remittances (Collinson et al. 2003).

3.4 Influence of Public Transfers

South Africa's key public cash transfer is the state old age pension (OAP), a very significant scheme in terms of coverage (approximately 2 million recipients) and relative size (740 rand [roughly $120] per month in 2004). Acquisition is essentially determined by age-eligibility (60 for women and 65 for men), and loss by the death of recipients (due to the long history and large size of the pension, it is very well-known, take-up is near-universal and the likelihood of self-selection is low). The pension is nominally means-tested, but this is overwhelmingly non-binding and in practise is rarely administered. Pensioners usually reside in large (often three-generation) households containing working age relatives, and sharing of pension income is well-documented. Thus, while the OAP is in principle a targeted old-age support scheme, in practise it has become the key conduit of direct government income support for poor households. Consequently, its labour supply (and migration) impact is of direct interest.[4]

Bertrand, Mullainathan and Miller (2003) analyse the OAP's influence on labour market outcomes and find negative associations with the labour supply of working age residents. However, Posel, Fairburn and Lund (2004) suggest that the OAP has a positive association with labour migration (a key labour supply channel for rural households in particular), and this result is replicated with different data in previous work by the author. Maitra and Ray (2003b) examine changes in household composition associated with pension receipt and find a decline in the number of resident, working-age individuals which could be explained by migration.

[4] A large empirical literature now exists evaluating aspects of the behavioural and welfare effects of the OAP. For the seminal analysis and a recent survey see Case and Deaton (1998) and Burns, Keswell and Leibbrandt (2005) respectively.

Two papers have focused on the susceptibility of remittances to crowding out by public transfers (specifically the large state old age pension). Using data spanning 1989 to 1992, Jensen (2003) finds that every 1 rand of pension income reduces private transfers by 25–30 cents. In contrast, using different (1993) data, Maitra and Ray (2003a) obtain weaker crowding out for very poor households, and complementarity between public and private transfers for the non-poor. One interpretation of Maitra and Ray's (2003a) findings (though not one they discuss) is that migrant motivations shift from largely altruistic when home families are very poor, to more self-interested as home families become relatively better-off.

3.5 Summary of Existing Evidence

The evidence on migration and remittances in South Africa suggests that within-household labour migration changed in the 1990s, while remaining a material feature of the labour allocation of (especially, but not exclusively, rural) households. The determinants of migration and remittance behaviour have been the focus of much less attention, with the very notable exception of the work of Posel. This paints a picture of persistently strong ties between migrants and their households of origin, broadly in line with contemporary migration theory which suggests that migration should be located in the ambit of family decision-making. Remittances generally behave as if migrants had altruistic motivations, with the strength of biological links being of particular importance. Evidence on crowding out is mixed but tends to suggest that public transfers do partly displace remittances.

4 Modeling Migration & Remittances in South Africa

4.1 Regional Context

Empirical analysis is based on data from KwaZulu-Natal (KZN), South Africa's largest province by population. While the province does have some unique characteristics (it is more densely populated than the rural South African average and dominated by the culturally-distinct Zulu ethnic group), migration dynamics are likely to be indicative of those in the rest of the country. I focus on the KZN context for the remainder of the paper.

Most people in rural KZN are supported by a combination of small-scale crop (primarily beans, maize and potatoes) and livestock (primarily cattle) agriculture, and an entrenched pattern of temporary migration to metropolitan areas which injects urban wage income into an otherwise largely subsistence agrarian economy. In the 1990s, the region was plagued by unrest stemming from competition between the African National Congress and Inkatha Freedom Party for regional political control.

Poor local economic conditions coupled with opportunities to compete in nearby, large urban labour markets (Durban, South Africa's second city by population, is located in coastal KZN, and Johannesburg, the country's economic capital, lies 500km north) seem to fit the Harris-Todaro model of the migration decision. But this conception does not explain the observed persistence of oscillating, rather than permanent, one-way, migration. Further, the 1990s witnessed sluggish macroeconomic growth (an average of only just over 1% a year from 1994-1999), and dramatic involuntary unemployment rates of well over 30% (and much more for low-skilled workers). Johannesburg's local name may be eGoli – "place of gold" – but it is far from obvious that South Africa's cities are an El Dorodo for prospective rural workers.

The idea that migration is a product of family decision-making resonates strongly for KwaZulu-Natal. Families are on average very large, and persistent ties between migrants and their rural households of origin, including relatively large remittance flows, have been documented by Posel and others. When the regional context is recalled – significant unrest coupled with the inherent environmentally-driven

riskiness of subsistence agriculture – the notion of migration anchored in household survival strategies adapted to scanty and volatile local income opportunities becomes compelling. More formally, rural KwaZulu-Natal conforms to Rosenzweig's (1988) typology of an "AF region":

A: an important production input (weather) is stochastic
B: the intertemporal distribution of weather outcomes is stationary
C: positive correlations in weather outcomes diminish with distance
D: another important production input, land, is immobile
E: the technology of production is stable
F: the costs of acquiring information are high

To which can be added (for the 1990s), G: violence and an uncertain political environment. Rosenzweig (1988) suggests that "consumption smoothing...represents a centrifugal force spreading out the family's members across space" when the AF conditions are met. Condition G is likely to add to this force directly by raising income volatility and indirectly by weakening extra-familial social networks that compete with migration as a conduit for risk-coping mechanisms.[5]

In these circumstances, a plausible hypothesis is that migration and remittances are a family response to limited local income opportunities, and to high levels of stochastic income risk. After describing the opportunism problem this may raise, and the potential importance of household size, I present a simple formalisation of this idea.

4.1.1 Migrant Opportunism

> *The problem we have as women is that we have husbands who go away on jobs...When they get to those places they forget about their families and have fun. The father leaves his children and does not know what they eat, what they do for school.* – Anonymous woman, rural Eastern Cape, quoted in Mturi, Xaba and Sekokotla (2005)

The postulate is that family members seek to optimise their aggregate income portfolio (maximising expected total income and, with risk aversion, minimising income uncertainty). Given preferences, expectations of family members' prospective local and migrant earnings, and the stochastic characteristics of those earnings, this will yield some optimal number of migrants.

Remittances between migrants and home families in this context should distribute individual income in order to maximise aggregate utility, governed by an implicit income and risk-sharing contract between local family members and migrants. But as hinted at by anecdotal evidence such as the quotation above, pointed out informally by Stark (1991), and examined explicitly by Foster and Rosenzweig (2001), the family is likely to face a post-contractual opportunism problem. Gains from migration accrue directly to migrants, giving migrants the opportunity to capture them should they wish to do so. The situation is analogous to the "hold up" problem of firm investment with specific assets – migration is an investment made by the family, but one whose gains (which accrue post-investment) may be expropriated by migrants, whose involvement is critical. The physical separation of family and migrants is central to this problem, since this is what neutralises any income-sharing enforcement mechanisms (including endogenous preference formation) that rely on everyday interactions amongst family members.

The most plausible explanation for observed, positive remittances from migrants to their home families – evidence that the family has some way of mitigating the contract enforcement problem – is broadly-defined migrant altruism (Stark 1991). Migrants may care at an emotional level about the well-being of

[5] Carter and Maluccio (2003) provide recent evidence using the data used here that poor households struggle to insure substantially against risk.

home family members, respond to a strong social norm of remitting (with reneging on this norm carrying psychic costs and the risk of opprobrium), or be unconscious maximisers of biological "inclusive fitness".

Forward-looking family members, like forward-looking firms, will anticipate opportunism when making initial investment (migration) decisions, and this has consequences for predicted migration and remittances.

4.1.2 Household Size Effects

KZN is marked by large households. This has several important implications for migration.

First, we might expect families with more economically-active members to cope better with income fluctuations. That is, larger families may be able to diversify income "in-house", without resorting to migration. For example, while the bulk of the family labour supply might be devoted to farming, some might be allocated to a community-based business. Some covariance in shocks to these income streams might be expected (poor farming conditions could reduce community disposable income and demand for the business' products, for example). But the likelihood of larger households being able to diversify some risk internally should be acknowledged.

Larger households may have an additional advantage: economies of scale in consumption. If households reap such scale economies, this would encourage their members to "stick together". In understanding why households exist at all from an economic perspective, scale economies might be important.

Finally, families contain dependents: children, the seriously ill and disabled, and the aged. The care they require adds to the glue countering Rosenzweig's "centrifugal force".

In contrast, if there are decreasing marginal returns to labour in family production, migration should be more likely in larger households.

4.2 A Model

The family has N members, of which D are dependents. It must decide how many of its $(N-D)$ economically-active participants should stay at home (H) and how many should leave to become migrant workers (M). Its objective is to maximise *per capita* expected utility, a function of consumption. Income is shared equally amongst dependents and resident household members and there are economies of scale in consumption that confer an advantage to sharing a given amount of income amongst more residents. In contrast, migrants do not enjoy consumption scale economies, and migrant income is not necessarily pooled perfectly. Rather, migrant income is linked to resident household income through the remittances that migrants choose to send. Because family members anticipate possible migrant post-contractual opportunism (less than perfect income pooling), the family's *ex ante* programme takes into account migrants' *ex post* decisions on how much to remit. In the language of contract theory, migration selection occurs subject to a migrant incentive compatibility constraint. Solution begins, therefore, with migrants' optimal remittance choices.

4.2.1 Remittances

Assuming full information, the migrant programme is as follows. Each identical migrant $j \in M$ chooses her remittance r_j to maximise own welfare (W_j), which comprises (additively) the utility from own consumption ($U(C_j^m)$) and family consumption. The latter is the *per capita* utility of consumption for family members ($V(C_h)$) weighted by the number of home family members, $H+D$, and an altruism parameter, $0 < \alpha \leq 1$. I.e.:

$$\begin{aligned}
\text{Max}_{r_j}\ (W_j) &= U(C_j^m) + \alpha(D+H)V(C_h) && (1)\\
\text{subject to } C_j^m &= y_m + \varepsilon_j^m - r_j && (2)\\
\text{and } C_h &= \frac{1}{(D+H)^{1-s}}\left(Hy_h + \sum_{i\in H}^{H}\varepsilon_i^h + \tau - M\omega + r_j + \sum_{(i\neq j)\in M}^{M} r_i\right) && (3)\\
\text{and } N &= D+H+M && (4)
\end{aligned}$$

where $0 \leq s < 1$ is a parameter measuring consumption scale economies, y_m is migrant income, ε_j^m is a stochastic migrant-specific income shock, y_h is home income[6], $\sum^H \varepsilon_i^h$ is the total shock to home income (comprising the sum of individual home income shocks, ε_i^h), τ is fixed public transfer income to the household, and ω is the per migrant cost of migration (assumed to be borne by the family to approximate an up-front cost in this static framework). If migrant j takes all other migrants' remittances ($\sum_{i\neq j}^{M} r_i$) as given, the first order condition for an interior maximum yields:

$$U'(C_j^m) = \alpha(N-M)^s V'(C_h) \tag{5}$$

This is a familiar marginal condition for an optimum; migrants do best by equating their own marginal utility of consumption with that of home residents' consumption (weighted by their concern for family consumption and the extra "bang" obtained from a unit of consumption amongst residents if there are scale economies). Condition 5 implicitly defines the optimal remittance, $r_j^\star$. To describe $r_j^\star$ explicitly it is necessary to ascribe a functional form to utility. An analytically convenient case arises when family members have identical, constant absolute risk aversion (CARA) utility functions: $U(C) = -\left(\frac{1}{a}\right)e^{-aC}$, where $a = -\frac{U_{CC}}{U_C}$ is the Arrow-Pratt coefficient of absolute risk aversion. In this case, the first order condition for migrant j's optimal remittance simplifies to:

$$C_j^m = C_h - \frac{1}{a}\left[\ln(\alpha(N-M)^s)\right] \tag{6}$$

Summing this expression over all migrants $j \in M$ allows us to solve for total remittances sent home by migrants, $\sum_j^M (r_j)^\star$:

$$\sum_j^M r_j{}^\star = \frac{1}{\xi+M}\left\{\xi\left[My_m + \sum_j^M \varepsilon_j^m\right] - M\left[Hy_h + \sum_i^H \varepsilon_i^h + \tau - M\omega - \frac{\xi}{a}\ln(\alpha(N-M)^s)\right]\right\} \tag{7}$$

where $\xi = (N-M)^{1-s}$. This characterises total remittances based upon the (generous) information structure that migrants face. It implies that expected optimal remittances per migrant (denoted $\bar{r}$) are:

$$\frac{E\left(\sum_j^M r_j{}^\star\right)}{M} = \bar{r} = \frac{1}{\xi+M}\left[\xi y_m - Hy_h - \tau + M\omega + \frac{\xi}{a}\ln(\alpha(N-M)^s)\right] \tag{8}$$

[6]This assumes that home income is exogenous to migration and remittances. While there is evidence to suggest that insurance-efficiency tradeoffs may arise in informal insurance schemes (Fafchamps 1992), this is not my focus here.

