INTERTEMPORAL REMITTANCE BEHAVIOUR

BY IMMIGRANTS IN GERMANY

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Intertemporal remittance behaviour by immigrants in Germany[*]

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Abstract

In this paper, we use data from the German Socio-Economic Panel (SOEP) in the 1997-2009 period for a large sample of migrants from 84 countries in order to develop an empirical model for the propensity by migrants to remit. Our model takes into full account the intertemporal aspects of the problem, which has been ignored by a large part of the applied literature, despite its theoretical and empirical importance.

We find that most results already established in the empirical literature are confirmed; however, the intertemporal nature of the remittance behaviour emerges very clearly, giving rise to individual patterns which are difficult to synthesize by a simple description. Building on our framework, we find also support for theoretical models which predict different remittance time paths between return and permanent migrants.

Keywords: Migration, Remittances, German Socio Economic Panel
JEL codes: F24, F22

1   Introduction

The literature on remittance behaviour of migrants has developed enormously in the last years due to the increasing importance these transfers have to improve living conditions and promote development in low-income countries. The key elements investigated in the literature are the factors driving the decision to remit, the purpose, and the amount of remittances.

Theoretical models have mainly considered the decision by the migrant to remit money to the home country in a static framework. Little of the large

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body of work done on the motivations to remit puts the choice in the context of a fully intertemporal optimisation problem despite the fact that how remittance flows develop over time is a crucial factor for the development prospects of migrants' countries of origin. If transfers rapidly decrease after migrants have moved abroad, continued migration becomes a prerequisite for keeping remittance inflows costant over time.

In addition, as far as empirical analyses are concerned, existing studies generally rely on cross-sectional data to investigate the factors affecting migrants' remittance behaviour. The choice is therefore static: a given individual is either a potential sender (who may or may not actually remit) or someone who simply is not interested in making any remittance with reference to a given time span. The intertemporal dimension of the whole decision process is only partly accounted for by introducing a measure for the time spent in the host country since immigrating with mixed results[1].

Our aim is to develop an empirical model that fully accounts for the intertemporal nature of remittance decisions. Such nature might depend both on migrants' intrinsically forward-looking strategy and on the persistence in observable characteristics that influence the decision to remit in each period t - immigrants' characteristics, but also characteristics of the recipients in the home country. In addition, the evolution of remitting behaviour over time might well depend on the degree of altruism which can be considered as part of each individual's time-invariant psychological attitude. All these factors need to be carefully taken into account and a proper analysis of the factors that affect the probability to remit at a given time t by considering the present situation but also the past history of an individual is an essential, preliminary step in order to build a structural model of the amount transferred.

By means of both static and dynamic panel probit models, we look at the main determinants of the probability to remit and the persistence over time of the remittance behaviour. In addition, we analyse in detail how the propensity to remit may differ between permanent and temporary migrants, this latter aspect being of paramount importance for developing countries in order to ensure beneficial effects from their diaspora abroad.

The empirical relationship between remittance behaviour through time and the nature of migration plans (temporary vs. permanent) has, to our knowledge, only been investigated thoroughly in the paper by Dustmann and

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[1]Brown (1997), for example, provides evidence that the remittance decay hypothesis is not valid for a sample of Tongan and Samoan immigrants in Australia. Funkhouser (1995), instead, shows that the effect of an increase in years since emigration might differ according to the kind of relationship to recipients in home country. In a sample of Salvadoran migrants in the U.S. remittances to immediate family members increase over time, while transfers to other relatives become lower. By controlling for the time spent in the host country, Menjivar, Da Vanzo, Greenwell, and Valdez (1998) also find that among Salvadoran and Filipino migrants the probability to remit decreases with the years spent in the U.S.

Mestres (2010) in which a dummy for the intention to return is used as an explanatory variable in a dynamic empirical model. However, the difference between temporary and permanent migrants could be more complex, in that the entire time path of the remittance propensity could be different between the two groups (Poirine, 1997), so we adapt our framework of analysis in order to provide some evidence in this regard.

Our empirical model is built on data from the German Socio-Economic Panel (GSOEP) and the period we consider goes from 1997 to 2009; this dataset represents a unique asset for our analysis compared to standard remittance studies in the literature because of the long time span over which migrant households are observed.

The evidence we provide shows that the actual remitting behaviour of migrants through time is more complex, as most remitters seem to follow highly irregular time patterns. All these different patterns are of course not easy to reconcile with existing theoretical models of remittance behaviour, nor with their principal empirical counterparts.

Section 2 describes the data and briefly revises the few studies on remittances which exploited GSOEP data as well. Some preliminary evidence to highlight the importance of persistence in remitting behaviour and the empirical setup of the analysis are discussed in Section 3. Section 4 presents our results, while section 5 concludes.

2 The data

The empirical analysis presented here is based on data from the German Socio-Economic Panel (SOEP) for the period between 1997 and 2009[2]. This dataset is a representative longitudinal survey carried out since 1984 by yearly interviewing a large sample of households residing in Germany. Individual questionnaires are administered together with household-level ones so that for every person in the sample information concerning demographic and socioeconomic individual characteristics are matched with details on household composition and budget decisions. Immigrant households were included in the sample from the very beginning of the study in 1984 but the nationality groups initially covered were only those with the longer tradition of immigration to Germany: Turkish, Italians, Greeks, Spanish and Yugoslavian[3]. Only from 1995 onwards the immigrant subsample was sig-

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[2]The data used in this paper was extracted using the Add-On package PanelWhiz for Stata. PanelWhiz (http://www.PanelWhiz.eu) was written by Dr. John P. Haisken-DeNew. See Haisken-DeNew and Hahn (2010) for details. The PanelWhiz generated DO file to retrieve the data used here is available from us upon request. Any data or computational errors in this paper are our own.

