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## Remittances of guest workers to their home countries: An econometric analysis

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**Forschungsschwerpunkt  
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**Ursula Oser**

**Remittances of Guest Workers  
to their Home Countries:  
An Econometric Analysis**

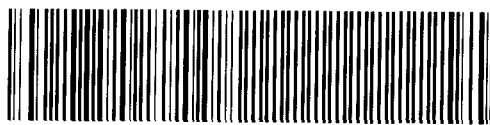
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# Remittances of Guest Workers to their Home Countries: An Econometric Analysis

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**Remittances of Guest Workers to their Home  
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**Abstract:**

The paper presents empirical evidence on the determinants of guest workers' remittance decision. Using a West German data set, the Socio-Economic Panel (SOEP), it is shown that the intensity to remit is well explained by remigration plans; personal characteristics, indicators for the degree of the guest worker's integration into the German economy and variables for disposable income. Furthermore, it is shown how the relative importance of specific determinants of the individual remittance decision have changed over the observation period 1984-1991.

# 1 Introduction<sup>1</sup>

In recent years research on the economics of labor migration has gained increasing importance. This development has to be interpreted on the background of the massive political and economic restructuring in Europe. On the one hand, the economic integration process in Western Europe was intensified with the enlargement of the European Union. On the other hand, the opening of the frontiers in Eastern Europe, following the political upheavals, was a prerequisite for the realization of a latent migration potential on a large scale. However, Germany is a country in rich historical experience with migration. In comparison to other immigration countries, the German experience with the employment of guest workers is peculiar in various respects. The great majority of migrants have migrated from Italy, Greece, Spain, Portugal, the former Yugoslavia, and Turkey in the late sixties and early seventies when the federal labour office hired guest workers by recruitment treaties with these countries. During this period the migrants enjoyed virtually unhindered access to the German labour market. As far as the migrants were concerned, the dominating explanatory factor of migration was seen in the so called *savings motive* implying that the temporary migrants return home after having saved enough either to set up their own business back home or to live on retirement. In fact, a considerable number of the migrants integrated in the German economy and actually remained in Germany as permanent stayers.

Through temporary as well as permanent migration, long-term economic links are established between Germany and the emigration countries. Remittances in kind and cash determine an important aspect of these economic links. They comprise transfers to support family members and to build up savings in the home country; flows, that are governed by different not necessarily mutually exclusive motivations. While the literature on economic development is very rich in explaining migration behaviour, there is no formal theory of how remittances are determined from the perspective of the migrant worker. This finding seems surprising given the importance of these transfers for the economies of the emigration countries. However, it seems possible to distinguish between at least four broad categories of factors determining the individual remittance decision:

- (i) Policies by the home countries, designed to attract remittances,
- (ii) disposable income,
- (iii) personal characteristics and assimilation indicators, and
- (iv) macroeconomic or financial variables, governing the portfolio allocation choice.

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<sup>1</sup>The critical remarks and suggestions of my colleagues at CILE and at the Faculty of Economics are gratefully acknowledged. I am also grateful to Winfried Pohlmeier and Sikandar Siddiqui for helpful comments. However, all errors are mine.

Straubhaar (1983) mentions a set of policies, designed in many labor exporting countries, to attract flows of remittances. Swamy (1981) analyzed such policies for the three sending countries Greece, Turkey and the former Yugoslavia. Each of them has made efforts to attract remittances by foreign exchange deposit schemes with attractive interest rates, special import privileges, premium exchange rates, and special investment schemes for workers living abroad. In this study the attempt is made to measure the effects of these policies through nationality dummies, notwithstanding the fact that these dummies incorporate a variety of explanatory factors, such as cultural and social differences between the respective home countries, as well as the above mentioned institutional regulations.

The Deutsche Bundesbank (1974) stresses that among the factors determining the amount remitted personal net income plays a decisive role. They find that income has a significant positive influence on remittances and that the proportion of net income remitted is significantly higher for income groups below average.