4.2.2 Migration

Knowing the nature of *ex post* remittances, the family is in a position to decide how many of its members should become migrants. Because this is an *ex ante* choice, the family maximises expected (not realised) utility. Its problem is:

$$\begin{aligned}
\text{Max}_M\, E(W) &= E\left((D+H)V(C_h)+\sum_{j\in M}^{M} U(C_j^m)\right) && (9)\\
\text{subject to } C_h &= \frac{1}{(D+H)^{1-s}}\left(Hy_h+\sum_{i\in H}^{H}\varepsilon_i^h - M\omega+\tau+\sum_{j\in M}^{M} r_j^\star\right) && (10)\\
\text{and } C_j^m &= y_m+\varepsilon_j^m - r_j^\star\,, \forall j\in M && (11)\\
\text{and } N &= D+H+M && (12)
\end{aligned}$$

Explicit solution of this programme requires that home and migrant income shocks be given structure and a functional form for utility assigned. I assume that $\varepsilon_i^m \overset{iid}{\sim} N(0,\sigma_m^2)$, $\varepsilon_i^h \sim N(0,\sigma_h^2)$ and CARA utility (as before).[7] While a closed-form, interior solution for migration does emerge, it is rather unwieldy, as are the partial derivatives which characterise comparative statics. These are therefore not shown here. However, with plausible parameter values, interior solutions for optimal migration frequently arise, and comparative static evaluation done on this basis yields consistent signs for the roles played by the key variables of interest. These yield the reduced form for optimal migration below.

4.3 Discussion

The reduced forms for optimal remittances and migration are:

$$\begin{aligned}
\bar{r} &= \bar{r}(\overset{+}{\alpha},\overset{+}{a},\overset{-}{s},\overset{+}{y_m},\overset{-}{y_h},\overset{+}{\omega},\overset{-}{\tau},\overset{-}{M},\overset{+}{D}) && (13)\\
M^\star &= M^\star(\overset{+}{\alpha},a,\overset{-}{s},\overset{+}{y_m},\overset{-}{y_h},\overset{-}{\sigma_m^2},\overset{+}{\sigma_h^2},\overset{-}{\omega},\overset{0}{\tau},D,N) && (14)
\end{aligned}$$

Additionally, total remittances will rise in positive shocks to migrant incomes and decline in positive shocks to home income. The model gives rise to a number of clear, testable implications. For remittances, the negative relationship between resident income, public transfers and remittances, and positive relationship between migrant earnings and remittances, are especially noteworthy; we expect crowding out. For migration, there is a distinction between earned income and transfer income: higher home income opportunities reduce migration, but higher public transfer income does not, all else equal. This is because the income optimisation logic of migration is unaltered by the addition of unconditional public transfer income, which simply makes everyone (including migrants, who retain more of their earnings in response) better off. If transfer income is observed to have an effect, this constitutes a challenge to this simple framework. One obvious possibility is that the family is unable to select the optimal number of migrants because migrant costs are initially prohibitive and it is unable to borrow against future migrant earnings to overcome this. Public transfer income will boost migration by relieving liquidity constraints in these households. Conversely, if family members have strong enough preferences for

[7] That is, allowable correlation between home income shocks (which could be perfect if everyone in the household is involved in the same activity), but not between migrant shocks (the underlying theme being that migrants are engaged in independent economic activity). In particular, I let ρ describe the (identical) correlation between household shocks, so that $\text{Var}\left(\sum_i^M \varepsilon_i^m\right) = M\sigma_m^2$, while $\text{Var}\left(\sum_i^H \varepsilon_i^h\right) = H\sigma_h^2(1+(H-1)\rho)$.

leisure (as opposed to being purely consumption-oriented as portrayed here), unconditional income may reduce households' aggregate labour supplies, including migrant labour.

Before turning to empirical analysis, some important limitations of the model, with implications for taking it to the data, should be acknowledged. Firstly and perhaps most importantly, migration and remittances are presented as static when in fact migration is a dynamic phenomenon that is likely, over time, to be influenced by broader processes of household demographic change. This makes it extremely important to identify temporary labour migrants (as opposed to other non-resident family members) correctly. Secondly, the model abstracts from individual heterogeneity (notably in earnings capability and, potentially, altruism). In reality, these are likely to influence outcomes significantly and need to be controlled for. As noted, treating residents' income as exogenous to migration and remittances assumes away the possibility of moral hazard (decreased effort or increased risk-taking) that may seem significant given the insurance dimension of the model; this source of endogeneity in resident income needs to be treated seriously since a negative relationship between resident income and remittances is a key testable implication. Finally, the assumption of perfect income and risk pooling amongst household residents is certainly stark (but does serve to highlight a likely strength of the residential household).

5 Empirical Analysis

Empirical analysis investigates the associations between the probability of migration and remittances sent and received, and individual and household characteristics. The aim is to determine how well the above conceptual framework fits the data and to draw policy-relevant conclusions on the possible extent of crowding in or out of private transfers by public ones. The policy question has two dimensions: (1) how might public transfers alter remittances by changing the migrant populations of households and (2) conditional on a household having a given number of potentially-remitting migrants, how will remittances change as resident household income is affected by policy?

5.1 The Data

Data come from the KwaZulu-Natal Income Dynamics Survey (KIDS).[8] KIDS provides three waves of data from 1993, 1998 and 2004 on individuals in approximately 1000 households in KwaZulu-Natal. The 1993 wave comprises the 1354 household KZN sub-sample of the national Project for Statistics on Living Standards and Development Survey (PSLSD, conducted according to World Bank Living Standards Measurement survey guidelines) and is designed to be representative at the provincial level.

The fundamental sampling unit in the initial wave is the household, defined to comprise individuals who are resident for at least 15 days a year, "eat from the same pot" (when resident) and contribute in some way to a "common resource pool". The survey thus encompasses non-resident household members (including, in particular, absent labour migrants), although data on these individuals is limited.

KZN households surveyed in the 1993 round which self-classify as African or Indian are revisited in 1998 and 2004. Because of the typically large size and potentially mutable nature of households, the focus of these surveys shifts to "core" individuals (adults deemed central to households sampled in 1993, essentially household heads and their immediate relatives).[9] Where core individuals, or groups of

[8] KIDS was a collaborative project of the International Food Policy Research Institute, the University of Natal-Durban, the University of Wisconsin-Madison, and the Southern Africa Labour and Development Research Unit at the University of Cape Town. For detailed descriptions of the survey see May, Carter, Haddad and Maluccio (2000) and May, Aguëro, Carter and Timæus (2006).

[9] Specifically, core individuals are (1) household heads, (2) in three-generation households: children, children-in-law, or nieces/nephews of heads, aged at least 30, with one or more children of their own in the household, and (3) partners of any of the above.

core individuals, have split, enumerators attempt to trace them to reduce attrition. In addition, the 2004 wave is refreshed with new households formed by the adult children of core individuals, and households fostering core adults' minor children. Figure 2 provides a diagrammatic overview.

Together, the three KIDS waves provide a representative sample of individuals in KZN in 1993, capturing the changing circumstances of the African and Indian sub-sample in two "snapshots" taken 5 and 11 years after that time. While a number of large household surveys have been conducted in post-apartheid South Africa, KIDS is unique in conferring the advantages of longitudinal data at the individual level on a large enough sample to support plausibly generalisable analytical results. The 1993 PSLSD survey which underpins the KIDS panel has been used extensively in empirical research and a number of studies have exploited the second (1998) KIDS wave. But with the third (2004) wave having been released only in 2006, empirical analysis making full use of these newest data, and the capabilities of a 3-wave panel data set, has only recently become possible.

5.2 Panel Construction

Analysis is restricted to African individuals. Indian households in KZN are overwhelmingly urban, and are smaller and much wealthier than African households on average. Pooling across these groups is thus questionable, and the Indian sub-sample is too small to be independently useful.

The time dimension is a key attraction of KIDS but difficulties arise in constructing a genuine individual-level panel, due primarily to differences in the surveys administered in each wave.

Crucially for the purposes of this study, remittance senders are only uniquely identified in the 1998 wave. It is therefore not possible to construct a three-wave individual level remitter panel.[10] However, information on remittances received in households is available in every wave. Consequently, I maximise the capabilities of the data by adopting a two-pronged approach. First, I construct a three-wave, individual-level panel to investigate the correlates of migration and remittance receipt. While remittance recipients are identified by the survey, migrant status must be inferred; construction of the migrant longitudinal sample is described in section 5.4.1. Second, I exploit the detailed information available on remitters in 1998 to investigate the correlates of remittances sent from the perspective of remitters in that year.

The panel has major advantages over cross-sectional use of KIDS, permitting a number of sources of possible endogeneity bias to be addressed and enhancing inference by adding observations and time variation. It also, however, introduces risks of its own. I elaborate the major pitfalls to unbiased inference before detailing the estimation strategies and discussing results.

5.3 Obstacles to Unbiased Inference

5.3.1 Attrition Bias

While there is little doubt that the 1993 sample is a good representation of KZN province, this wave is now quite dated, estimation using panel techniques is clearly attractive, and only the 1998 wave allows remitters to be identified. A clear risk in using subsequent KIDS waves is that the sample on which testing is based ceases to be representative of the population of interest, so that results are not externally valid. In particular, if there has been individual and household attrition from the 1993 sample based

[10] An attempt was made to identify remitters in 2004 manually on the basis of their recorded relationships with remittance recipients (whose identities are known). However, this proved impossible due to the frequency with which multiple non-resident household members matched the available relational criteria (e.g. multiple departed children in the case of a resident who reported receiving remittances from a non-resident child). Posel (2001a) attempts to circumvent the issue differently, by restricting examination of remittance determinants to households reporting a single absent migrant in 1993.

on any factors which also affect migration and remittance choice, then estimation based on the class of observed migrants and remittances in 1998 may be uninformative or, worse, misleading. This is true of any investigation that is not based exclusively on the representative 1993 KIDS wave.

Considering the enormous change that occurred in KwaZulu-Natal over the eleven year span of the survey, attrition in KIDS is quite reasonable (thanks largely to near-perfect response rates and the surveyors' commitment to tracking households that moved or split between surveys). Nevertheless, a material number of individuals disappear over the survey period. Of the 8269 individuals sampled in 1993, 1759 (21.2%) have attrited by 1998, and a further 2013 (24.3%) are lost between 1998 and 2004. Using the crucial 1998 wave to illustrate the causes of this attrition:

- 264 individuals had died;
- 32 individuals were no longer present in the household and survey respondents did not know whether they were still alive;
- 1463 individuals were members of households which, in their entirety, were not re-surveyed in 1998 (because the household refused to be re-surveyed, could not be tracked, or because all household members had died). In all, 271 out of 1139 households (24%) sampled in 1993 attrited.[11]

On the assumption that the deaths of individuals in sampled households are broadly representative of deaths in the population leading up to 1998, the wholesale disappearance of households is the main source of potential attrition bias. This is of particular concern because these disappearances are much more likely to arise from the inability to trace households which are known to have moved (67 cases) than the death of all core members (4 cases) or refusal (5 cases).[12] Such household mobility may frequently be connected to the kind of individual mobility that is of direct interest – labour migration. For example, it is plausible that relatives might relocate to be with migrants if the latter are successful enough, in which case we would be conducting inference based on a sample of disproportionately "unsuccessful" migrants.[13]

Mean comparisons suggest that attriting households do differ in some observable ways from their non-attriting counterparts. In particular, they are smaller, a bit wealthier and much more likely to be urban, than the average non-attriting household in 1993.[14] These differences are not driven purely by the higher likelihood that a vanishing household is urban; within the class of rural households, households which attrite are slightly better off in non-farm income terms (though the difference is not statistically significant), while appearing significantly worse off in terms of land and cattle ownership. Systematic differences such as these suggest that correcting for non-random attrition may be necessary.