[3]Formal guest workers programmes were implemented in West Germany during the 1950s and 1960s. Foreign workers were recruited from Southern Europe first (bilateral agreements with Italy and Greece were signed in 1955 and 1960, respectively), but soon

nificantly increased to include also other nationalities. The list of origin countries[4] covered is reported in Table 7 in the Appendix. Unfortunately, the major shortcoming affecting SOEP subsample of migrants is the lack of information concerning relatives in the home country, if still alive. Missing data on the family of origin are probably the reason why, despite its wide usage in the literature on migrants' assimilation and performance in the labour market[5], SOEP has been employed in very few contributions in order to analyse remittance behaviour.

The relationship between gender, transnational networks, legal status and the remittance patterns is addressed in Holst, Schäfer, and Schrooten (2008, 2010, 2011) while Bollard, McKenzie, Morten, and Rapoport (2011) include SOEP data in their cross-country study and shed light on how remittance patterns change according to migrants' different educational levels.

Piracha and Zhu (2007) and Bauer and Sinning (2011) compare savings rate of immigrants in Germany (both temporary and permanent) with those of the native-born population while Sinning (2011) focuses on the differences in remitting behaviour between permanent and temporary migrants. Also Dustmann and Mestres (2010) investigate how return plans affect remittances and their work is the only one to exploit the panel dimension in the dataset through GMM estimates. Their work, however, refers to the period 1984-1995 when only the five major immigrant groups were surveyed in the SOEP.

It is worth noting that none of these studies have provided a proper empirical treatment of the issue of intertemporal remitting behaviour despite the availability of longitudinal data from the survey.

In our analysis, we of course restrict the sample to the adult immigrant population, which includes 4967 individuals. Immigrants are defined as foreign-born individuals who immigrated to Germany since 1948, as per the SOEP criterion. Such definition includes individuals who became German citizens after immigration while it excludes second-generation immigrants (see also Bauer and Sinning (2011)). The analysis is conducted at the individual level although household-level variables are also included in the model as control variables.

When looking at preliminary descriptive statistics on remitting migrants by country of origin (Table 1), it is rather clear that sensible differences exist across nationalities. If on average the share of migrants which send money back is around 10% in the total sample with a slightly diminishing trend over time, migrants from Ex-Yugoslavia and from Asian and Pacific countries

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from Turkey and former Yugoslavia as well.

[4]Immigrants who entered the SOEP in the 1980s indicated Yugoslavia as their home country. Aggregate data have been calculated as mean values for the group of current countries that were once enclosed in the Federal Republic.

[5]See Schmidt (1997), Dustmann and Soest (2002), Constant and Massey (2003) and Zibrowius (2011) among the others.

show sensibly higher probabilities to remit. Among the nationalities with the longest tradition of immigration to Germany, it is interesting to highlight how the different numbers for Turkey on one hand and Italy, Greece and Spain on the other might reflect the relative level of economic development of these countries.

3 The persistence of remitting behaviour

3.1 Stylised facts

Classifying migrants into the "remitters" and "non-remitters" categories is harder than it seems at first sight, because it is difficult to define a status on the basis of an instantaneous action which may occur at irregular intervals. Empirical studies which rely on cross-sectional data usually exploit the information provided by surveys about any household member having remitted at least once in the reference period (last year, in most cases).

When analysing panel data, the behaviour is observed for a certain time span; a first element to be taken into account is the fact that the decision to remit seems persistent over time. Table 2 shows a cross-tabulation of the probability to remit in time t and $t-1$ for all 4967 individuals in our sample. Frequencies are higher on the diagonal: 94% of zero observations also had zero in the previous period, while 55% of individuals who remit at time $t-1$ still do so at time t.

The evidence displayed in Table 2 needs to be further explored; a revealing picture emerges by considering Table 3, in which migrants can be classified on the basis of the number of years they have been in the SOEP survey[6] and the number of years in which they have declared to have remitted money to their country of origin at least once.

The first column comprises non-remitters: however, classifying as such the 475 individuals who have taken part in the survey for the 13-year period considered is clearly not the same as classifying as non-remitters the 785 individuals who were or have been in the SOEP for one year only. On the diagonal, we have the regular remitters: for example, there are 3 individuals who have been in the SOEP for 13 years and have always sent remittances; but again, would we consider the 97 individuals who sent money in the only year they were in the sample as "regulars"? The problem appears even more complicated when moving away from the diagonal in the table, since the irregularity of remitting behaviour becomes stronger and several different patterns emerge.

Table 4 presents an indicator of "irregularity over time", that is the relative frequency of actual state transitions on potential ones, which is computed for each individual who appears more than once by following

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[6]The table refers to the period considered in our analysis, 1997-2009.