Assimilation indicators such as residence of the spouse and children of a migrant seem to be decisive for the individual migrant's propensity to remit. In the 1960s, family separation among the recruited workers was quite common. The reason for coming to Germany was to earn and save money. Without the presence of family members, the head of the household would be able to accumulate more savings and consequently remit more. Other determining factors are years of residence in Germany and planned duration of stay. Galor and Stark (1990) analyze the savings and transfer decision of guestworkers with an overlapping generations model. They conclude that temporary migrants (with a positive remigration propensity) show an increased savings propensity. This finding is compatible with the lifecycle theory of consumption. The migrants expect a significant decrease of income after remigration and save in the home country to smooth their consumption path. Temporary migrants as opposed to permanent migrants are likely to preserve their bonds to their family back home. They will transfer income in kind and cash for several different motives: to fulfil their obligations toward the family, the need to ensure that their assets at home are properly taken care of and the desire to enhance the family relationships.<sup>2</sup>

Remittances to build up savings in the home country may be modelled as a

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<sup>2</sup>In this context, it should be mentioned that Stark and Lucas (1988) explain remittances as a part of a contractual arrangement between the family left in the home country and the migrant. These contracts are closed for the time span of the (temporary) migration and comprise a variety of relevant economic variables. The family takes on some of the risk initially incurred by migration and later participates in the steeper income profile of the migrant. Alternatively, altruistic considerations may be predominant in the decision to remit. The migrant's welfare, in this latter set-up, is positively related to both his own and his family's consumption levels. In choosing the optimal level of remittances the migrant will try to equalize the marginal utility of the recipient's and his own consumption. Such a differentiation between altruism and implicit contracts is based on the findings in the literature on intergenerational transfers but, because of lack of appropriate data for the migrant family in the home country, is not testable for remittances from migrants residing in Germany. As a reference for the literature on intergenerational transfers, see Cox (1987) and Cremer, Kessler and Pestieau (1992).

portfolio allocation choice, where the migrant decides how large a share of his wealth should be remitted to his home country to be invested there. Katseli and Glytsos (1986) model a simple two-period model explaining the portfolio allocation choice. The results suggest that higher interest rates in Germany increase the attractiveness of holding funds in German deposit accounts and at the same time they increase the wealth of immigrant deposit holders. Immigrants are therefore wealthier and tend to remit more money to the respective home country. This wealth effect might dominate effects of the higher return on German deposits.

In this study, I am less concerned with the question of what determines the emigrant's propensity to invest his savings either in his home country or abroad. Instead, I focus on the question of what determines the overall individual propensity to save and consequently to remit. Thus, I will restrict my research to the first three categories of factors, mentioned above, to explain the remittance decision and will neglect financial or macroeconomic factors in the analysis. Based on these considerations, with the data set of the German Socio-Economic Panel (SOEP), I will try to include the major influencing factors in the explanation of the remittance decision. Furthermore, it is tested whether the relative importance of the individual factors changed considerably during 1984-1991, the time period under consideration. An advantage of this study is the use of the panel data, as compared to estimation with cross-sectional data. Whereas earlier studies did examine the transfer decision with the data of the SOEP isolated for one period,<sup>3</sup> this seems to be the first study of the kind for Germany based on panel data.

The data used in estimation comprises information from the personal questionnaire, answered by each family member of more than 16 years of age, as well as the household questionnaire, answered by the so called head of the household of Italian, Spanish, Greek, Turkish or former Yugoslavian origin. The amount of overall remittances, as reported in the data set, includes information on the amount remitted to support the family back home, to build up savings in the emigration country and for other reasons. The guest workers from the five major sending countries were asked for a variety of personal characteristics, income variables, the integration into the host country and the individual's intention to return. The model is estimated with the data of the SOEP, covering the years 1984 to 1991 for which panel data for guest workers are available.

The paper is organized as follows: First some stylized facts are presented to highlight the importance of the employment and the amount remitted of the German migrants, concentrating on migrants from Spain, Italy, Turkey, Greece, the former Yugoslavia and Portugal. Based on the considerations briefly outlined above, the specification underlying the econometric model is presented as well as the data used

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<sup>3</sup>Merkle and Zimmermann (1992) provide an empirical analysis of the remittance and savings behaviour based on the data for household heads, who were interviewed in 1988. In addition to the annually raised information included in the household questionnaire, data on the stock of savings in the host and home country is available for this year only.

for estimation. The presentation of the econometric specification is followed by a discussion of the estimation results. I will conclude with some final remarks.