5.3.2 Selection Bias

The second risk to inference, specific to investigating remittance determinants, is the classic selection problem. If the amount that migrants remit is related to whether they remit at all (which will essentially depend on whether or not they become migrants in the first place), then an accurate estimate of the role played by remittance factors must take this conditionality into account. It is helpful to think of this as a kind of omitted variable problem in a remittance regression, where the omitted variable is the probability of being observed to send or receive remittances (whichever is relevant). Left uncorrected, correlation

[11] A further 632 individuals no longer lived in surveyed households for at least 15 days a year, and consequently were defined out of their original households by the survey (excluding individuals who met this definition but were re-sampled as members of new "split" households). Because it is possible to infer earnings-relevant information such as gender and age and (in some cases) completed educational attainment from their 1993 records, and since 38 of these individuals are identified as active remitters, these observations are not lost to the survey in the practical sense.

[12] The rest are simply not found.

[13] This would correspond to a full-migration corner solution in the model presented in section 4.2.

[14] These findings are in line with those of Maluccio (2000) and Alderman, Behrman, Kohler, Maluccio and Watkins (2001).

between regressors of interest and this probability in the error term will bias coefficients in the direction of the sign of the correlation.

5.3.3 Addressing Attrition and Selection Bias

As outlined in section 3, the general research questions in this study have been posed before for South Africa. In providing answers, researchers have been quite sanguine about attrition and selection bias. Examining crowding out, Jensen (2003) relegates the issue to a footnote, describing but not showing a model in which remittances are conditional on selection into migration, and stating that the results are qualitatively similar to those reported. Posel (2001b), in the work that this paper seeks to build on and also using KIDS, makes no allowance for selection into observed remittances or attrition in the 1998 wave. Such neglect is understandable: correcting for potential attrition bias needs to be done carefully lest the cure be worse than the disease, and addressing selection bias is hard because it is difficult to find plausible exclusion restrictions (essentially factors influencing migration but not remittance choice conditional on having migrated) which underpin the now-standard correction techniques pioneered by Heckman.[15]

To attempt to address attrition, I use inverse probability weighting. Probit regressions are run on 1993 observations, modeling the probability that individuals remain in the 1998 and 2004 samples as a function of observable individual and household characteristics. The overall predictive power of these regressions turns out to be quite low, though a number of variables (such as household size and location) have strong statistical significance and material magnitudes. Observations in subsequent waves are then weighted by the inverse of the predicted probability of selection generated by these estimations. Intuitively, the aim is to "penalise" observations which are more likely to have remained in the sample because of their observable characteristics, and *vice versa*, making the 1998 and 2004 KIDS waves more like the representative 1993 wave. The method relies on the assumption that these characteristics have enough predictive power over selection to restore the consistency of parameter estimates in regression specifications once the causes of attrition have been partialled out.

Probability weights are not compatible with all estimators. In particular, they are incompatible with random effects models. Results for these models are therefore presented using the raw samples. Fortunately, however, the application of inverse probability weights has only a small impact on coefficients of interest. To the extent that non-random attrition is based on observable characteristics, then, it does not appear likely to be a major source of bias. See appendix A for details.

To address selection bias in investigating remittances, I focus on 1998 remittance sender data. I first model the probability that an individual is observed to be a remitter in the 1998 wave. This is used to adjust estimates of remittance correlates using the standard joint maximum likelihood variant of Heckman's (1979) selection model approach. Individual and household characteristics in 1993 are used as regressors in the first-stage selection equation predicting the probability of being an observed remitter, essentially replicating the model used to predict migration (see below). This is a valid strategy if these regressors help determine the probability of being observed to remit in 1998 but have no additional bearing on 1998 remittance amounts. Given the inclusion of the 1998 counterparts of these variables in the final regression, this seems reasonable; for example, household income in 1993 may affect the likelihood that an individual is a migrant in 1998, but should have no independent bearing on 1998 remittances once 1998 household income has been accounted for. The sample for potential selection

[15] Jensen (2003) uses local unemployment rates as an exclusion restriction, arguing that unemployment boosts the probability of migrating but should have no effect on remittances once household income is partialled out. In rural areas characterised by subsistence farming, however, official unemployment rates are unlikely to have much power to predict migration and may affect remittances directly, for example by influencing resident income security.

into remittance sending status is restricted to working-, pre-pension-age individuals (men aged 16-63 and women aged 16 to 58, with the two year leeway before gender-specific eligibility age designed to exclude possible anticipation effects on migration and remittance behaviour).

Other remittance results are based on the sample of observed remittances. Coefficients thus report associations conditional on selection into observed remittances and these must therefore be interpreted cautiously.

5.3.4 Measurement Errors

As with all survey data, measurement error is a potential concern in KIDS. This is particularly important for income, a variable of key interest. The quality of information garnered on individual income in KIDS is generally very high. Nonetheless,a number of inferences and, in some cases, imputations need to be made to yield consistency between survey waves. The exclusion of household enterprise and agricultural income from the income measure used in regression analysis is especially noteworthy. Questions have been raised as to the reliability of the former, stemming mainly from the usefulness of income and expense data from a single month (that previous to the survey) to capture the permanent income stream from self-employment, with many households reporting negative earnings on this measure. Agricultural income, including the value of subsistence production, can be imputed using production quantity data and prevailing input and food prices; but these yield some implausible values (with measurement errors in food quantities likely to be especially problematic) and cannot be considered reliable. Since many households are food producers, however, this is an important facet of income, so it is proxied using land access and cattle ownership measures.

5.3.5 Endogeneity

Reliable interpretation of regression correlates rests on their exogeneity, but a number of potential sources of endogeneity arise in estimating migration and remittance determinants.

For resident income variables, reverse causation is a risk. Having migrants and their remittances in the family may lower resident income by lowering recipients' effort levels; or raise income by enabling investment in income-generating capital (including farm capital like livestock); or affect income by altering residents' risk appetites.

Unobserved, or inadequately controlled-for, heterogeneity in the earnings ability of residents and migrants is another potential problem. For example, if individuals with the highest earnings capability migrate, then their departure will tend to lower *per capita* resident income and, unless carefully controlled for, establish a negative association between migration and resident income that has nothing to do with the true influence of income on migration.

Household size and composition may also be endogenous. For example, a stream of remittance income may cause new, economically-dependent individuals to attach themselves to the recipient household leading to spurious household size coefficient interpretations. This could also affect income variables that are adjusted for household size.

These problems are mitigated as far as possible using appropriate regression specifications and techniques. Those that remain qualify the results.

5.4 Empirical Strategy

5.4.1 Migration

Migration is investigated by examining the probability that an individual is a labour migrant, conditioned on the variables suggested by the reduced form of the model presented in section 4.2 (expression 14). The general empirical specification is:

$$y_{iht} = \alpha_i + x'_{ih}\beta + z'_h\gamma + w'_{i,t-1,t}\delta + v'_{h,t-1,t}\theta + s'_{h\triangle t}\tau + \varepsilon_{iht} \tag{15}$$

Where y_{iht} is the probability that individual i in household h is a migrant at time t, x and z are vectors of time-invariant individual and household characteristics, w and v are vectors of time-varying individual and household characteristics at time $t-1$ or t, and s is a vector of exogenous household shocks leading up to time t. ε is the individual (composite) error term.

This choice of empirical model is informed by the theoretical framework, data constraints and endogeneity concerns. While the theoretical model describes migration in static terms, in reality migration clearly does not occur instantaneously. Family members will take time to adjust to changes in household circumstances and allowing for this is likely to be informative. The use of lagged variables confers the added advantage of escaping any endogeneity bias arising from simultaneity.

Migrant status must be inferred (respondents are not asked to identify "labour migrants"). I therefore restrict the sample of individuals whose migrant status is examined to "core" household members of working, pre-pension age[16] as identified in the representative 1993 survey. In that survey the reason for the absence of non-resident family members is noted, so labour migrants can be identified as family members who are active economic participants in the household and whose absence is attributable to work or active job search. The 1998 and 2004 surveys canvass information on all 1993 household members, including those who continue to be non-resident, as well as new members. But the structure of the survey makes it impossible to be certain, in general, about whether non-residents remain integral members of the household. The instance where it *is* possible to do so is when individuals are "core" members; in cases where core members have separated permanently these are tagged as "split" households and departed core members are, where possible, tracked and surveyed. Labour migrants can then be identified as individuals who are not resident in the household, whose primary activity is work or active job search and whose absence is not as a result of permanent household dissolution (a "split"). This has the further advantage of dramatically reducing attrition (largely restricting it to cases where entire households cannot be traced).

Conceptually, this restricted investigation focuses on the migration behaviour of household heads and their immediate (nuclear) families, rather than on the mobility of all adult household members, whose presence may be transitory and perhaps deeply endogenous to the outcomes of interest. The result is to minimise the risk of conflating other forms of spatial mobility with labour migration.

Turning to particular regressors, expected migrant earnings are proxied using "Mincerian" earnings characteristics (age, age squared, gender, education). Altruism is captured by relatedness indicators (whether the individual is a parent of minors or has a partner in the household). Additional controls include a rural/urban dummy and household size.

Income measures are of central interest. A notable source of variation in household income (in terms

[16] Men aged 16 to 63 and women aged 16 to 58 at time t. The lower bound is essentially irrelevant (core members are all older than 16). The upper bound is important, however, as state pension age eligibility is 65 for men and 60 for women. In examining the impact of transfer income changes on migration, our interest is in "prime age" migration in households, rather than the potential, direct impact of pension income on the mobility of the elderly. In practise, the restriction has no material impact on results.

of both frequency and magnitude) is acquisition or loss of the state old age pension (OAP). This is not only of direct interest, but also plausibly exogenous under weak assumptions (section 3.4 refers). Income is included as follows:

- Resident earned non-agricultural income at time $t-1$. Since many households report zero earned income, and to allow for discontinuities in the effect of resident income on migration, dummy variables for earned income quartiles are used, with the omitted category zero reported earned income.
- Arable land access and cattle ownership variables proxy agricultural income.
- Dummy variables capture the presence of male and female OAP recipients. The appropriateness of gender-differentiated controls is strongly suggested by previous analysis and dummies rather than transfer amounts are used because almost all pensioners draw the same (maximum) pension amount. The dummy variables are: receipt of pension income at $t-1$ and t, new pension acquisition by men or women in the household between periods, and loss of pension income (so that the reference category is no OAP receipt in the household in either period).
- Land and cattle variables are presented, and resident income quartiles calculated, in real per adult equivalent terms using the formula that has become standard in the South African empirical literature: Adult equivalents $= (0.5 \times \text{minors} + \text{adults})^{0.9}$. This converts income into something like an individual welfare indicator, and allows for the consumption scale economies which are predicted to play a role.

Additional data on "economic surprises" are also exploited. Negative crop and livestock events, losses due to theft, and income losses due to temporary illness or injury (prior to the survey year), are plausibly exogenous indicators of income variability. Strong correlations between these events and household income or agricultural assets would introduce collinearity, and this could arise if wealthier households had more to lose and hence reported more and higher value shocks (or, conversely, if poorer households reported smaller shocks that richer households did not consider material). However, examination suggests that shocks are not systematically related to household income and assets.

Finally, we note that the observed dependent variable is binary: 1 if the core is a migrant, 0 otherwise (subject to the age restriction). I first adopt a linear probability model (LPM), but its usefulness is limited by the fact that predicted values will not necessarily map onto the probability space. Alternatively, assuming that the observed, binary y arises from a latent, continuous propensity to migrate, depending linearly on the regressors listed above, and that errors follow the standard normal distribution, allows us to fit a probit model.

In principal, pooled estimation (whether LPM or probit) using all available observations will be consistent (though not efficient unless made robust to serial correlation arising from the time-invariant component of the error term). Under stronger assumptions, we can apply (efficient) feasible GLS for the LPM, and random effects estimation for the probit model. The latter is computationally demanding and coefficient stability needs to be carefully assessed (see appendix B). The models (LPM and probit, pooled and random effects) produce a very consistent picture.

5.4.2 Remittances

Regressions on remittances sent in 1998 take the general form:

$$y_{ih} = \alpha_i + x'_{ih}\beta + z'_h\gamma + \varepsilon_{ih} \tag{16}$$

Where y_{ih} is the log of the value of remittances sent by individual i in household h in the year to the survey, x is a vector of remitter characteristics, z is a vector of recipient household characteristics, and ε is the individual error term. All regressors are as suggested by expression 13. Because remitters' incomes are not observed, x contains Mincerian earnings characteristics, as well as a dummy variable for whether

the remitter is in an urban or rural location. z includes the number of other remitters in the household, household-level resident income, and exogenous income variation using the same OAP dummy variables employed in migration analysis.