Table 1: Remitting migrants by country of origin

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Turkey remitters	84	76	78	101	98	77	69	49	50	45	30	27	30
	13,21%	12,69%	13,40%	14,03%	14,80%	12,48%	12,19%	8,99%	9,63%	9,30%	7,01%	7,38%	9,09%
Ita-Gre-Spa remitters	57	43	39	32	26	24	17	14	13	15	10	12	8
	10,34%	8,25%	8,32%	6,08%	5,53%	5,77%	4,49%	3,94%	3,86%	5,08%	3,80%	4,92%	3,43%
Ex Yugoslavia remitters	114	80	76	108	98	71	62	58	60	49	48	44	40
	29,46%	23,19%	23,90%	26,60%	27,22%	20,88%	19,20%	18,53%	21,20%	18,99%	19,92%	19,64%	20,62%
Other EU15 + OECD remitters	8	6	6	18	19	16	12	13	9	16	15	15	23
	7,48%	5,83%	5,88%	7,32%	9,22%	6,56%	5,17%	5,88%	4,37%	7,27%	7,01%	7,58%	10,80%
EU new members remitters	74	59	54	91	82	64	71	55	56	46	51	37	35
	20,90%	16,30%	15,74%	14,82%	15,89%	12,40%	14,64%	11,98%	13,49%	10,29%	12,56%	10,16%	10,14%
Ex USSR remitters	34	38	41	59	70	65	75	55	45	53	37	30	29
	12,93%	13,06%	14,75%	10,21%	13,28%	13,16%	15,31%	11,46%	10,00%	11,25%	8,56%	7,71%	8,17%
Africa remitters	4	3	1	6	3	5	6	11	5	6	6	6	4
	17,39%	15,00%	4,76%	6,25%	4,17%	7,04%	8,70%	16,42%	9,09%	9,52%	12,24%	12,77%	9,09%
Latin America remitters	2	1	1	3	5	5	4	5	2	5	2	4	3
	11,11%	5,56%	5,26%	8,57%	16,13%	16,13%	12,90%	16,13%	6,67%	15,15%	6,90%	14,81%	11,54%
Asia and Pacific remitters	13	8	5	16	14	14	14	12	14	16	12	9	10
	76,47%	42,11%	35,71%	27,59%	35,00%	36,84%	34,15%	34,29%	37,84%	43,24%	36,36%	31,03%	24,39%
Total	390	314	301	434	415	341	330	272	254	251	211	184	182
	16,55%	13,78%	14,03%	13,24%	14,39%	12,32%	12,61%	10,85%	10,89%	10,88%	10,07%	9,75%	10,22%

Table 2: Probability to remit in time t and $t-1$

| | P_t | | |
P_{t-1}	0	1	Total
0	22176	1409	23585
	94.03	5.97	100
1	1485	1826	3311
	44.85	55.15	100
Total	23661	3235	26896
	87.97	12.03	100

Table 3: Distribution of individuals by presence in SOEP and number of remittances, 1997-2009

| Years in SOEP | Years in which the individuals has remitted money | | | | | | | | | | | | | |
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
1	785	97												
2	383	50	39											
3	261	36	16	8										
4	270	50	29	13	8									
5	198	37	21	6	2	5								
6	166	28	14	9	7	8	6							
7	146	24	21	12	12	3	4	0						
8	199	34	19	9	9	6	5	5	2					
9	180	27	18	11	10	5	6	7	3	3				
10	305	57	25	30	16	11	10	4	8	7	1			
11	91	20	4	5	7	6	3	4	4	2	1	2		
12	154	17	7	6	5	9	2	6	3	3	3	5	4	
13	475	88	63	39	25	23	21	15	17	12	8	9	2	3

formula:

$$F_i = \frac{\sum_{i=2}^{T_i} |y_{i,t} - y_{i,t-1}|}{T_i - 1},$$

where $y_{i,t}$ is a dummy variable indicating whether individual i has remitted money in year t and T_i stands for the number of years an individual has been interviewed in SOEP. As can be seen, most people never change their status, but those who do may do so several times. There are even 65 individuals who remit money every other year[7].

It should be evident that any clear-cut classification is essentially arbitrary. All these kinds of behaviour are not easy to reconcile with existing theoretical models of remittance behaviour, nor with their principal

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[7]Of course, a thorough analysis of the regularity of remitters' behaviour should take also the amount remitted into account. Given the existence of fixed costs in remittance transactions, remitters would probably choose to transfer larger amounts of money on a less regular basis. The evidence we provide here, far from being exhaustive, simply wants to highlight the complexity in remittance patterns and their evolution over time.

Table 4: Number of transitions between remitter and non-remitter status as a share of the presence in SOEP

F_i	Frequency of individuals	%
$F_i = 0$	2902	71.65
$0 \leq F_i < 0.1$	41	1.01
$0.1 \leq F_i < 0.2$	228	5.63
$0.2 \leq F_i < 0.3$	251	6.20
$0.3 \leq F_i < 0.4$	204	5.04
$0.4 \leq F_i < 0.5$	107	2.64
$0.5 \leq F_i < 0.6$	152	3.75
$0.6 \leq F_i < 0.7$	70	1.73
$0.7 \leq F_i < 0.8$	22	0.54
$0.8 \leq F_i < 0.9$	8	0.20
$0.9 \leq F_i < 1$	—	—
$F_i = 1$	65	1.60
Total	4050	100

empirical counterparts which usually do not consider the evolution of the phenomenon over time.

3.2 Empirical strategy

The descriptive statistics presented in the previous sub-section should make it clear that building a statistical model for the remittance behaviour of individuals has to take into account the persistence of such behaviour.