## 2 Empirical relevance of remittances

The purpose of this paper is to provide an empirical analysis of the remittance decision of guest workers staying in Germany temporarily or permanently. Before proceeding, some stylized facts are presented to highlight the importance of the employment of foreign workers for the German economy. This presentation is followed by a short description of some figures concerning aggregate remittances, as reported by the *Deutsche Bundesbank*. Germany is a country with a rich experience in the employment of foreign workers. In 1989 (i.e. before unification) the foreign population in West Germany amounted to 4.9 million persons, i.e. 7.8 percent of the West German population. Compared to other immigration countries the German employment of guest workers is peculiar in some respects. The great majority of guest workers migrated from Italy, the former Yugoslavia, Turkey, Greece, Spain and Portugal in the late sixties and early seventies when the federal labour office hired guest workers under recruitment treaties with these countries. The recruited workers were expected to stay in Germany only temporarily to satisfy an excess demand for labour at that time. However, a considerable number of the guest workers successfully integrated into the German economy and settled as permanent stayers. The total number of foreign workers covered by social security for the time period 1960–1992 is displayed by the solid line in figure 1. With the exception of the mild recession in 1967, the sixties are characterized by a steady increase in the number of foreign workers continuing until 1974, with the enactment of an immigration stoppage for non-EC workers at the beginning of a deeper recession.<sup>4</sup> As a consequence of these regulations, an almost continuous decline in the employment of guest workers was registered.<sup>5</sup> By the end of the eighties, however, the figures again show an upward trend explained by a massive inflow of immigrants from Eastern Europe. In 1992 the employment of foreigners reached a present maximum with 2 million employed guest workers.<sup>6</sup>

Through temporary as well as permanent migration, long-term economic links are established in the form of remittances in kind and cash between Germany and the emigration countries, as can be seen by the dotted line in figure 1. Up to 1974 remittances and the number of foreign workers show an almost parallel pattern. The sharp decrease of employment with the beginning of the recession in 1974 only mod-

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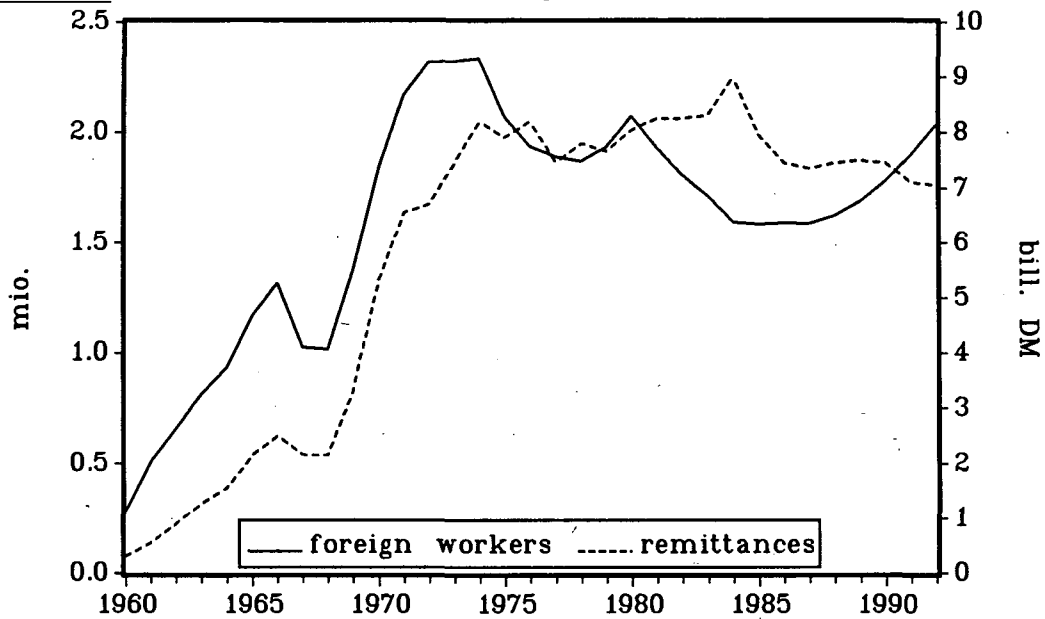
<sup>4</sup>However, these more rigid regulations were not applied to the case of family reunification which was still allowed on humanitarian grounds, explaining at least part of the further inflow of persons of foreign origin. For an investigation on the role of family unification in Germany in the seventies and eighties refer to Velling (1993).