Also incorporated in z is the estimated value of exogenous negative and positive economic shocks in the two years to the survey. For the former, direct expenses incurred, the value of assets lost, and income foregone from negative agricultural "surprises" are aggregated. Losses are discounted by 10% a year to calculate the present value of recent shocks at the time of survey. In the same way, positive, exogenous windfalls for the household (inheritances, receipt of prizes and scholarships for children, good harvests) are calculated. Since the welfare impact of a shock of given size will vary by family size, shock values are normalised to per resident adult equivalent amounts.

The Heckman model run to account for selection into observed remittance-sending status can be described as:

$$y_{ih} = \begin{cases} y^{\star}_{ih} & \text{if } w_i > 0 \\ . & \text{otherwise} \end{cases}$$

Where y_{ih} is the log of observed remittances sent by individual i in household h in the year to the 1998 survey, $y^{\star}_{ih}$ "true" remittances determined as described by the right hand side of equation 16 and $w_i \lesseqgtr 0$ is a selection equation based on the individual and household characteristics that drive migration as described by equation 15. Estimation is by joint maximum likelihood and is predicated on the irrelevance of 1993 variables that drive selection in determining remittance value, conditional on the inclusion of their 1998 counterparts. Under this assumption, results from the Heckman model are expected to be asymptotically consistent and efficient.

Finally, the full panel is used to examine the correlates of remittances received. In this case, the general specification is:

$$y_{iht} = \alpha_i + x'_{ih}\beta + z'_h\gamma + w'_{it}\delta + v'_{ht}\theta + s'_{h\triangle t}\tau + \varepsilon_{iht} \tag{17}$$

where y_{iht} is the log of the value of remittances received by individual i in household h in the year to the survey at time t and the right hand side comprises vectors of time-invariant and time-varying individual and household characteristics, and an individual composite error term (consisting of an individual effect and time-specific error). Because remitters are only identifiable in the 1998 wave, controlling for their relevant characteristics is a problem. While regressions control for earnings-relevant, mean household characteristics, this is a limitation of these estimations.

Pooled OLS and random effects generalised least squares specifications are reported.[17]

5.4.3 Data Poolability & HIV/AIDS

The use of pooled panel data is based on the apparent stability of relationships of interest across waves (using single-wave regressions, not shown). This is supported by some evidence that migration patterns have not changed as much as might have been expected in the post-Apartheid period (section 3 refers), with the exception of a possible change in the gender mix of migrants. However, the data do span a long (eleven year) period. Over this period, no analysis of the economic behaviour of households, and welfare impact of public transfers, can be complete without recognising the magnitude of the HIV/AIDS epidemic.

[17] A Hausman test does not reject the null hypothesis of no systematic differences between coefficient estimates under the (consistent) fixed effects model and (efficient) random effects model and motivates the use of the latter.

KwaZulu-Natal is the epicenter of the epidemic in South Africa. South African Department of Health statistics indicate a national HIV prevalence rate of around 11% in 2006, and 16% in KZN (1.5 million of the estimated provincial population of 9.6 million). Amongst antenatal clinic attendees (i.e. pregnant women visiting state health clinics) in KwaZulu-Natal, figures suggest annual increases in prevalence to an apparent peak of 40.7% in 2004. The number of AIDS-sick in KZN is estimated to have increased from 1 571 in 1993, to 29 885 in 1998, and 167 515 in 2004. Estimated cumulative AIDS deaths in the province stood at 407 862 in 2004 and life expectancy at birth was 43.1 years.[18] Large-scale anti-retroviral treatment in the public health sector to suppress full-blown AIDS and reduce mother-to-child transmission post-dates the 2004 wave.

The KIDS survey does not deal directly with HIV/AIDS, but inferences can be drawn from health and mortality data. 264 individuals sampled in 1993 are deceased in 1998; their mean age at death is 50. 480 individuals sampled in 1998 are deceased in 2004, with a mean age at death of 44. Taking into account the fact that there is one more year between waves 2 and 3 than between 1 and 2, this is an effective rise in "raw" mortality of 55% and a six year decline in the average age at death. By comparing the estimated age distribution densities of the 1998 and 2004 samples, and superimposing the density of the ages at death of people dying in the interval leading up to these waves, figure 1 demonstrates that this is unlikely to be an artefact of changing samples. While the estimated (smoothed) age profile of the sample changes little between waves, the mortality age profile changes dramatically, with the decline in mean age at death arising from a major leftwards shift in the distribution. All the evidence is that this can be ascribed to a rise in AIDS-related deaths.

Figure 1: Age & age-at-death distribution densities (kernel estimates), 1998 and 2004

The impact of HIV/AIDS-related illness and mortality on migration and remittances is not clear, *a priori*. The obvious, general characterisation of likely effects is a decrease in the earnings power of affected

[18] All statistics from Dorrington, Johnson, Bradshaw and Daniel (2006).

individuals and a rise in the dependency ratio in households. Affected households are thus likely to be faced with a decrease in earnings (or farm production) and a rise in (money and time) care costs. Simplistically, these effects might be expected to encourage migration and boost remittances as local conditions deteriorate and the need for cash income increases. Because whole communities are affected, the ability of local social networks to cushion general idiosyncratic economic shocks may be reduced, while high HIV-prevalence is itself a kind of systemic shock, which local social insurance mechanisms struggle to mitigate. In principle, this should raise the comparative advantage of migration as a risk management strategy.

However, family members who would normally migrate may themselves be the ones afflicted. The need to care for the ill may discourage departure from the household and the monetary costs of care may worsen liquidity constraints to migration. This could change the profile of migrants (for example, older adults might migrate when younger family members would ordinarily do so). In addition, high prevalence in migrant communities may discourage migration, by raising the perceived risks of migration, or increasing migration costs if migrant support networks are weakened. Reduced remitter earnings may outweigh remitters' desire to remit more to mitigate the effects of the disease on their home families.

More generally, the epidemic is likely to be an additional source of household compositional change. Better-off households (perhaps including those receiving steady remittances or pension income) may take on the children of badly-affected families, or adults (related or not) in need of care. Sick younger adults who would normally leave to start their own households may remain in their households of origin in order to access income and care, while badly-hit families may fragment entirely as bread-winners are lost.

This kind of endogenous household change driven by the effects of HIV is one specific risk to inference in this study. Another is that ill-health acts as an omitted variable in the error term. For example, resident ill-health may be negatively correlated with resident earnings and positively correlated with remittances, skewing earned income coefficients. To control for the impact of the epidemic, I use data from KIDS' health module which asks core household members "how healthy" they are. If one or more core household members of working age (16 to pension-eligibility age) considers themselves to be in poor or very poor health (there are five categories) this is reflected in a dummy variable. This measure is clearly extremely crude, but it should serve to differentiate households in which key members have symptomatic HIV. In addition, a dummy variable captures households which experience the death of one or more working-age members between $t-1$ and t. While also crude, this is another way to control for variation in households' exposure to the epidemic, and may be important if chronic ill-health arising from HIV and AIDS-related mortality affect migration and remittances differently.

5.5 Results - Descriptive Statistics

Tables 1 and 2 report descriptive statistics at the individual and household levels respectively.

5.5.1 Remittances and Remitter Characteristics

Turning first to remitters:[19] of 537 recorded remitters in 1998, none had lived in the survey household for more than 15 days in the month prior to the survey, so none are classified as "resident household members". 56% are classified as "non-resident household members" since they had been resident for 15 or more days in the year to the survey, with the rest resident for less than that time and so described by the survey as "non-household members with links".

[19] See Posel (2001a) for comparable descriptive statistics based on the KIDS 1998 survey

A more precise picture of where remitters fit into the generally large and complex households making up the sample emerges through information on the relationship between remitters and remittance recipients. In 55% of cases, remitters are the children or grandchildren of recipients. 22% of remitters are the partners of recipients, 10% the siblings, 4% the parents (likely including recipients of the relatively generous state old age pension) and 6% "other family members". The likelihood that an individual sending a transfer to a household is not a family member is just 2.6%, implying that almost all the 44% of remitters classified as non-household members are considered to be family by survey respondents. This highlights the (perhaps inevitably) arbitrary nature of categorisations made by the survey, and the difference between the primary survey unit (locationally-defined household) and economic network of interest (family).

59% of remitters are male, compared to 44% of non-remitting adults. Their average age is 39, compared to 35 for adult non-remitters; it does not seem, therefore, that remitting migrants are drawn from the youngest labour force participants in this household sample. With 6.12 years of education (just under primary school completion), the average remitter's education attainment is statistically indistinguishable from that of the average working-age resident, though considerably higher than that of the average core household member. Just 6% of remitters had completed higher education (versus 5% of working-age non-remitters not in education). For secondary education the equivalent figures are 23% and 19%.

Remitters are quite widely geographically dispersed (not on table): 59% are resident in urban KZN (including 32% in Durban, the economic capital of the province, and 7% in Pietermaritzburg), 17% in Gauteng province (which contains Johannesburg), just over 10% in rural KZN and the rest dispersed elsewhere in South Africa or "foreign countries".

Total remittances in the year to the survey date average 2708 rand per remitter, or an average of 252 rand in 10 transfers per year.[20] Cash remittances dominate over in-kind transfers, accounting for 82% (2222 rand) of annual remittance value at the mean. Cash remittances are also made more frequently on average: the average remitter made 2.7 in-kind transfers a year, compared to 8.1 cash transfers.

How significant are these remittances? Two perspectives are pertinent: that of remitters and recipients. We do not observe remitters' earnings, so a direct statement about the relative magnitude of their remittances cannot be made. However, we can use information on their earnings-relevant characteristics to infer an answer. Perhaps the simplest approach is to use a standard Mincerian earnings function to predict wages for remitters based on their observable characteristics. Doing so, we find that remitters have mean predicted monthly earnings of 1108 rand, statistically significantly higher than predicted earnings for all working-age non-remitters (720 rand), and working-age non-remitters excluding those still in full-time education (802 rand). This is attributable largely to remitters' higher average age and probability of living in an urban area.

Based on this estimation, the average remitter remits 20% of their predicted wage, and this proportion is approximately equal for men and women (with the latter predicted to earn, and observed to remit, significantly less than men). This is a conservative estimate given that this is the proportion of predicted wages conditional on employment; high involuntary unemployment means that remittances are a higher proportion of expected wages.

38% of sampled households receive remittances from non-resident members, rising to 46% of households in rural areas (compared to 22% of urban households; a smaller proportion, but migration is far from an exclusively rural-urban phenomenon). While 67% of households receiving remittances do so from a single remitter, 22% count two, and the remainder (11%) more than two, remittance-sending members. Remittances are clearly widespread, affecting directly a significant minority of (especially rural) families.

[20] One South African rand bought approximately twenty U.S. cents in 1998.

Remittances are important as much for their relative size for recipient households as their breadth of coverage: total annual remittances received by remittance-receiving households average 3985 rand, or 332 rand a month in 1998. This is 24% of the mean estimated value of total monthly consumption for remittance-receiving households (and 28% for rural households).[21] Alternatively, the average monthly remittance amount is 70% of the maximum value of the most generous public transfer (the state old age pension, worth up to 470 rand), and equal to 140% of mean total public transfer income in all sampled households in 1998.

Across the survey waves, remittance-receiving households appear worse off than the average household in per resident equivalent adult (r.e.a) income terms (although this gap appears to be closing over time). Part of this is explained by the greater preponderance of rural households amongst remittance-receivers, with remittance-receiving households having access to more land and owning more cattle than average. Food expenditure per r.e.a. is insignificantly different, suggesting that remittance-receiving households make up for lower cash earnings with own-food production and remittances. Remittance-receiving households do not receive less OAP income than average (so there is no immediate sign of crowding out).

5.5.2 Migrants

Migrant core individuals are generally younger, more likely to be male, and slightly better educated than non-migrant cores. However, the proportion of migrants who are men drops from 74% in 1993 to 53% in 1998 (and 58% in 2004). This changing migrant gender mix is in line with existing evidence for the 1990s reported in section 3.[22]

Households with core members who are migrants tend (unsurprisingly, because they are very often the same) to look very similar to remittance-receiving households. Migrants tend to come from larger households. Total household income per resident equivalent adult is much lower in households containing migrant cores than average, and remittance income is far more important. But, as in the case of remittance-receiving households above, migrants usually come from rural households, and are better off in terms of land access and cattle ownership, so that cash income is likely to understate consumption. Food expenditure per r.e.a suggests no significant difference. Families with core migrant members do not appear much more likely to receive pension income, except in the 2004 survey. But households which have lost the OAP are less likely to contain core migrants (again, particularly in 2004), suggesting (tentatively) that transfer income may matter in determining migration.