The observed persistence in the probability to remit might indeed be due to different factors:

- persistence in observable characteristics (for example, individual and household income, employment status etc.);

- persistence in unobservable characteristics (in our case, mainly recipients' characteristics, since we do not have any explicit information on the family in the country of origin);

- migrants' forward-looking behaviour (smoothing of remittances over time);

- individual, time-invariant psychological characteristics (for example, the degree of altruism).

The first model[8] we propose is a plain pooled probit model:

$$y_{i,t}^* = x_{i,t}'\beta + z_{j(i),t}'\gamma + \varepsilon_{i,t} \tag{1}$$

where the binary dependent variable $y_{i,t} = \mathbf{I}(y_{i,t}^* > 0)$ indicates whether a given individual has remitted in the last year; $y_{i,t}^*$ is the customary latent propensity variable and $x_{i,t}$ and $z_{j(i),t}$ represent two sets of explanatory variables, which describe the individual and his/her country of origin, respectively (we adopt the convention of using $j(i)$ for the country individual i is from).

In equation (1), time persistence in the propensity to remit can be ascribed only to persistence in the observables, since previous remitting behaviour is not taken into account in any way. In order to encompass persistence in a more systematic way, we extend equation (1) so to include persistence factors other than the observables: a very natural and simple choice is a random-effects probit model, in which unobserved, time-invariant characteristics of the individual are an additional cause of persistence:[9]

$$y_{i,t}^* = x_{i,t}'\beta + z_{j(i),t}'\gamma + \alpha_i + \varepsilon_{i,t} \tag{2}$$

where α_i represents the individual time-invariant effect. It is interesting to note that the ratio

$$\rho = \frac{\sigma_\alpha^2}{\sigma_\alpha^2 + \sigma_\varepsilon^2}$$

could be interpreted as the autocorrelation coefficient of the composite error term $u_{i,t} = \alpha_i + \varepsilon_{i,t}$ and hence as a measure of the persistence due to individual-specific unobservable factors. In fact, the possibility of estimating ρ also makes it possible to make a quantitative appraisal on the relative importance of the two sources of persistence (if ρ was 0, then persistence attributable to unobservables would be negligible).

A further generalisation of model (2) stems from the possibility that time-persistent remittance behaviour may also be due to persistence in unobservable time-varying factors. This could, in principle, be accommodated by relaxing the white-noise assumption on $\varepsilon_{i,t}$; however, a more manageable model which retains a comparable interpretation is a dynamic panel probit model of the form

$$y_{i,t}^* = \varphi y_{i,t-1} + x_{i,t}'\beta + z_{j(i),t}'\gamma + \alpha_i + \varepsilon_{i,t} \tag{3}$$

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[8]In principle, we may take it for granted that the remittance behaviour is persistent and, instead of investigating the factors that affect the decision to remit at time t, concentrate on the factors that affect the decision to *keep* remitting or to *start* remitting at time t, which would be considered as different decisions, with potentially different motivations. Such a model, however, might be quite difficult to interpret empirically. We therefore ignore this possibility and focus on more stylised models whose interpretation is more straighforward.

[9]Of course, the customary assumption one has to make in this context is the orthogonality between α_i and $\varepsilon_{i,t}$, which seems rather harmless here.

Model (3) is not trivial to estimate, since consistent estimation requires the specification of an auxiliary model for $y_{i,0}$ (this is known in the literature as the "initial conditions problem"). The method that has proven most used in the applied literature is one devised by Wooldridge (2005).[10] In practice, Wooldridge's method is implemented by adding to specification (3) the initial obervation $y_{i,0}$ and a vector of additional variables which could be considered informative on the expected value of α_i conditional on $y_{i,0}$ and the other explanatory variables. In most cases, common practice uses for this purpose the time-average of the explanatory variables in the model. The resulting model can then be estimated as if it were an ordinary random-effects panel probit model.

A note of caution, however, is in order. For a start, the regressors used for this purpose must be strictly exogenous. Moreover, there is an identification issue to consider: including a variable in the auxiliary model for $y_{i,0}$ makes it impossible to separately identify the effect of its time-invariant component on α_i and on $y_{i,t}$[11].

3.3 The explanatory variables

The set of explanatory variables $x_{i,t}$ we use in our models is common to all the models presented here and includes factors usually considered in the literature as observable determinants of the propensity by an individual to be a remitter: gender (1 if male), age and age squared, migrant household composition (total number of household members and number of children in the household), years of education and its square, time since migration (expressed in decades), intention to stay in Germany (1 for stay, 0 for going back to the home country), German citizenship (1 if acquired), migrants' individual yearly labour income and household net yearly income (both in natural logarithm), migrant's employment status (1 if employed).

In addition, since no direct information are available on remittance recipients, country-level macroeconomic conditions for migrants' countries of origin[12] $z_{j(i)}$ are also included. The indicator we consider is the ratio between per capita GDP in the home country and Germany (in logs), plus its square to take care of possible nonlinear effects. GDP per capita is expressed

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[10]An alternative approach was put forward by Heckman (1981), but it is rarely used due to its computational complexity. For a review of this and other more exotic alternatives see Stewart (2007).

[11]See Wooldridge (2005), page 44.

[12]The home country declared by migrants was not chosen from a predefined list, but rather declared freely. For this reason, a non negligible share of individuals list as their home country a territorial entity that is not recognized as a sovereign state per se or no longer exists as such. As a consequence, data for Benelux are calculated as means between those for Belgium and the Netherlands. For Kurdistan and Ex-Yugoslavia we make use of data for Iraq and Serbia, respectively.

in constant 2005 international dollars[13]. In this way, we can partially control for persistence in unobservable characteristics even if microdata on the economic situation of the family at home are missing.