<sup>5</sup>Franz (1994) provides an overview of characteristics and categorisation of the employment of foreign workers in Germany.

<sup>6</sup>Franz, Oser and Winker (1994) describe the more recent development of migrant labor supply and the consequences for the German labor market.



Figure 1: Amount of remittances and foreign workers in Germany<sup>a)</sup>



a) Workers covered by social security.

Sources: Arbeits- und Sozialstatistik (1985) and (1993) of the Ministerium für Arbeit und Sozialordnung, Zahlungsbilanzstatistiken of the Deutsche Bundesbank

estly decreases the amount of overall remittances. From 1980 to 1984 the amount of money remitted actually increases in spite of the ongoing sharp decrease in the employment of foreign workers. In 1984 the transfers reach a maximum with 9 billion DM at a time when the decrease in the employment of foreigners amounted to over 100,000 persons a year.<sup>7</sup> This pattern in the development of the figures may possibly be explained by the fact that migrants take with them considerable amounts of savings when ultimately leaving Germany, a proposition that will be tested later.<sup>8</sup>

In addition to the examination of the aggregate amount of remittances between Germany and the emigration countries a closer look at the division within the group of guest workers seems insightful. Table 1 shows that the total amount of remittances, as published by the *Deutsche Bundesbank*, amounted to over 7 billion DM in 1992. The six major groups of foreign workers – the Turkish, Italian, Greek, the former Yugoslavian, Spanish and Portuguese – combine almost 80 percent of total remittances.

<sup>7</sup>A comparison between the number of foreign workers in Germany and the amount remitted, deflated with a cost-of-living index for West Germany, shows an almost similar pattern in the development. Real remittances increase up to the mid-seventies, where they reach an absolute maximum, followed by a relative maximum in the mid-eighties.

<sup>8</sup>The data of the SOEP comprises information on the planned duration of stay in Germany. In particular, data on migrants planning to return within one year is available.

Table 1: Total amount of remittances in millions of DM, foreign workers in Germany in thousands and per capita amount remitted 1992

	remittances	foreign workers	per capita remittances
all countries	7050	2184	3200
Turkey	2300	631	3600
Italy	1250	194	6400
Greece	700	120	5800
former Yugoslavia	700	417	1700
Spain	350	55	6400
Portugal	200	42	4800

Sources: Balance of Payments of the Deutsche Bundesbank, Statistisches Bundesamt, various issues.

With 2.3 billion DM the 28 percent foreign workers of Turkish origin, for example, transfer more than 32 percent of total remittances to their home country. The last column in table 1 shows the average amount of remittances per capita for the six major guest worker groups. The figures indicate significantly lower remittances for migrants from the former Yugoslavia, possibly explained by the political situation in their home country at the time. The influence of the nationality will be tested later with the help of the data of the SOEP, which comprises all major guest worker groups with the exception of workers from Portugal.

### 3 Econometric specification and data description

The purpose of the estimation is to isolate the determinants of the remittance decision for the period 1984–1991. As the dependent variable *remittances* is limited to nonnegative values and shows a relatively high percentage of null observations<sup>9</sup> a Tobit model is estimated to deal with the data adequately.

#### 3.1 Econometric specification

The econometric specification takes into account the shaping of the endogenous variable as a latent variable as well as individual effects by using a Tobit model with stochastic effects, i.e. the specification takes into account the assumption of condi-

<sup>9</sup>The percentage of null observations of transfers varies between 48 and 56 percent in the period under consideration.

tional cross-sectional homoscedasticity and temporal interdependence.<sup>10</sup> The structural parameters are estimated by a minimum distance method by appropriately generalizing the Probit approach by Chamberlain (1982) to the case of an unbalanced panel.

The data base is designed as an unbalanced panel, i.e. the number of years for which information for a particular household is included in the analysis is not equal for all households. In each period attrition occurs and there are new entries, being explained by the fact that an individual or household no longer participates in the interrogation or, in the case of accessions, by the founding of an own household of one of the former participants. As we concentrate in the analysis on temporary as well as permanent stayers, we also have to cope with the fact of remigration. In each period we observe only such individuals who have not remigrated. However, only a small minority of migrants actually returns home each year, so that the potential selectivity-bias seems of minor importance and will not be corrected for. In fact, each year between 0.26 and 1.11 percent of the households remigrated, referring to the total data base.