5.6 Regression Results

5.6.1 Migration

Table 3 presents migration regression results. I focus on signs and statistical significance levels (rather than on marginal effect interpretation of coefficients), and these are generally robust across specifications. Age and gender have no apparent effect on migration probability, but more education has a positive influence at the 5–10% level. The Mincerian earnings characteristics of individuals thus appear to have only limited power to explain migration, with the exception of education (probably the key determinant

[21] Calculated as the sum of the estimated value of food consumption (including imputed value in the case of own-production), regular non-food expenditure and occasional non-food expenditure (respectively 40%, 32% and 28% of total household consumption of 1664 rand at the mean). Consumption and non-food regular expenditure are monthly figures in the raw data; occasional non-food expenditure is the monthly average of expenditure over the previous year. Consumption figures should be treated as indicative given the difficulties involved in imputing the value of own-production.

[22] Male migrants in 1993 are more likely to have attrited in 1998 than women (11.7% *versus* 17.8%), but not by nearly enough to make gender-differentiated attrition a compelling explanation

of earnings in the formal labour market). Being married reduces the likelihood of migration, while being the father (but not the mother) of minor children raises it. The latter relationship accords with expectations if children increase the need for cash income and fathers have a comparative advantage in migration over mothers. It might be that mothers bear more of the burden of direct care and indeed, while statistical significance is not robust across specifications, there is some indication that motherhood reduces the probability of being a migrant.

The likelihood of migration increases with the size of the core member's household (significant at the 5% level), perhaps driven by declining scale economies in consumption, or diminishing returns to additional labour in the household (an effect not captured in the theoretical model). Migration probability is lower in urban households. The presence of core members in poor health is negatively related to migration, while the deaths of working age family members in the household have no apparent bearing. As outlined in section 5.4.3, the negative relationship between migration and serious illness in the household may be attributable to the direct care needs of the ill, or possibly the money costs of care (worsening liquidity constraints to migration).

Turning to earned and transfer income (OAP) correlates:

- Being in a household in any of the upper three quartiles of positive, earned income per r.e.a is associated with a reduced probability of being a migrant relative to belonging to a household that reports zero earned income. To the extent that the earned income quartile dummies reflect better earnings prospects at home, this is in line with notions of migration as a family, income-optimising decision.
- Land access and cattle ownership do not appear to influence migration (this holds when regressions are run on the sub-sample of rural households [not shown]). Land access has a negative sign, but is significant (at the 10% level) in only two of six specifications. However, significant livestock losses between periods raise the odds of being a migrant (at the 5-10% level). Thus although agricultural income as proxied by land access and cattle ownership does not appear to drive migration in either direction, there is some evidence that shocks to agricultural income do have an effect, with negative livestock events boosting migration probability.
- OAP variables are revealing: receipt of the OAP by men at time $t-1$ and t has no impact, but receipt by women in the household makes the migration of cores more likely. The loss of both male and female OAP income makes migration less likely, while the gain of female (not male) OAP makes migration more likely (all relative to households which receive no OAP). There appears to be a strong, positive link between (particularly female) pension income and migration.

Finally, we note that individuals observed in 2004 are less likely to be migrants than individuals observed in 1998, all else equal. With controls for migrant age in place, the refreshment of the panel in the 2004 wave with the children of core individuals, and an attempt made to counter possible non-random attrition using inverse probability weighting, this is not likely to be a statistical artefact. The strong year effect may reflect a general decline in labour migration compared to the 1990s but further analysis is needed to uncover whether (and if so, why) this is occurring.

5.6.2 Remittances

Table 4 presents regressions on the log of remittances sent in 1998. I focus first on the results of regressions (1.1) and (1.2) – unweighted and weighted OLS on the log of observed remittances. Analogously to the migration results, the Mincerian earnings characteristics of remitters have surprisingly little impact on the value of observed remittances, except for the strong impact of higher education (associated with remittances more than 65% higher than those from remitters with no recorded educational attainment, the reference education category). Remitters in urban areas remit almost half as much again as remitters

in rural areas, most likely attributable to an urban earnings premium. Dropping this dummy variable has no impact on any of the Mincerian variables (collinearity between remitter location and age or education level may have explained the latters' insignificance).

Relational variables are very important. Remitters with partners or children in the recipient household remit much more than those with some other relationship to recipient household members (the omitted category), including being the child of household members (no significant effect); partners remit *much* more. As expected if altruism drives remittance decisions, remittances decline with the presence of other remitters in the household (significant at the 5-10% level, on the order of a 13% reduction). The presence of core members in poor health, and the deaths of working age individuals in the two years to the survey, have no apparent bearing on remittance amounts.

Turning to income and economic shocks: remittances in households in the second and third per r.e.a earned income quartiles are lower than for households which report no earned income, with growing magnitude. Signs for quartiles 1 and 4 are also negative, but statistical significance is weaker – at only the 10% level in the unweighted specification for quartile 1, and insignificant at any reasonable level for quartile 4. All income quartile coefficients have the "right" (negative) sign, and the large standard error of the quartile 4 estimate may be attributable to the fact that this is a rather small category (33 households). In general, then, we see a negative relationship between remittances as households become better off in resident earned income terms, in line with theoretical expectations.

Households with access to more land receive less remittance income, but this effect is not large (an extra hectare of land per r.e.a, a very big increase, reduces total remittances by about a quarter).

Ownership of an extra head of cattle per resident adult equivalent is positively related to remittances, a surprise since cattle are intended to proxy farm income, which we expect to reduce private transfers. Stark and Lucas (1988) obtain a similar (now dated) result for Botswana. The explanation may lie in the practical difference between cash earnings and own-production. If a family owns more cattle, this may indicate that the family is more heavily involved in farming, raising the need for cash earnings to pay for non-food consumption. Altruistically-driven remittances would be higher for such a farm-oriented household than another with some resident cash earnings, all else equal.[23] Alternatively, this result may be an artefact of reverse casuality as recipients invest remittance income in cattle, or be indicative of an alternative remittance motivation at work, with remittances reflecting migrants' savings in livestock form.

The value of positive and negative shocks have the expected signs (negative and positive respectively), but coefficients are extremely small and not statistically significant. This holds in alternative specifications using dummy variables for recent shocks (not shown). There is thus no evidence that remittances respond to the exogenous shocks accounted for in these specifications. But this may be due to the difficulty in accurately gauging the magnitude of these events relative to household income, and recall that we do see livestock shocks having substantial effects on migration.

Amongst the OAP variables, the loss of the female pension is strongly associated with remittance value in terms of both significance and magnitude (compared to households which do not receive any pension income in periods $t-1$ to t, households which lose the female pension see a remittance increase of more than two-thirds). No other OAP variables are significant, though all have the sign predicted by the altruistic remittance framework.

Column (2) reports results from the Heckman model that attempts to account for selection into being an observed remittance sender (see appendix 8 for the full Heckman model output, including the selection

[23] Note that the link between residents' productive activity and land access is much weaker, because land access is generally communal. Thus it is likely to be a good indicator of the agricultural possibilities open to the household (making it suitable as an agricultural income proxy), but not necessarily its level of actual agricultural activity.

equation). A Wald test rejects the null hypothesis of independent selection and final equations at the 10% level, suggesting that selection is indeed an issue. Rho – the inferred correlation between selection and final equation error terms – is positive; the standard interpretation is that the unobserved factors (in the error term) which raise the probability of selection into being an observed remittance sender also tend to raise remittances conditional on selection. This is perhaps the intuitive result. For example, high unobserved individual motivation may encourage migration, while also raising earnings and thus remittances. In short, there is some evidence that selection into being a remittance sender matters in determining remittance amounts sent conditional on that status. The bias implied when this dependency is ignored is regressor-specific, depending on the sign of the correlation between the regressor and the "omitted variable" of selection probability.

Heckman results report full marginal effects (that is, the estimated marginal effect of the variable on the expected value of the log of remittances sent, including the variable's estimated effect on the probability of remittances being sent at all). There are some notable differences between these results and those based on simple, conditional OLS:

- Being male becomes significant at the 1% level, raising remittances by 37% compared to being female. With no evidence from the migration probability estimations that migrants are more likely to be men, it is not clear precisely what is driving this change except that something about being male raises the probability of being a remitter. It could be that while men and women are equally likely to be away for work, and while remittances conditional on remitting do not differ much by gender, male earnings are more likely to be high enough to enable them to remit some amount; 60% of remitters are men.
- The magnitudes of the higher education, urban, relational , "other remitters", resident earned income quartile, land access and cattle coefficients are all reduced, but they remain statistically significant. These changes are generally intuitive given that each is likely to reduce the likelihood of being a remitter in the first place (with the possible exception of being a parent, judging by the migration probability estimations).
- The most striking differences lie in the OAP variables. Taking selection probability into account:
  - makes female OAP receipt at $t-1$ and t positive and significant (at the 5% level);
  - makes loss of a female OAP negative and significant (at the 10% level);
  - makes gain of a female OAP positive and significant (at the 5% level);
  - does not impact other OAP variables (notably male receipt and male OAP change), which remain statistically insignificant.

The impacts of these OAP factors on selection probabilities are clearly strong enough to flip the signs of the associations obtained when selection probability is ignored. Their final, estimated impact on remittances is very material: altering remittances sent by 25% or more on average relative to the no OAP case. These OAP findings resonate with those for migration discussed in section 5.6.1 in which the presence of the female pension was found to have associations of the same sign with migration. This is not surprising given the natural interpretation that selection into remittance sending status is essentially selection into migration.

Thus while transfer income appears to have classic crowding out effects on remittances in the class of observed remittances, accounting for the positive influence of the OAP on migration changes the picture completely. Complete marginal effects point to the OAP crowding in remittances by increasing migration.

Table 5 reports the results of regressions on the log of the value of remittances received. As established by the discussion above, these need to be treated cautiously because they condition on observed remittance receipt. A further difficulty is the inability to control well for the likely earnings power of remitters. These regressions are therefore included mainly for the purposes of comparison with those in

table 4, and in order to exploit all available remittance information over the three KIDS waves (recall that remittances received are recorded in all waves, while remitter identification is possible only in 1998).

Results are very similar to those of specifications 1.1 and 1.2 (unweighted and weighted OLS) in table 4. In particular, more earned income per r.e.a reduces remittances relative to households reporting zero earned income, and OAP coefficients are qualitatively identical. I do not attempt to model selection into remittance receiving status.

6 Qualifications

Several qualifications must be made concerning the interpretation of the above regressions.

Coefficients on earned income generally indicate a negative relationship between this variable and the probability of (subsequent) migration, and (contemporaneous) remittances. Because it is lagged, interpreting this negative association as causal seems plausible in the migration case. But for remittances, it is not possible to rule out the possibility that this is an artefact of endogeneity, as outlined in section 5.3.5. Land access is consistently negatively related to remittances, however, and since we might expect this measure of household earnings capability to be less vulnerable to reverse causation from remittances this is reassuring.[24] An attempt was made to instrument resident income using the Mincerian earnings characteristics of residents. Resident earnings were not statistically significant in these specifications; but since the correlation between these characteristics and earnings is quite low this may be due to a weak instruments problem rather than the implication of removing endogeneity bias.

Changes in OAP status are plausibly exogenous (I exclude the [handful of] cases where change in pension status is due to pensioner mobility). Even so, caution needs to be exercised in interpreting the coefficients on these variables as pure income effects.

OAP acquisition reflects family members crossing the age-eligibility threshold. Due to the fact that the means-test is rarely applied and in any case almost universally non-binding, it is safe to say that recipients are not compelled to reduce their labour supply. Nevertheless, to the extent that they do, OAP acquisition may involve an increase in pensioner leisure time in households, as well as transfer income. Loss of the OAP, on the other hand, generally reflects the death of recipients. Crassly-stated, this reduces household size and eliminates pensioner time in addition to decreasing transfer income.

