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## A dynamic double hurdle model for remittances: evidence from Germany

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## ABSTRACT

In the last thirty years, migrant remittances have become a stable source of external finance for developing countries. In this paper, we investigate whether aggregate persistence can be traced back to individual remitting behaviour, as a result of migrants' intertemporal choices. We propose a dynamic random-effects double hurdle model based on micro data from the German Socio-Economic Panel dataset. Our results show that there is significant state dependence in remitting behaviour, but in steady-state neither the probability to remit nor the transferred amounts are particularly large, thus suggesting that long-term intertemporal planning is rather sporadic. On these grounds, the medium-long term counterbalancing effect of remittances on the brain drain appears to be weak.

## 1. Introduction

International remittances have long been one of the most investigated issues in the migration research agenda. Transfers sent home by international migrants exceeded official development assistance and portfolio investment since the late 1990s. Despite a slight decline for two successive years, by 2.4 percent in 2016 and 1 percent in 2015, they are more stable than other private capital flows and are a major source of income and foreign exchange revenue for a large number of poor countries. According to the World Bank estimates, in 2016 remittances amounted to 34.5% of GDP in Kyrgyzstan, 29.7% in Nepal, 29.6% in Liberia (World Bank, 2017).

Given their size, the resilience of remittance flows and its determinants represent crucial factors for the future of migrants' countries of origin. Brown and Jimenez-Soto (2015) argue that the stability of remittances over time can be ascribed to two main facts: migrants act in a counter-cyclical manner, thus increasing remittances in times of hardship of their beloved in the home country, and remittances depend on the cumulated stock of migrants abroad more than on current migration flows. For the second fact to be true, however, individual behaviour over time becomes of crucial importance. In the absence of new migration flows, remittances would remain stable only as long as all remitting migrants keep on transferring money. If individual behaviour was not to

display high persistence over time, uninterrupted outflows from developing countries would become a prerequisite to observe stable aggregate remittances.

The way individual remittance behaviour over time contributes to aggregate trends is hence of noticeable interest for both policy makers and scholars in the field. Nevertheless, relatively little attention has been placed on the intertemporal nature of remittance strategies, given that the vast majority of migration and remittances surveys provide cross-sectional information and empirical evidence from longitudinal surveys is still scarce (Dustmann and Mestres, 2010; Duval and Wolff, 2010; Holst et al., 2012). Among the few contributions based on panel data, Bettin and Lucchetti (2016) focused on persistence but the issue was addressed within the decision to remit only.

We aim at filling this gap by proposing a fully dynamic empirical model of remitted amounts that accounts for the intertemporal nature of individual transfer decisions. To this purpose, we need to properly identify and estimate the *true* state dependence, that is the effect of past remittance decisions on their present value, separately from permanent individual unobserved heterogeneity, i.e. the propensity of the individual to make the same decision in all periods (Heckman, 1981a) that may capture, in this context, unobserved altruistic attitudes.

The possible selection bias deriving from the large share of non-remitting migrants has been long recognised and allowed for by mod-

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elling the decision process as the outcome of two separate steps: first, the choice to remit or not (the extensive margin) and second, the choice on the amount remitted (the intensive margin). Recent contributions in particular have explored the censoring mechanism by allowing zero remitters to have a double nature: they may either be unwilling remitters or unable to remit because of a budget constraint (or high transaction costs) (Sinning, 2011; Bettin et al., 2012; Brown et al., 2014; Batista and Umblijs, 2016).

We build on this empirical literature and propose a dynamic, random-effects double hurdle (DH) model for remittances. We extend the Maximum Likelihood (ML) estimator introduced by Jones (1989) in order to deal with state dependence and individual permanent unobserved heterogeneity as in Heckman (1981b). Given the complex non-linear nature of our model, which does not allow for a direct interpretation of estimated coefficients, and specifically state dependence parameters, we further investigate the dynamics of remittance decisions by simulation, in order to identify the long-run steady state distribution and the path of convergence towards it.

The analysis is based on micro-level panel data from the German Socio-Economic Panel (GSOEP), which covers a large sample of immigrants from 1997 onwards and provides information on their characteristics, including remitting behaviour, both at the individual level and at the household level. We find evidence of significant state dependence in both the probability to remit and the amount remitted. However, the magnitude of such persistence is rather small, which suggests that strong intertemporal planning in remittance decisions may be present, but certainly is not prevalent in our sample.

The paper is structured as follows: the main empirical issues in modelling remittance decisions and the way they have been addressed in the literature so far are discussed in depth in Section 2. In Section 3 we illustrate the dynamic random-effects DH model and survey the related econometric literature. Section 4 describes the GSOEP data and provides some descriptive evidence and the related empirical results are presented and discussed in Section 5. Section 6 concludes.