For the *observable variable transfers*  $y_{it}$  the following threshold-value model is specified:

$$\begin{aligned} y_{it} &= y_{it}^* && \text{for } y_{it}^* > 0, \\ y_{it} &= 0 && \text{for } y_{it}^* \leq 0, \end{aligned} \quad (1)$$

while the *latent variable propensity to remit*  $y_{it}^*$  is given by the linear model

$$y_{it}^* = x_{it}'\beta + u_{it}, \quad i = 1, \dots, N, \quad t = 1, \dots, T; \quad (2)$$

where  $x_{it}$  is a vector of the explanatory variables including a constant and  $\beta$  the corresponding vector of coefficients. The following error components model shall be given for the error term  $u_{it}$ , assuming a normal distribution and that  $u_{it}$  is composed of a time-constant individual effect  $\alpha_i$  and an error component  $\varepsilon_{it}$ , which varies in both dimensions between individuals and over time, i.e.

$$u_{it} = \alpha_i + \varepsilon_{it}.$$

The following assumptions are made concerning the error components  $\alpha_i$  and  $\varepsilon_{it}$ :  $E(\alpha_i) = E(\varepsilon_{it}) = 0$ ,  $Var(\alpha_i) = \sigma_\alpha^2$  and  $Var(\varepsilon_{it}) = \sigma_\varepsilon^2$ . All  $\alpha_i$  and  $\varepsilon_{it}$  are uncorrelated with each other, i.e.  $E(\alpha_i\alpha_j) = 0$  and  $E(\varepsilon_{it}\varepsilon_{js}) = 0$ , for  $i \neq j$  or  $t \neq s$ . The total variance of  $u_{it}$  is thus given as follows:

$$\sigma^2 = \sigma_\alpha^2 + \sigma_\varepsilon^2.$$

The covariance of the error component is defined as

$$Cov(u_{it}, u_{is}) = \sigma_\alpha^2, \quad \text{for } t \neq s,$$

<sup>10</sup>This approach can be compared to the use of pooled estimators, neglecting the existence of temporal correlation of the error terms, which are not asymptotically efficient.

i.e. the observations for a particular individual  $i$  are temporally correlated. The likelihood function for each period  $t$  can be written as in equation 3

$$L_t = \prod_0 \Phi_t \left( \frac{-x'_{it}\beta}{\sigma} \right) \prod_1 \frac{1}{\sigma} \varphi_t \left( \frac{y_t - x'_{it}\beta}{\sigma} \right), \quad (3)$$

with  $\Phi$  as a normal distribution function and  $\varphi$  as a normal density function. 0 stands for all households with  $y_{it}^* > 0$  and 1 for households with  $y_{it}^* \leq 0$ . Given the assumptions concerning the error components, the likelihood function for the whole sample is given by integrating with respect to  $\alpha_i$ . Using a pooled sample, maximization of the likelihood function for the Random-Effects Tobit model in equation 4 yields consistent estimates of the  $\beta$ 's.

$$L = \prod_{i=1}^N \left\{ \int_{-\infty}^{\infty} \left[ \prod_{t \in T_i} [\Phi_{it}]^{d_{it}} \prod_{t \in K_i} \left[ \frac{1}{\sigma_\epsilon} \cdot \varphi_{it} \right]^{d_{it}} \frac{1}{\sigma_\alpha \sqrt{2\pi}} \exp \left( -\frac{\alpha_i^2}{2\sigma_\alpha^2} \right) \right] d\alpha_i \right\}, \quad (4)$$

where  $\varphi_{it}$  is the density conditional on  $\alpha_i$ , i.e.

$$\varphi_{it} = \frac{1}{\sigma_\epsilon \sqrt{2\pi}} \exp \left\{ -\frac{1}{2\sigma_\epsilon^2} (y_{it} - \alpha_i - x'_{it}\beta)^2 \right\}.$$

$d_{it}$  is an indicator variable defined as

$$\begin{aligned} d_{it} &= 1 && \text{for all } i \text{ with complete data in } t, \\ d_{it} &= 0 && \text{other.} \end{aligned} \quad (5)$$

The distribution of the indicator  $d_{it}$  is assumed to be independent from  $(y, x)$  as well as the  $\beta$ 's.  $K_i$  shall indicate the set of waves the individual  $i$  does transfer money to the home country and  $T_i$  the complementary set.<sup>11,12</sup>

Efficient estimates can be obtained by maximizing the likelihood function in equation 4. Alternatively, following the two-stage estimation procedure put forward by Chamberlain (1982), efficient estimates can be based on equation 3 taking into account the correlation between the error terms.<sup>13</sup> In the first step, consistent estimates

<sup>11</sup> As a reference for the derivation of the likelihood function as well as for the exposition of an error components model, for example, Ronning (1991) is referred to.