These factors make it important to allow for asymmetries in the effect of gaining and losing the OAP, as is done here. In fact, OAP gain and loss appears to have roughly symmetrical effects on migration and (net) remittances on average. It is tempting to conclude that a more or less pure income effect is being observed, but of course a competing source of symmetry is gain and loss of pensioner time. Untangling these effects is difficult, but there are some reasons to think that income effects dominate in explaining the apparent importance of the pension. First, *voluntary* withdrawal from farm production or income-earning activity in the case of pension acquisition is itself a kind of income effect (nothing forces recipients to stop working), and we could infer that transfers to other household members would have the same impact if income is substantially fungible. Secondly, in the case of pension loss, many pensioners who pass away are old and (presumably) infirm. Their economic usefulness to the household prior to death is likely to be very limited, and in fact they may be (direct care and time) dependents of working-age people. In such cases we would expect their death to release relatives from the burden of care and hence enable migration. In fact we see that OAP loss reduces migration, as predicted if the

[24] Though not necessarily. Endogenous household change will bias the land access coefficient through the *per capita* adjustment made to render land access comparable across households. And land access may be directly affected by remittances if household claims to communal land are influenced by how much income support they are known to receive from absent family members.

major effect is loss of income and migration is liquidity constrained. Thirdly, the large size of the OAP relative to other income in recipient households makes it reasonable to infer that a substantial part of its observed impact is a cash income effect.

7 Conclusions

Migration and remittances generally behave in a manner consistent with family income optimisation sustained by migrant altruism. Observable earnings characteristics are unexpectedly weak in explaining migration probability and remittance values, but this could easily be due to the difficulty of accurately predicting earnings based on observable characteristics (or to limited variation in earnings for all but the most-educated labour force participants). In addition, there is no evidence that remittances respond to agricultural shocks. However, shock value measurement difficulties (including the need to control for households' ability to smooth consumption without recourse to migration) qualify this result, and we do see some indication that migration responds to livestock shocks. Given South Africa's extreme unemployment problem, it is also possible that migration and private transfers are driven primarily by the difficulty of earning cash income locally (especially in rural areas), with household income risk diversification a real but second-order motivation.

Looking at earned income suggests that higher resident income makes migration less likely and crowds out remittances (substantially but incompletely). This is in line with theoretical predictions, but must be qualified in the remittance case by the possibility that some of this is driven by reverse causation.

Turning to public transfer income, the evidence is that the OAP tends to increase labour migration, and powerfully so when recipients are women. This adds to previous results based on nationally-representative Labour Force Survey data and the seminal findings of Posel et al. (2004).

In regressions on observed remittances, we observe some signs of crowding out. However, taking into account the positive relationship between the pension and migration, the pension boosts remittances on average – there is crowding in. Causal interpretations of these associations can be made with some confidence since changes in pension status are plausibly exogenous and further strengthened by the explicit use of variation generated by pension gain and loss variables.

Thus, as we might expect given the relative size of the transfer, the OAP appears to alter household labour supply and resource flows substantially. The surprise lies in the direction of the changes it induces: on average, public cash income support increases labour supply in the form of migration and, in so doing, private transfers to residents. This striking result arises from joint consideration of household compositional (migration) and resource flow (remittances) responses to policy. It contradicts existing evidence for South Africa (with the partial exception of Maitra and Ray (2003a)) that takes household organisation as given, and is compatible with the theoretical framework established to explain migration and remittance behaviour in as much as households are initially liquidity constrained in migration choice.

Figure 2: The KwaZulu-Natal Income Dynamics Surveys (African households, all waves)

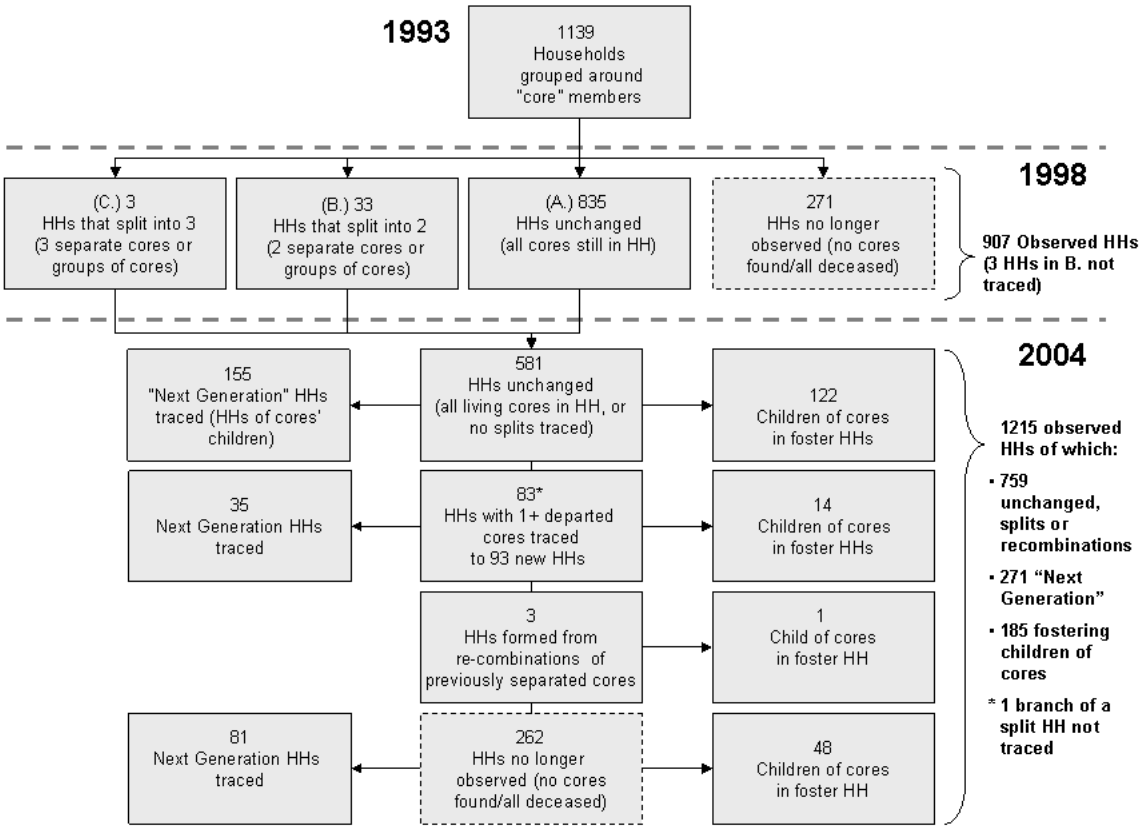

Table 1: Descriptive Statistics – Individuals: All, Core, Migrant Cores [Mig], Remitters [1998] (Mean Values, Std. Deviations in Brackets)

	1993			*1998*				*2004*			*Pooled*		
	All	Core	Mig	All	Core	Mig	Remitters	All	Core	Mig	All	Core	Mig
Basic Demographics													
Age	34.84	46.20	43.15	35.34	50.07	44.77	38.76	35.24	45.08	35.53	35.14	46.93	41.59
	(16.08)	(14.23)	(10.50)	(16.20)	(14.17)	(8.89)	(11.42)	(16.42)	(14.86)	(8.94)	(16.22)	(14.57)	(10.27)
Male	0.45	0.40	0.74	0.44	0.38	0.53	0.59	0.46	0.44	0.58	0.45	0.41	0.62
	(0.50)	(0.49)	(0.44)	(0.50)	(0.48)	(0.50)	(0.49)	(0.50)	(0.50)	(0.49)	(0.50)	(0.49)	(0.48)
Primary Schooling	0.08	0.08	0.08	0.09	0.10	0.11	0.08	0.07	0.08	0.11	0.08	0.08	0.10
	(0.26)	(0.27)	(0.27)	(0.28)	(0.29)	(0.31)	(0.27)	(0.26)	(0.27)	(0.31)	(0.27)	(0.28)	(0.29)
Some Secondary	0.34	0.23	0.29	0.35	0.23	0.28	0.26	0.39	0.31	0.33	0.36	0.27	0.30
	(0.48)	(0.42)	(0.46)	(0.48)	(0.42)	(0.45)	(0.44)	(0.49)	(0.46)	(0.47)	(0.48)	(0.44)	(0.46)
Complete Secondary	0.10	0.04	0.07	0.16	0.06	0.09	0.24	0.15	0.13	0.20	0.14	0.08	0.11
	(0.29)	(0.21)	(0.25)	(0.37)	(0.24)	(0.29)	(0.43)	(0.35)	(0.34)	(0.40)	(0.34)	(0.28)	(0.32)
Higher Education	0.02	0.02	0.02	0.03	0.02	0.02	0.06	0.03	0.04	0.05	0.03	0.03	0.03
	(0.13)	(0.14)	(0.13)	(0.16)	(0.15)	(0.14)	(0.24)	(0.18)	(0.20)	(0.22)	(0.16)	(0.17)	(0.16)
Total Education (Yrs.)	4.87	3.63	4.18	5.55	3.80	4.47	6.12	7.45	6.90	8.09	6.04	5.01	5.37
	(3.43)	(3.28)	(3.38)	(3.59)	(3.40)	(3.39)	(3.72)	(4.38)	(4.54)	(4.26)	(4.01)	(4.18)	(4.02)
Partner/Married	0.31	0.66	0.69	0.25	0.66	0.57	0.29	0.22	0.36	0.16	0.26	0.54	0.50
	(0.46)	(0.47)	(0.46)	(0.44)	(0.47)	(0.50)	(0.45)	(0.41)	(0.48)	(0.37)	(0.44)	(0.50)	(0.50)
Minor Children (No.)	0.89	1.62	2.08	0.57	1.15	1.31	0.77	0.49	0.72	0.65	0.64	1.13	1.42
	(1.43)	(1.73)	(1.64)	(1.14)	(1.54)	(1.60)	(1.33)	(0.98)	(1.17)	(1.17)	(1.19)	(1.52)	(1.61)
Income													
Total Income (non-farm)	297.69	548.81	.	271.05	577.99	.	.	278.13	445.19	.	281.61	512.38	.
	(601.84)	(720.29)	(.)	(677.43)	(865.77)	(.)	(.)	(960.46)	(1149.74)	(.)	(777.48)	(961.30)	(.)
Earned Income	205.99	360.01	.	197.04	369.89	.	.	200.71	306.07	.	201.07	339.65	.
	(575.68)	(725.08)	(.)	(656.48)	(872.02)	(.)	(.)	(945.26)	(1138.64)	(.)	(758.41)	(956.91)	(.)
Non-labour Income	56.96	115.89	.	50.90	142.43	.	.	64.29	112.10	.	57.73	121.23	.
	(179.37)	(244.13)	(.)	(187.14)	(302.04)	(.)	(.)	(186.21)	(244.62)	(.)	(184.59)	(261.01)	(.)
Remittance Income	34.73	72.91	.	23.11	65.67	.	.	13.13	27.02	.	22.81	51.49	.
	(139.43)	(196.43)	(.)	(109.61)	(180.65)	(.)	(.)	(117.92)	(172.91)	(.)	(122.48)	(183.76)	(.)
Frequency	8269	2203	296	8877	1864	266	537	8910	2811	216	26056	6878	778

Unweighted sample statistics. All comprises all working age individuals (aged 16 and above). Core comprises core household members as defined by KIDS. Migrants are as defined in text. 2004 figures refreshed with children of original core individuals and their households. Income figures in 1998 rands.