As for the dynamic probit model, we used, as auxiliary explanatory variables for $y_{i,0}$ the time average of all time-varying regressors[14], with a few exceptions: we omitted employment status and all variables on the composition of the household on the account of them being possibly not strictly exogenous, plus the variables on the time since migration and the intention to stay in Germany, as we must be able to identify their effect separately in order to perform specific tests on the link between return intention, time spent in the host country and propensity to remit (see section 4.1).

The first two models (pooled probit and random-effects probit) are also estimated after turning annual data into three-year data to verify the robustness of our results. Continuous variables have been transformed into three-year averages while binary variables have been set to 1 if yearly observations were equal to 1 in at least 2 out of 3 years. In particular, the probability to remit is positive for those migrants who remitted at least twice in a three-year period. Estimation sample for three-year estimates includes only individuals who were interviewed in SOEP for at least six consecutive years in 1997-2009 period.

4 Estimation results

When comparing estimates on annual and three-year data (Table 5), results look in general very similar and can be therefore considered robust to the choice of the time span needed to classify an individual as a remitter. In most cases, coefficients are roughly proportional between the 1-year and the 3-year specification, with a different scale factor that can be explained by the fact that the frequency of remitters is lower in the 3-year specification due to the stricter definition of a remitter.

The signs of the coefficients in the pooled model are broadly in line with results from previous literature. No significant differences emerge in the probability to remit between male and female migrants (Funkhouser, 1995). Other things being equal, the effect of age on the propensity to remit is a concave function with a positive slope for younger migrants and a negative slope for older ones[15]. By employing SOEP data for 1984-1995, Dustmann and Mestres (2010) and Sinning (2011) also find a positive effect of the age of the migrant on the probability to remit, but they do not control for a nonlinear impact. Menjivar, Da Vanzo, Greenwell, and Valdez (1998),

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[13]Data are drawn from World Development Indicators database.

[14]Except for age, which is taken at time 0; this choice is obviously inconsequential.

[15]The test for the joint significance of age and age^2 always refuses the null hypothesis.

in contrast, find an inverted U-shape relationship between the age of the immigrant and the amount remitted in the main equation and a U-shape relationship in the selection equation.

Table 5: Persistence in the propensity to remit - Baseline estimates

	pooled (1-year)	pooled (3-year)	static random eff. (1-year)	static random eff. (3-year)	dynamic random eff. (1-year)
prob remit$_{t-1}$					0.666***
male	-0.012	0.006	-0.011	0.036	-0.047
age	0.077***	0.074**	0.140***	0.149**	0.096***
age^2	-0.001***	-0.001**	-0.001***	-0.001*	-0.001**
n household	-0.164***	-0.278***	-0.152***	-0.397***	-0.112***
n children	0.057**	0.148**	0.038	0.148	0.042
education yrs	0.091**	0.12	0.160*	0.178	0.153
education yrs^2	-0.003*	-0.005	-0.006	-0.007	-0.005
stay in Ger	-0.197***	0.09	-0.255***	0.149	-0.204***
decades since mig	-0.208***	-0.244***	-0.257***	-0.474***	-0.231***
Ger nationality	-0.190***	-0.301***	-0.252***	-0.500***	-0.178**
employed	0.165	0.056	0.306*	0.094	0.295**
individual income	0.153***	0.162***	0.179***	0.333***	0.110**
household income	0.255***	0.374***	0.336***	0.750***	0.305***
gdp differential	-0.881***	-0.967***	-1.329***	-1.915***	-1.215***
gdp differential^2	-0.174***	-0.213***	-0.249***	-0.406***	-0.308*
y_0					1.064***
av education yrs					-0.093
av education yrs^2					0.002
av individual income					0.016
av household income					0.022
av gdp differential					0.437
av gdp differential^2					0.185
age$_0$					-0.020**
ρ			0.618	0.749	0.384
σ_u			1.273	1.727	0.789
N obs	11890	3028	11890	3028	11890
N individuals			2414	1574	2414

Note: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Educational level of migrants hardly plays any role in determining the probability to remit, but, when significant, has a positive sign, in line with the repayment hypothesis according to which educated migrants need to pay back the investment in their education made by the family of origin (Bollard, McKenzie, Morten, and Rapoport, 2011). Dustmann and Mestres (2010) instead show that the probability to remit is negatively affected by the number of years of education.

The inclusion of both individual and household income demonstrates how they both exert a significant effect on the probability to remit, although

the size of the coefficient on household income is larger. When looking at income effects on the propensity to remit, however, we need to consider the possibility of our results being biased by endogeneity problems which unfortunately we are not able to take properly into account at this stage of analysis[16].

The GDP differential between the home country and Germany and its square both exert a negative and very significant effect on the probability to remit. As the economic distance between home and host country decreases, migrants become less likely to send money.

When we include individual-specific unobservable factors by estimating a random-effects probit models, the signs and the significance levels of the coefficients are not very different from those of the simple pooled probit model. This finding is valid both with annual and with three-year data. We interpret the near-constancy of parameters as the individual time-invariant factors α_i being substantially orthogonal to observed factors and, hence, representing a distinct source of persistence. ρ - a measure of the persistence due to individual-specific unobservable factors, as we said before - is indeed rather high and equal to 0.604 with annual data and to 0.708 with three-year data.