<sup>12</sup> The specification used assumes temporal, over the time constant correlation. With increasing temporal distance a decreasing correlation seems plausible, an assumption leading to far more complex expressions for the likelihood function. However, the occurrence of decreasing temporal correlation should be more of a problem for large numbers of waves under consideration. Given the relatively short time period of eight years it is abstracted from the above assumption. Another problem is the possibility of stochastic effects  $\alpha_i$ , depending on the vector of explanatory variables  $x_{it}$ . Given the relatively small variation of at least some of the explaining variables over time on the individual level and the associated high multicollinearity I abstract from the possibility of random effects correlated with the explanatory variables.

<sup>13</sup> The minimum distance estimator, because it does not impose any restriction on the variance-covariance matrix, will in general be consistent and is efficient within the class of estimators that do not impose restrictions on the variance-covariance matrix. See also Hsiao (1986).

for the  $\beta$ 's and the standard deviation  $\sigma$  are obtained for each single cross section  $t \in (1, 8)$  and a matrix  $\Pi$  of the  $r$  estimated parameters is formed. In the second step, the matrix of regression parameters is restricted such that the estimated parameters are identical for the whole time period. Restricting the constant as well as the estimated  $\sigma$  will allow testing for the existence of trend effects and temporal heteroscedasticity. The restrictions are specified with the help of the condition  $\theta = f(\delta)$  with  $\delta$  as a  $(8 \cdot r) \times 1$  vector and  $\theta$  as the stacked vector  $\theta = \text{vec}(\Pi)$ . A minimum distance estimator determines  $\hat{\delta}$  at the minimum of the function

$$\min_{\delta} [\hat{\theta} - f(\delta)]' V(\hat{\theta})^{-1} [\hat{\theta} - f(\delta)], \quad (6)$$

with  $V(\hat{\theta})^{-1}$  as asymptotically optimal weighting matrix.

The  $\Pi$ -matrix approach for the Tobit model shows some practical advantages as compared to the one-step estimation based on (4). The computational cost is relatively low and with the  $\chi^2$ -distributed distance statistic an easy test of the temporal restrictions on the parameters is possible.

An estimation of the asymptotic variance-covariance matrix of  $\theta$  for the entire sample of  $N$  individuals ("sandwich formula")<sup>14</sup>

$$V(\hat{\theta}) = (\hat{I}' \hat{\Omega}^{-1} \hat{I})^{-1}$$

is calculated from the first and second partial derivatives of (3), with  $I$  as the block diagonal matrix  $I = \text{diag}\{I_1, \dots, I_8\}$  and

$$I_t = -E \left\{ \frac{\partial^2 L_t}{\partial \theta_t \partial \theta_t'} \right\} \quad (7)$$

as information matrix for  $t \in (1, \dots, 8)$ .

$\Omega = (\Omega_{s,t})_{1 \leq s, t \leq 8}$  may be represented with

$$\Omega_{s,t} = E \{ (\partial L_s / \partial \theta_s)' (\partial L_t / \partial \theta_t) \} \quad (8)$$

as elements. Replacing the expectation in (7) and (8) by a statistic with equal expectation and computing the information matrix of the vectors gradients,<sup>15</sup> it is possible to calculate  $V(\hat{\theta})$  consistently from the empirical moments of the data.

The asymptotic variance-covariance of  $\delta$  may be calculated consistently as:

$$V(\hat{\delta}) = \left\{ \hat{F}' V(\hat{\theta})^{-1} \hat{F} \right\}^{-1},$$

with  $F = \frac{\partial f(\delta)}{\partial \delta'}$  as the matrix of derivatives of  $F$  with respect to  $\delta$ .

<sup>14</sup> Also see White (1982).