Table 2: Descriptive Statistics – Households: All, Remittance-Receiving [RR], and with Migrant Cores [Mig] (Mean Values, Std. Deviations in Brackets)

	1993			*1998*			*2004*			*Pooled*		
	All	RR	Mig	All	RR	Mig	All	RR	Mig	All	RR	Mig
Composition, Location, Health												
Household Size	7.26	8.99	9.22	8.14	9.16	9.00	7.14	8.01	10.47	7.48	8.82	9.42
	(4.14)	(4.28)	(4.34)	(4.53)	(4.70)	(4.87)	(4.27)	(4.44)	(5.25)	(4.32)	(4.49)	(4.78)
Residents	6.26	7.01	6.88	6.81	7.07	6.52	6.22	6.48	7.40	6.41	6.91	6.86
	(3.63)	(3.74)	(3.60)	(3.97)	(3.97)	(4.04)	(3.74)	(3.78)	(4.54)	(3.77)	(3.84)	(3.99)
Non-residents	1.00	1.98	2.34	1.32	2.09	2.48	0.92	1.53	3.07	1.07	1.92	2.55
	(1.49)	(1.70)	(1.81)	(1.97)	(2.29)	(2.48)	(1.65)	(1.99)	(2.42)	(1.71)	(2.01)	(2.23)
Children (under 16)	2.77	3.44	3.56	2.84	3.17	3.07	2.53	2.90	3.32	2.71	3.22	3.32
	(2.31)	(2.44)	(2.37)	(2.44)	(2.42)	(2.57)	(2.18)	(2.35)	(2.83)	(2.31)	(2.42)	(2.56)
Men	1.33	1.18	0.99	1.50	1.35	1.19	1.52	1.33	1.49	1.45	1.28	1.17
	(1.18)	(1.26)	(1.15)	(1.33)	(1.35)	(1.20)	(1.27)	(1.19)	(1.26)	(1.26)	(1.28)	(1.21)
Women	1.76	1.98	1.96	1.97	1.96	1.76	1.77	1.77	1.99	1.82	1.93	1.89
	(1.27)	(1.38)	(1.32)	(1.44)	(1.47)	(1.40)	(1.38)	(1.39)	(1.57)	(1.36)	(1.42)	(1.41)
Elderly	0.41	0.42	0.38	0.50	0.58	0.50	0.40	0.48	0.60	0.43	0.49	0.47
	(0.63)	(0.60)	(0.59)	(0.65)	(0.66)	(0.61)	(0.62)	(0.67)	(0.70)	(0.63)	(0.64)	(0.63)
Migrants	0.26	0.63	1.11	0.31	0.57	1.16	0.21	0.42	1.49	0.26	0.56	1.21
	(0.51)	(0.63)	(0.41)	(0.56)	(0.65)	(0.43)	(0.61)	(0.85)	(0.87)	(0.56)	(0.70)	(0.57)
Urban	0.27	0.13	0.08	0.22	0.16	0.09	0.24	0.21	0.21	0.25	0.16	0.11
	(0.45)	(0.34)	(0.28)	(0.42)	(0.37)	(0.29)	(0.43)	(0.41)	(0.41)	(0.43)	(0.37)	(0.32)
Work-age core(s) in ill-health	.	.	.	0.08	0.06	0.05	0.28	0.29	0.21	0.19	0.15	0.11
	(.)	(.)	(.)	(0.27)	(0.24)	(0.21)	(0.45)	(0.46)	(0.41)	(0.39)	(0.36)	(0.31)
Work-age death(s) since t-1	.	.	.	0.16	0.14	0.10	0.28	0.33	0.39	0.22	0.21	0.21
	(.)	(.)	(.)	(0.36)	(0.35)	(0.30)	(0.45)	(0.47)	(0.49)	(0.42)	(0.41)	(0.41)
Residents' Income & Spending												
Food Expenditure	484.54	514.80	495.89	587.30	608.72	562.06	652.69	709.83	654.65	571.15	593.67	555.58
	(362.74)	(366.99)	(335.16)	(356.39)	(340.42)	(298.55)	(548.69)	(605.44)	(492.40)	(438.12)	(431.85)	(368.38)
Total Income (non-farm)	1220.84	1031.45	940.32	1537.39	1234.45	952.74	1655.76	1396.68	1265.96	1457.90	1188.97	1016.73
	(1271.94)	(1163.98)	(1089.51)	(1809.09)	(1337.18)	(1101.67)	(2476.26)	(1763.91)	(1189.92)	(1904.31)	(1390.08)	(1122.97)
Earned Income (non-farm)	838.70	431.61	299.67	1117.29	592.58	408.09	1138.54	624.80	535.99	1021.25	534.35	392.21
	(1242.69)	(1022.24)	(885.27)	(1847.28)	(1294.82)	(1085.20)	(2456.70)	(1586.59)	(1168.42)	(1901.64)	(1271.33)	(1031.16)
Non-labour Income	236.24	225.48	216.78	293.33	340.46	257.05	403.38	466.47	555.07	309.04	322.54	306.61
	(379.46)	(363.28)	(368.77)	(431.89)	(473.86)	(355.10)	(469.04)	(516.60)	(469.37)	(432.30)	(452.61)	(410.33)

Table 2: Continued...

	1993			*1998*			*2004*			*Pooled*		
	All	RR	Mig	All	RR	Mig	All	RR	Mig	All	RR	Mig
OAP Income	184.82	180.66	184.20	206.77	251.38	213.95	197.88	240.09	308.97	195.66	219.95	222.86
	(333.13)	(309.32)	(329.09)	(284.80)	(299.88)	(273.45)	(315.72)	(335.97)	(359.52)	(313.70)	(313.75)	(320.09)
Remittance Income	149.88	396.09	448.03	133.07	315.12	306.10	76.02	322.21	190.06	120.19	349.76	338.26
	(276.78)	(324.02)	(347.26)	(242.07)	(285.41)	(325.81)	(279.66)	(502.89)	(351.21)	(269.84)	(362.85)	(354.48)
Cattle (Head)	1.01	1.91	2.06	1.45	2.13	2.02	0.92	1.09	1.42	1.11	1.80	1.91
	(2.89)	(3.93)	(3.85)	(4.33)	(5.33)	(3.97)	(2.63)	(2.58)	(3.12)	(3.31)	(4.27)	(3.75)
Land Access (Hct.)	0.41	0.65	0.68	0.70	0.96	0.96	1.34	1.41	2.40	0.81	0.94	1.17
	(0.91)	(0.98)	(0.92)	(1.41)	(1.57)	(1.66)	(10.76)	(8.99)	(11.73)	(6.31)	(4.46)	(5.67)
Food Expenditure (equiv.)	134.14	129.41	130.13	147.70	152.68	152.43	194.00	199.83	154.45	158.18	154.03	143.79
	(95.25)	(91.05)	(91.54)	(103.36)	(121.81)	(80.55)	(200.01)	(189.65)	(96.98)	(143.42)	(133.10)	(89.49)
Total Income (equiv.)	350.13	239.83	225.02	384.89	285.57	264.72	470.75	355.17	309.96	400.09	282.92	258.46
	(403.14)	(250.73)	(236.05)	(462.81)	(277.79)	(321.58)	(671.43)	(421.66)	(330.58)	(524.46)	(310.19)	(293.23)
Earned Income (equiv.)	251.94	90.06	61.57	276.45	121.62	112.60	332.25	148.97	136.37	286.06	115.04	97.06
	(415.17)	(223.00)	(191.38)	(475.10)	(264.47)	(324.80)	(678.45)	(354.63)	(315.24)	(534.32)	(273.69)	(277.06)
Non-labour Inc (equiv.)	58.98	49.39	46.29	74.33	82.75	68.91	103.72	112.68	127.83	78.49	76.03	72.74
	(113.55)	(83.46)	(80.50)	(123.91)	(129.45)	(101.00)	(135.76)	(126.48)	(107.70)	(125.79)	(114.80)	(99.64)
Shocks & OAP												
Neg. Shocks (est. val.)	.	.	.	1350.42	1468.21	1196.46	1253.25	1359.17	1228.13	1298.75	1425.88	1208.30
	(.)	(.)	(.)	(5689.27)	(6547.77)	(4282.96)	(4045.17)	(5079.51)	(4161.91)	(4883.34)	(6016.42)	(4232.76)
Pos. Shocks (est. val.)	.	.	.	901.41	707.18	620.80	1052.63	812.74	406.83	981.82	748.16	540.83
	(.)	(.)	(.)	(7701.85)	(6507.11)	(7433.31)	(6007.27)	(3520.92)	(1614.51)	(6851.71)	(5539.17)	(5960.90)
1+ OAP Recipients	0.30	0.32	0.31	0.38	0.45	0.40	0.36	0.40	0.49	0.34	0.38	0.38
	(0.46)	(0.47)	(0.46)	(0.48)	(0.50)	(0.49)	(0.48)	(0.49)	(0.50)	(0.47)	(0.49)	(0.49)
OAP Gain	.	.	.	0.13	0.14	0.11	0.11	0.11	0.16	0.12	0.13	0.13
	(.)	(.)	(.)	(0.33)	(0.35)	(0.31)	(0.32)	(0.31)	(0.37)	(0.32)	(0.33)	(0.33)
OAP Loss	.	.	.	0.09	0.06	0.07	0.21	0.17	0.10	0.15	0.10	0.08
	(.)	(.)	(.)	(0.29)	(0.24)	(0.26)	(0.41)	(0.38)	(0.30)	(0.36)	(0.31)	(0.27)
Frequency	1139	431	267	907	383	243	1030	243	145	3076	1057	655

Unweighted sample. Figures in monthly 1998 rands. Food expend. includes imputed value of own-produced consumption (indicative). Equiv. denotes per adult equivalent.

Table 3: REGRESSIONS: MIGRANT PROBABILITY

	(1.1) LPM Pooled	(1.2) IPW	(2) LPM GLS (RE)	(3.1) Probit (Pooled)	(3.2) IPW	(4) Probit RE
Age, t-1	−0.002	−0.003	−0.003	−0.002	−0.002	−0.001
Age squared, t-1	0.000	0.000	0.000	−0.000	−0.000	−0.000
Gender (male=1)	0.026	0.023	0.041^{+}	0.027	0.024	0.021
Educ. (yrs.), t-1	0.005*	0.004^{+}	0.004^{+}	0.005*	0.004^{+}	0.002^{+}
Married, t-1	−0.088**	−0.076**	−0.092**	−0.094**	−0.083**	−0.055**
Mother of minor, t-1	−0.031	−0.038*	0.006	−0.040*	−0.046*	−0.012
Father of minor, t-1	0.102**	0.093**	0.123**	0.101**	0.093**	0.076**
HH size, t-1	0.004*	0.004**	0.004*	0.003*	0.004**	0.002*
Urban HH	−0.067**	−0.055**	−0.078**	−0.064**	−0.053**	−0.030*
Resident core(s) in poor health	−0.033*	−0.031*	−0.021	−0.040**	−0.037*	−0.017^{+}
Working-age death(s) btw. t-1 and t	0.006	0.006	−0.005	0.004	0.005	0.000
Resident earned income (equiv.) quartile 1, t-1	−0.015	−0.013	0.009	−0.010	−0.010	−0.001
Resident earned income (equiv.) quartile 2, t-1	−0.071**	−0.072**	−0.045*	−0.061**	−0.061**	−0.024*
Resident earned income (equiv.) quartile 3, t-1	−0.056**	−0.057**	−0.015	−0.045**	−0.046**	−0.014
Resident earned income (equiv.) quartile 4, t-1	−0.097**	−0.096**	−0.062**	−0.083**	−0.081**	−0.030*
Land access (hct., equiv.), t-1	−0.029	−0.026	−0.037^{+}	−0.036^{+}	−0.031	−0.021
Cattle (head, equiv.), t-1	0.009	0.011	0.008	0.007	0.009	0.004
Theft/prop. damage losses	0.011	0.009	0.011	0.011	0.009	0.008
Major crop losses	0.018	0.023	0.026	0.012	0.018	0.008
Major lvstk losses	0.068*	0.058^{+}	0.055^{+}	0.057*	0.048^{+}	0.037^{+}
Male OAP at t-1 and t	−0.000	0.004	0.027	0.006	0.007	0.009
Female OAP at t-1 and t	0.097**	0.091**	0.093**	0.081**	0.074**	0.053*
Male OAP loss	−0.065*	−0.060*	−0.050*	−0.054*	−0.050*	−0.021^{+}
Female OAP loss	−0.078**	−0.082**	−0.076**	−0.073**	−0.075**	−0.030*
Male OAP gain	−0.032	−0.030	−0.024	−0.032	−0.030	−0.014
Female OAP gain	0.053^{+}	0.046^{+}	0.045^{+}	0.054*	0.047^{+}	0.041^{+}
Year is 2004	−0.109**	−0.103**	−0.104**	−0.117**	−0.113**	−0.079**
N	2845	2845	2845	2845	2845	2845
$\bar{R}^2$	0.099	0.092				
F-statistic	12.33	11.82				
Log Likelihood	-1026.7	-998.6		-1088.9	-1075.0	-1072.9

IPW indicates inverse probability weighted counterpart of regression to the left. Variables at time t unless otherwise noted. Equiv. denotes variable in adult-equivalent terms. Reference earned income category is zero resident earned income (i.e. quartiles are of positive earned income). Coefficients report marginal effects at the mean (or effect of 0 to 1 change in case of discrete variables). Std. errors are heteroskedasticity-robust and corrected for correlation due to individual effects where relevant. $^{+}$, *, ** denote significance at 10%, 5% and 1% levels.