The effects of the control variables on the probability to remit are not much different from those discussed for the pooled model: the coefficients are only slightly bigger in modulus while the signs are substantially confirmed. The number of children in the household does not play any significant role anymore and also the years of education lose part of their explanatory power. On the other hand, the dummy for the immigrant being employed turns out to be significant at the 5% level (Dustmann and Mestres, 2010).

When we move from the static to the dynamic model, the lagged dependent variable is strongly significant with the expected positive sign, thus suggesting that an additional source of persistence has to be taken into account: the remittance strategy doubtless looks like an intertemporal forward-looking behaviour. However, even when taking into account the persistence in the probability to remit, estimation coefficients display the same signs and significance they had in the static model and result only slightly smaller in modulus. The value of ρ decreases by half but is still significantly greater than zero (0.384) thus hinting at the fact that individual time-invariant characteristics cannot be disregarded when modelling the probability to remit over time.

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[16]For a comprehensive analysis of endogeneity issues in models of remittances, see Bettin, Lucchetti, and Zazzaro (2012). However, it should be noted that possible endogeneity of income would prevent us to read the estimated coefficients as behavioural parameters, but would not hinder our main purpose here, which is the study of persistence. We therefore leave this issue for future work.

4.1 Remittance time path and return decisions

Results in the previous section clearly show that the probability to remit strongly decreases with the intention to stay permanently in Germany. Along the same line, in their GMM estimates Dustmann and Mestres (2010) find that the probability to remit is 16 percentage points higher and the total amount transferred 1.3 log points larger for individuals with temporary migration plans.

However, when modeling empirically the intertemporal remittance decision, it is interesting to look deeper into this relationship and analyse how migration strategies (permanent vs. temporary) might evolve over time and hence play different effects on the remittance behaviour.

A theory on the shape of the remittance function over time was formulated by Poirine (1997). Remittances are considered as an implicit family loan arrangement; after migrating, the individual needs to repay the informal loan received in her/his youth to finance education and the length of the repayment period is more or less equal to that of the loan period (according to Poirine's view, approximately 10 years). After the loan has been totally repaid, whenever the migrant has children or young siblings left in the country of origin, he/she becomes a lender to pay for their education. Such a loan will be repaid when the migrant finally goes back to the home country for retirement and/or when the young educated will become migrant themselves. A third, final wave of remittances is associated in Poirine's model to the individual return plans. If migrants intend to retire in their home country, they will use remittances to guarantee themselves enough resources to live there after retirement.

When looking empirically at the average remittance function for a migrant community over time, the result according to Poirine should be the sum of the three waves. If we consider migrants who want to return home after retirement, the function is likely to have an 'M' shape where the peak corresponding to the second wave (the "loan" wave) is lower compared to the other two because only a fraction of migrants will actually finance education of those left behind. If we look at permanent migrants instead the third wave of remittances would not exist at all thus causing an hill-shaped function.

Theoretical predictions deriving from Poirine's model cannot be properly tested in our framework due to the lack of essential information on both the sending and the receiving side; however, we try to extend our baseline specification to investigate if the evidence from the SOEP sample is supportive for differences in intertemporal remittance planning between temporary and permanent migrants.

We introduce further variables in our set of control variables x_{it} in order to allow for an M-shaped function of the probability to remit over time. In particular, we introduce powers of the decades since migration variable

Table 6: Length of stay and return intentions - Augmented specification

	pooled (1-year)	pooled (3-year)	static random eff. (1-year)	static random eff. (3-year)	dynamic random eff. (1-year)
Prob remit$_{t-1}$					0.665***
male	-0.01	-0.004	-0.005	0.012	-0.044
age	0.078***	0.076**	0.142***	0.146**	0.097***
age^2	-0.001***	-0.001**	-0.001***	-0.001*	-0.001**
n household	-0.162***	-0.269***	-0.151***	-0.371***	-0.111***
n children	0.054**	0.150**	0.033	0.147	0.041
education yrs	0.080*	0.114	0.149	0.171	0.152
education yrs^2	-0.003	-0.004	-0.005	-0.007	-0.005
stay in Ger	-0.567	-0.917	-0.806	-1.106	-0.189
decades since mig	-0.511	-3.406*	-0.501	-5.483	-0.401
decades since mig^2	0.372	2.214*	0.352	3.435	0.353
decades since mig^3	-0.119	-0.563*	-0.14	-0.855	-0.145
decades since mig^4	0.011	0.047*	0.017	0.069	0.017
stay*dsm	1.589*	3.503	1.757	4.909	0.724
stay*dsm^2	-1.432**	-2.801*	-1.545	-4.067	-0.915
stay*dsm^3	0.439**	0.779*	0.492	1.155	0.332
stay*dsm^4	-0.043*	-0.070*	-0.051	-0.106	-0.037
Ger nationality	-0.213***	-0.282***	-0.275***	-0.445***	-0.192**
employed	0.166	0.055	0.307*	0.096	0.290*
individual income	0.154***	0.171***	0.178***	0.349***	0.111**
household income	0.245***	0.352***	0.333***	0.684***	0.306***
gdp differential	-0.885***	-0.942***	-1.337***	-1.837***	-1.102***
gdp differential^2	-0.177***	-0.214***	-0.252***	-0.403***	-0.302***
y_0					1.063***
av education yrs					-0.103
av education yrs^2					0.003
av individual income					0.016
av household income					0.015
av gdp differential					0.318
av gdp differential^2					0.177
age_0					-0.019*
ρ			0.618	0.743	0.381
σ_u			1.271	1.702	0.785
N obs	11890	3028	11890	3028	11890
N individuals			2414	1574	2414
Test WH	0	0.001	0.001	0.039	0.001
Test SH	0.004	0.001	0.512	0.031	0.270

Note: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

until the fourth power and all their interactions with the dummy for return intentions. All models above are hence estimated again using this augmented specification.