## 2. Empirical issues in modelling remittance behaviour

Empirical literature investigating the drivers of individual remittance decisions by means of micro-level data has largely developed in the last decade (Rapoport and Docquier, 2006; Brown and Jimenez-Soto, 2015).

In general, the modelling of remittance behaviour poses a first main issue that needs to be addressed, that is the treatment of zeros. The share of remitting migrants is rarely high in dedicated surveys<sup>1</sup> and might become even lower when using data from standard household surveys on either receiving or sending countries.

Heckman (1979)'s procedure has been largely used to model the extensive and the intensive margins separately (e.g. Banerjee, 1984; Hoddinott, 1992, 1994; Funkhouser, 1995; Cox et al., 1998; Aggarwal and Horowitz, 2002; Amuedo-Dorantes and Pozo, 2006; Bouyiour and Miftah, 2015).

More recently, the DH model (Jones, 1989) has been proposed in the empirical literature on remitting decisions as a further alternative to Heckman's selection model in order to take into account that non-remitting migrants might not simply be individuals who are unwilling to send any money home whatever their income, but also individuals that are prevented from doing so by the presence of transfer costs<sup>2</sup> and/or budget constraints. The double hurdle setting in fact allows for

the existence of a positive minimum transfer below which the costs to be covered are not offset by the additional utility migrants derive from remitting. Sinning (2011), Brown et al. (2014) and Batista and Umblijs (2016) used a DH model in its restricted independent version (Cragg, 1971), while Bettin et al. (2012) developed an instrumental variable extension of the dependent DH model, where the potential endogeneity of explanatory variables (migrants' income and consumption expenditure) is also taken into account.

All the above mentioned studies, however, are based on cross-sectional surveys that do not allow for an analysis of the individual behaviour through time. Evidence based on household panels is still relatively scarce. Duval and Wolff (2010) adopted a static framework and estimated the probability to receive remittances for Albanian households using the Living Standard Measurement Study (LSMS) data for 2002–2004 and control for unobserved heterogeneity of recipient households via either a random effects probit model or a fixed-effects logit model according to the different assumptions on the correlation between covariates and individual effects. In a similar vein, Biyase and Tregenna (2016) employ alternatively a random effects Tobit, a Heckman selection, and a two-part model to model the determinants of remittances received by South African households.

A few other studies made use of the GSOEP data which are available since 1984 and offer information on remittance behaviour of immigrant households in Germany. Holst et al. (2011, 2012), for example, addressed both the censored nature of the amount remitted and unobserved heterogeneity at the individual level by means of a random-effects Tobit model, thus assuming that the explanatory variables were uncorrelated with the unobserved individual effects. Dustmann and Mestres (2010) investigate how return plans affect the decision on whether to remit and on the amount remitted, separately considered. Some dynamics was introduced in their model, but only by treating the intention to return as endogenous and using past realisations of either the probability to remit or the transfer size as corresponding instruments.

The persistence in the decision to remit was instead the focus in Bettin and Lucchetti (2016), where dynamic binary choice models (random-effects probit and fixed-effects logit) were applied to GSOEP data in order to model the propensity to remit over time and evidence was in favour of an intertemporal strategy: true state dependence was found to be highly significant, thus implying that the propensity to remit at time  $t$  depends on what the migrant actually did at  $t - 1$ , even after controlling for persistence in observable and unobservable characteristics. The authors thus suggested a multi-period scheme as the best description of the allocation of remittances in time.

Building on these premises, we contribute to the existing literature on empirical remittance modelling by introducing for the first time a fully dynamic model, where persistence is addressed both in the decision to remit and in the amount remitted.

## 3. Random-effects dynamic DH model

In this section, we discuss the specification and ML estimation of a dynamic random-effects DH model that extends the traditional setting for cross-section data put forward by Jones (1989). We also illustrate the simulation strategy adopted to identify the long-run steady-state distribution of the probability of sending remittances and of the amounts transferred.

### 3.1. Model specification

In order to pursue the censored nature of the data, for  $i = 1, \dots, n$  and  $t = 1, \dots, T$  let us consider the latent variables

$$y_{it}^* = \mu_{it} + \varepsilon_{it} \quad (1)$$

$$s_{it}^* = v_{it} + u_{it} \quad (2)$$

<sup>1</sup> Amuedo-Dorantes and Pozo (2006) for example use the Encuesta sobre Migración en la Frontera Norte de México (EMIF) and show that approximately 53% of working immigrants in their sample does not remit.

<sup>2</sup> Evidence of the negative effects of transaction costs on aggregate remittances has been provided by Freund and Spatafora (2008) and Kakhkharov et al. (2017), among the others.

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