Table 4: REGRESSIONS: LOG OF REMITTANCES SENT (1998)

	(1.1) OLS	(1.2) OLS (IPW)	(2) HECKMAN ML
Age	0.025	0.025	0.0031
Age squared	−0.00040	−0.00039	−0.000034
Gender (Male=1)	0.049	0.061	0.37**
Primary educ.	0.088	0.085	0.012
Secondary educ. (partial)	0.048	0.046	0.016
Secondary educ. (completed)	0.041	0.060	0.021
Higher educ.	0.68**	0.66**	0.078**
Remitter is Urban	0.46**	0.44**	0.039**
Partner in HH	1.59**	1.59**	0.15**
Child in HH	0.71**	0.71**	0.065**
Parent in HH	0.78**	0.80**	0.080**
Sibling in HH	0.38	0.39+	0.037+
Other remitters (No.)	−0.13*	−0.13*	−0.011*
Resident core(s) in poor health	0.035	0.048	−0.27*
Working-age death(s) in last 2 years	−0.23	−0.24	−0.016
Resident earned income (equiv.) quartile 1	−0.29+	−0.27	−0.022
Resident earned income (equiv.) quartile 2	−0.35*	−0.35*	−0.031*
Resident earned income (equiv.) quartile 3	−0.59**	−0.59**	−0.058**
Resident earned income (equiv.) quartile 4	−0.12	−0.14	−0.015
Land access (hct., equiv.)	−0.24**	−0.25**	−0.021**
Cattle (head, equiv.)	0.082*	0.085*	0.0078*
Negative Shocks (Value, equiv.)	0.000016	0.000016	0.0000016
Positive Shocks (Value, equiv.)	−0.000017	−0.000015	−0.0000016
Male OAP at t-1 and t	−0.19	−0.21	−0.16
Female OAP at t-1 and t	−0.065	−0.071	0.23*
Male OAP loss	0.14	0.16	0.046
Female OAP loss	0.72**	0.68**	−0.25+
Male OAP gain	−0.31	−0.32	−0.14
Female OAP gain	−0.065	−0.074	0.33*
N	535	535	4151
$\bar{R}^2$	0.31	0.31	
F-test	11.02	11.12	
Rho			0.36

IPW indicates inverse probability weighted regression. Heckman ML results report full marginal effects (i.e. coefficients report partial effects adjusted for variables' impact on probability of selection). See appendix C for complete Heckman output. Equiv. denotes variable in adult-equivalent terms. Reference earned income category is zero reported earned income (i.e. quartiles are of positive earned income). Std. errors are heteroskedasticity-robust and corrected for within-household correlation. +, *, ** denote significance at 10%, 5% and 1% levels.

Table 5: REGRESSIONS: LOG OF REMITTANCES RECEIVED

	(1.1)Pooled OLS	(1.2) IPW	(2)GLS (RE)
Mean age (adult HH members)	−0.0059	−0.0072	−0.0049
HH gender mix (prop. of adults male)	−0.28	−0.33	−0.27
Mean educ. (Yrs., adult HH members)	0.10**	0.11**	0.10**
Absent partner	0.81**	0.83**	0.79**
Absent child	0.25**	0.26**	0.25*
Absent parent	−0.0011	0.018	0.0091
Urban HH	−0.046	−0.028	−0.055
Migrants (no. of cores)	0.20**	0.20**	0.18**
Resident core(s) in poor health	−0.19	−0.25+	−0.20
Working-age death(s) in last 2 years	−0.41+	−0.38+	−0.40+
Resident earned income (equiv.) quartile 1	−0.20	−0.17	−0.21
Resident earned income (equiv.) quartile 2	−0.20	−0.21	−0.18
Resident earned income (equiv.) quartile 3	−0.66**	−0.66**	−0.64**
Resident earned income (equiv.) quartile 4	−0.49**	−0.50**	−0.52**
Land access (hct., equiv.)	−0.048+	−0.043	−0.043+
Cattle (head, equiv.)	0.093**	0.094**	0.092**
Negative shocks (value, equiv.)	0.000023	0.000015	0.000024
Positive shocks (value, equiv.)	0.00000071	−0.0000026	−0.000000032
Male OAP at t-1 and t	0.031	0.066	0.011
Female OAP at t-1 and t	−0.22+	−0.29*	−0.23+
Male OAP loss	0.15	0.20	0.11
Female OAP loss	0.37*	0.32+	0.36*
Male OAP gain	−0.28	−0.25	−0.30
Female OAP gain	0.15	0.15	0.13
Year is 2004	−0.36**	−0.35**	−0.36**
N	654	654	654
$\bar{R}^2$	0.20	0.20	
F-statistic	8.28	7.62	

IPW indicates inverse probability weighted counterpart of regression to the left. Equiv. denotes variable in adult-equivalent terms. Reference earned income category is zero reported earned income (i.e. quartiles are of positive earned income). Std. errors are heteroskedasticity-robust and corrected for within-household correlation where relevant. +, *, ** denote significance at 10%, 5% and 1% levels.

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A Inverse Probability Weighting Calculations

A general-to-specific approach is applied in regressing the probability of attrition in 1998 and 2004 on observable individual and household characteristics in 1993, ultimately yielding the specification reported in table 6, below.

Only a few observable characteristics are consistently related to subsequent attrition. In particular, being older, female and more educated raises the odds of being observed in future waves. Household income measures have no discernable effect (although the presence of OAP income in the household does raise the probability of attrition in the 2004 wave, perhaps reflecting household breakup as elderly household heads age). Individuals in urban and smaller households are notably more likely to attrite in 1998 or 2004.

Where possible, the inverse predicted values produced by these probits are used to weight observations. These estimators can be expected to be consistent. However, the efficacy of the procedure for removing attrition bias is essentially based on the assumption that the probit regressors are strong enough predictors of attrition to make all the regressors used in the estimations of interest (after the application of the selection predictors) irrelevant in doing so themselves (Wooldridge 2002). Given the rather low predictive power of these specifications, it is possible that this assumption is not met. Since no specification based on 1993 observables can do better, this means that much of the attrition that occurs in KIDS is either based on unobservable factors (and thus very difficult to correct), or largely random and ignorable.

May et al. (2006) find that "...most of its [KIDS] important characteristics remain broadly representative of the population of the province" (assessed using 2001 national census data). Evidence on the importance of attrition in other work using these data is mixed. Keswell (2004) and Alderman et al. (2001) find that correcting for attrition has little to no impact on their findings (on earnings dynamics and child welfare changes respectively). Conversely, Maluccio (2000) finds that accounting for attrition has a small but statistically significant impact on expenditure function estimations. See Maluccio (2000) also for much more detail on attrition in KIDS. Minor discrepancies between attrition statistics in that paper and those presented here arise because of a data revision conducted in the latest KIDS release.

Table 6: PROBIT REGRESSIONS: PROBABILITY THAT INDIVIDUAL SAMPLED IN 1993 IS RE-SURVEYED

	(1.1) Cores to 98	(1.2) Cores to 04	(2.1) All to 98	(2.2) All to 04
Age	0.0025**	0.0010	−0.00051**	−0.0015**
Male (d)	−0.043**	−0.088**	−0.0044	−0.017+
Education (yrs.)	0.0097**	0.011*	0.0012	0.0073**
Total earned income (/a)	−0.0000037	−0.0000040	0.0000063	−0.00000082
OAP(s) in HH (d)	−0.037	−0.097**	0.00056	−0.053+
Land access (hct.)	0.022	0.0080	0.013	−0.00083
Cattle (head)	−0.0033	−0.00083	−0.0034	−0.0033
Urban HH (d)	−0.088**	−0.040	−0.074*	−0.054
Residents (no.)	0.024**	0.033**	0.016**	0.025**
Non-residents (no.)	0.0022	0.012	0.0012	0.0087
N	2162	2162	8091	8091
Pseudo R^2	0.08	0.05	0.05	0.03
Log-Likelihood	-1009.49	-1403.27	-3360.32	-5188.46

Dependent variable is 1 if individual is present in relevant wave (1998 or 2004), 0 if they have attrited in that wave. Coefficients report marginal effects at the mean (except in case of dummy variables [denoted d], for which coefficients report the association with a 0 to 1 change). +, *, ** denote significance at 10%, 5% and 1% levels.

B Random Effects Probit: Coefficient Robustness Check

The random effects probit model reported in table 3 is estimated using adaptive Gauss-Hermite quadrature. Results using this method may be sensitive to the number of initial points used. Comparing parameter estimates under different numbers of quadrature points gives an idea of their stability. In general using this test, coefficient estimates appear quite stable. 144 quadrature points are used to estimate the likelihood function in the results presented, and table 7 demonstrates the relative difference in the maximum and the coefficients of selected variables of particular interest if 132 or 156 points are used instead.

The apparent stability of estimated coefficients should not be interpreted as proof of their precision given that we are optimising an approximated non-linear function. Rather, the check provides some grounds to think that results are based on a reasonably "well-behaved" likelihood function. The emphasis is also on coefficient sign and statistical significance rather than interpreting magnitudes as marginal effects. In this regard, the typical robustness of coefficient signs and significances across model specifications (including random effects probit) is reassuring.

Table 7: COEFFICIENT SENSITIVITY TO NUMBER OF INITIAL QUADRATURE POINTS

	Coefficient	Difference	Difference
Quadrature points	144 points	132 points	156 points
Log likelihood	-1072.862	-2.878e-09	-2.878e-09
Income Quartile 1	0.018	-.00003	-.00003
Income Quartile 2	-0.479	4.159e-06	4.159e-06
Income Quartile 3	-0.246	1.180e-06	1.180e-06
Income Quartile 4	-0.740	3.754e-06	3.754e-06
Cattle (equiv.)	0.064	6.342e-06	6.342e-06
Land (equiv.)	-0.316	6.170e-06	6.170e-06
Female OAP receipt at t-1 and t	.559	5.356e-06	5.356e-06
Loss of female OAP	-.682	4.235e-06	4.235e-06

C Heckman Selection Model: 1998 Remittances, Full Results

Table 8: LOG OF REMITTANCES SENT (1998): HECKMAN JOINT MAXIMUM LIKELIHOOD RESULTS

	Select.	Final (raw coeffs.)	Final (full marg. effects)
Age		0.034	0.0031
Age squared		−0.00037	−0.000034
Gender (Male=1)	0.31**	0.11	0.37**
Primary educ.		0.14	0.012
Secondary educ. (partial)		0.18	0.016
Secondary educ. (completed)		0.23	0.021
Higher educ.		0.87**	0.078**
Remitter is Urban		0.44**	0.039**
Partner in HH		1.63**	0.15**
Child in HH		0.73**	0.065**
Parent in HH		0.89**	0.080**
Sibling in HH		0.41+	0.037+
Other remitters (No.)		−0.12*	−0.011*
Resident core(s) in poor health	−0.27*	−0.051	−0.27*
Working-age death(s) in last 2 years		−0.18	−0.016
Resident earned income (equiv.) quartile 1		−0.25	−0.022
Resident earned income (equiv.) quartile 2		−0.35*	−0.031*
Resident earned income (equiv.) quartile 3		−0.65**	−0.058**
Resident earned income (equiv.) quartile 4		−0.17	−0.015
Land access (hct., equiv.)		−0.23**	−0.021**
Cattle (head, equiv.)		0.087*	0.0078*
Negative Shocks (Value, equiv.)		0.000018	0.0000016
Positive Shocks (Value, equiv.)		−0.000018	−0.0000016
Male OAP at t-1 and t	−0.14	−0.22	−0.16
Female OAP at t-1 and t	0.19*	−0.019	0.23*
Male OAP loss	0.025	0.18	0.046
Female OAP loss	−0.30+	0.66**	−0.25+
Male OAP gain	−0.11	−0.28	−0.14
Female OAP gain	0.26*	0.0051	0.33*
Age, t-1	−0.026*		
Age squared, t-1	0.0010**		
Educ. (yrs.), t-1	0.11**		
Married, t-1	−0.20*		
Size of household, t-1	−0.0083		
Urban HH	−0.37**		
Working-age death(s) btw. t-1 and t	−0.045		
Res. earned income (equiv.) quart. 1, t-1	0.050		
Res. earned income (equiv.) quart. 2, t-1	−0.18+		
Res. earned income (equiv.) quart. 3, t-1	−0.28**		
Res. earned income (equiv.) quart. 4, t-1	−0.30*		
Land access (hct., equiv), t-1	−0.14		
Cattle (head, equiv), t-1	0.11*		
Theft/prop. damage losses	−0.048		
Major crop losses	0.062		
Major lvstk losses	0.045		
Observations		4151	
Censored obs		3637	
Log-Likelihood		-1971.33	
Wald test statistic		3.33+	
Rho		0.36	

t-1=1993, t=1998. Standard errors are corrected for heteroskedasticity and within-household correlation. +, *, ** denote significance at 10%, 5% and 1% levels. Wald test is for null hypothesis of independence of the selection and final equations.