We propose two different tests that can provide some insights on the interaction between return intentions, length of stay and intertemporal remitting behaviour in the SOEP sample. Our weak hypothesis (WH) simply states that the intention migrants have to return to their home country matters in determining remittance behaviour. The strong hypothesis (SH) instead predicts that not only the intention to return does significantly influence remittances, but it also affects the shape of the migrant community's remittance function over time[17]. The rejection of the WH implies the rejection of the SH while a rejection of the SH does not imply the invalidity of the WH.

Results from the augmented baseline specification are reported in Table 6. Compared to our baseline specification, results remain substantially unchanged as far as the common set of control variables is considered.

P-values from the tests for the SH and the WH are reported under estimation results. All in all, the evidence we provide is strongly in favour of the WH. In all the specifications we considered, the *p* value is uniformly well under 5%. There seems to be no doubt that the intention to return (or lack thereof) affects the remittance behaviour of migrants even after accounting for persistence effects. The results by Dustmann and Mestres (2010) are therefore strongly confirmed.

As for the SH, evidence is more mixed. The irrelevance of the interaction between *stay* and the powers of the length of stay is accepted in two specifications out of five. It would seem that evidence in favour of the SH becomes somewhat weaker once persistence effects are taken into account.

If we plot the probability to remit over time, however, the shape of the curves is broadly compatible with the idea of different waves in remittances time path. Figure 1 reports different functions for the two subgroups of migrants, one for the stayers $(S(x))$ and the other for those who want to return to the home country $(M(x))$, which depict the partial effect on the probability to remit of the length of stay in Germany[18]. The probability to remit for the permanent migrants reaches its peak between five and ten years after the arrival in Germany and then costantly decreases, thus taking

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[17]From a practical point of view, such tests are implemented as hypothesis tests on the regression coefficients. Represent the relevant part of the regression function as $\ldots \beta_0 s + \beta_1 s \cdot d + \beta_2 s \cdot d^2 + \beta_3 s \cdot d^3 + \beta_4 s \cdot d^4 + \ldots$ where we dropped the i, t indices for clarity. Variable s is the "intention to stay" variable and the d variable is the "decades since migration" variable. A test for the WH, therefore, is $\beta_0 = \beta_1 = \ldots = 0$. We interpret rejection of this restriction as supportive of the WH. To test the SH, instead, we run the same test with the exclusion of β_0, that is $\beta_1 = \beta_2 = \ldots = 0$. Since both tests have the statistical insignificance of the coefficients of interest under the null hypothesis, we need to reject H_0 for the theory to be valid.

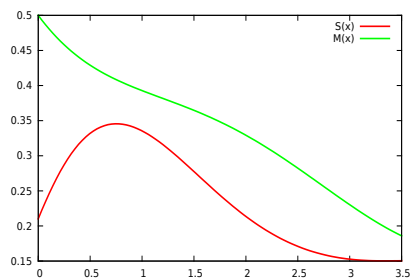[18]A constant of 2 was added to the functions for 3-year data to improve readability.

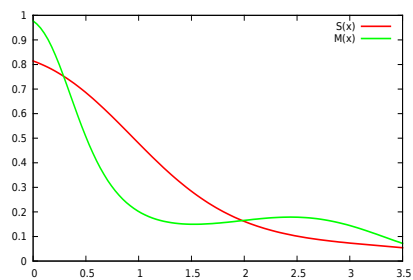Figure 1: Probability to remit over time
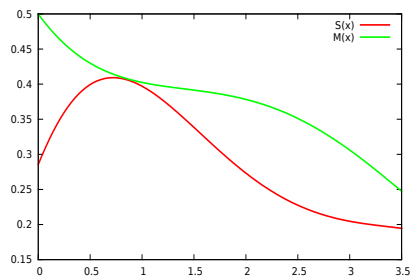
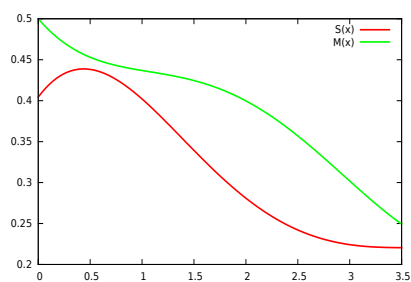
Pooled estimates, annual data
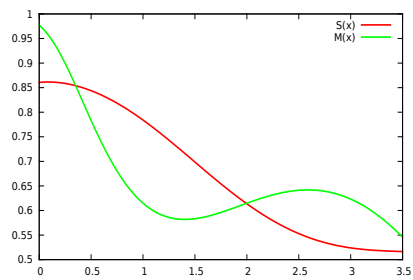
Pooled estimates, three-year data

Random effects, annual data

Random effects, three-year data

Dynamic random effects, annual data

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a hill-shaped form.

The probability function for the potential returnees partly recalls that M-shaped function described by Poirine as the sum of the three different waves. In particular, it is rather clear that, compared to the function for the permanent migrants, the probability to remit increases again between 15 and 20 years after migration in order to arrange the return to the home country. The "pay-back" wave (first wave), which, according to Poirine, is likely to involve the vast majority of migrants, in our sample seems to be even stronger with the first peak being much higher for returnees compared to permanent migrants.

In short, while the available evidence enables us to be confident in considering the intention to return as relevant in the remittance choices, we cannot be equally confident in saying that their pattern through time is significantly affected by the return choice. Although some of the results are suggestive that this may be the case, we have no definitive evidence either for or against this conjecture.

It must be said, however, that our results suffer from the lack of information on the size and composition of the family of origin. Moreover, it may be surmised that the difference in the initial propensity to remit between those who plan to return and those who do not is (at least) partly due to the composition of migrant household. In fact, it is very likely that migrants who leave their country of origin with the intention to settle permanently somewhere else will bring most, if not all, their famlily members to the host country in the future and have therefore weaker incentives to remit at the very beginning. In addition, since they do not have to care about saving for their retirement at home, they can exploit a longer time span to pay back their debts.

4.2 Implications for structural modelling of remittance behaviour

It would be of great interest to build an empirical model for the amount remitted which takes fully into account its dynamic nature. If developing countries want to exploit the growth potential of remittances received from their diaspora abroad, the intertemporal behaviour of migrants is a key element in order to predict how these flows might evolve over time.

However, as has been convincingly argued in Bettin, Lucchetti, and Zazzaro (2012), an empirical model for remittances must handle properly the endogenous self-selection of remitters. In addition, attention needs to be paid to the potential endogeneity of labour and consumption decisions by households who want to maximize the amounts sent home and set their labour offer and consumption patterns accordingly.

Methods for estimating dynamic models subject to endogenous sample selection in a panel data context have been proposed by Kyriazidou (2001),

Gayle and Viauroux (2007) and more recently by Semykina and Wooldridge (2011). None, however, seem to be readily applicable to remittances: Kyriazidou (2001) is a GMM method which hinges on a set of orthogonality conditions such that, for an observation to be usable, y_{it}^* must be observable for three consecutive periods. As we showed in the previous sections (see especially Table 4), this is a very rare occurrence in the SOEP dataset. Gayle and Viauroux (2007) propose, instead, a dynamic panel adaptation of the nonparametric setup for sample selection models as put forward, for example, in Das, Newey, and Vella (2003) or Newey (2009). Its non-parametric nature, however, makes it very prone to dimensionality problems, especially because the binary dynamic selection equation has (as argued in the previous section) to take into account a complex set of diverse factors. The method put forward in Semykina and Wooldridge (2011), on the other hand, looks much more promising from a practical viewpoint, but rules out the possibility of dynamics in the selection equation; again, from the evidence we presented earlier in the paper, this limitation seems very serious for remittances data, since past behaviour is certainly important in determining current remittance choices.

5 Conclusions and directions for future research

In this paper, we develop an empirical model for the propensity by migrants to remit which takes into full account the evolution of the phenomenon over time. To the best of our knowledge, the dynamic nature of the propensity to remit which we addressed here have never been satisfactory dealt with in the literature. According to our findings, several results already present in the literature are confirmed, but the evidence we provide shows unambigously that the propensity to remit has a time dimension that cannot be ignored.

There are at least two consequences for the empirical modelling of remittance behaviour.

First, models of the propensity to remit should not disregard the intertemporal information when available such as in the SOEP dataset. Second, the task of building structural models for the amount remitted which take selection bias into proper account should be extended to accomodate persistence of behaviour throught time. Of course, persistence might be observed not only in the propensity to remit, but also in the amount of money sent home. This empirical task is left as object of future research; it nevertheless represents a crucial element from a policy perspective in order to understand the real effects emigration might have for the future of developing countries. As long as the loss of people, especially high-skilled ones, is compensated by remittance inflows and return migration, the "brain-drain" scenario can be partially mitigated. The individual remittance time path is therefore a key element to predict the evolution of aggregate flows over

time.

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A   Auxiliary tables

Table 7: Immigrants' countries of origin

Afghanistan	Costa Rica	Ireland	Portugal
Albania	Croatia	Israel	Romania
Algeria	Czech Republic	Italy	Russia
Argentina	Denmark	Japan	Singapore
Armenia	Egypt	Jordan	Slovakia
Australia	El Salvador	Kazakhstan	Slovenia
Austria	Eritrea	Korea	South Africa
Azerbaijan	Estonia	Kurdistan	Spain
Bangladesh	Ethiopia	Kyrgyzstan	Sri Lanka
Belarus	Ex-Yugoslavia	Latvia	Sweden
Belgium	Finland	Lebanon	Switzerland
Benelux	France	Liberia	Tajikistan
Bolivia	Georgia	Lithuania	Thailand
Bosnia-Herzegovina	Ghana	Luxembourg	Trinidad and Tobago
Brazil	Great Britain	Macedonia	Tunisia
Bulgaria	Greece	Mexico	Turkey
Canada	Holland	Moldavia	Ukraine
Chad	Hungary	Namibia	USA
Chile	Indonesia	Paraguay	Uzbekistan
China	Iran	Philippines	Venezuela
Columbia	Iraq	Poland	Vietnam