<sup>15</sup> Assuming certain regularity conditions, it can be shown that:  $E \left\{ \frac{\partial L}{\partial \theta} \frac{\partial L}{\partial \theta'} \right\} = -E \left\{ \frac{\partial^2 L}{\partial \theta \partial \theta'} \right\}$ . The term on the left hand side can then be written as:  $E \left\{ \frac{\partial L(\theta)}{\partial \theta} \frac{\partial L(\theta)}{\partial \theta'} \right\} = E \left\{ \sum_{i=1}^n \frac{\partial L_i(\theta)}{\partial \theta} \frac{\partial L_i(\theta)}{\partial \theta'} \right\}$ . Also see Cramer (1986), pp. 27.

Inference for minimum distance estimators is based on the asymptotic normality of the estimates. Given the null hypothesis that a set of restrictions on the parameters over time (the temporal restriction on all parameters) is true, the distance statistic  $D(\hat{\delta})$  is centrally  $\chi^2$ -distributed with  $n$  d.o.f.

$$D(\hat{\delta}) = [\hat{\theta} - f(\delta)]'V(\hat{\theta})^{-1}[\hat{\theta} - f(\delta)] \sim \chi^2(n). \quad (9)$$

The number of d.o.f. is equal to the number of overidentifying restrictions (, i.e. equal to the number of variables in the model.) The difference between two distance functions is equally  $\chi^2$ -distributed so that it is possible to test for several different restrictions of the estimated parameters of the first stage such as for temporal heteroscedasticity as well as for trend effects.

### 3.2 Data description

The empirical analysis is based on the first eight waves of the Socio-Economic Panel for West Germany, covering a period from 1984 to 1991. The original data set comprises personal and household information on 1400 households with a foreign head. The data set used in this estimation comprises data on a total of 1718 households.<sup>16</sup> Taking advantage of the panel structure of the SOEP the amount of annual remittances by guest workers of the five major emigration countries (Italy, Turkey, Greece, Spain, and the former Yugoslavia) is regressed on the planned duration of stay, a variety of personal characteristics, the integration of the guest worker family and the disposable family income.

As the transfer decision seems to be a household decision, the data on the amount remitted and the income variable refer to information for the whole household. The first is calculated as the cumulated sum of the amount of remittances as reported in the personal questionnaires, the latter is based on information from the household questionnaire. Personal characteristics such as age or educational attainment refer exclusively to the household member most influential for the transfer. The analysis is restricted to information concerning the household heads, either male or female, because the assumption that the family remittance decision is predominantly determined by them seems plausible.<sup>17</sup> Such a proceeding necessarily sacrifices some of the relevant information of the data set and was chosen so as not to inflate the number of possible explanatory variables beyond a certain scope.<sup>18</sup>

Table 2 gives the definition and summary statistics for major variables included in the regression. The numbers refer to values within the observation period 1984–1991 with the exception of the monetary variables *REMIT* and *YNET* referring to 1991

<sup>16</sup>A detailed description of the data of the SOEP is given in Wagner, Schupp and Rendtel (1991).

<sup>17</sup>The head of the household is the one with the best knowledge concerning the economic situation and other relevant information for the whole household.

<sup>18</sup>Alternatively, the analysis could be based on information of individual transfers but, given the above reasoning, this proceeding does not seem superior to the one chosen in this study.

only. The latter figures did not seem to be comparable over a time span of eight years. In the regression the variables *REMIT* and *YNET* are deflated by a cost-of-living index.<sup>19</sup> Most of the variables, being potential explanatory determinants for the transfer decision, that are (partly) listed in table 2 are self explanatory. In the

Table 2: Definition of major variables and summary statistics for the time period 1984–1991

Variable	Variable definition	Mean/ Proportion	$\sigma_y$	min (y)	max (y)
REMIT <sup>a,b)</sup>	last year's transfer in DM <sup>c)</sup>	5800	5722	50	50000
AGE	years of age	42	11.35	16	84
CHILD	child(ren) in home country = 1	0.11			
EDUC <sub>LOW</sub>	low education = 1	0.54			
EDUC <sub>HIGH</sub>	high education = 1	0.14			
FAM	spouse living in home country = 1	0.05			
HGR	household size	3.5	1.73	1	17
MIGY	years in Germany	18	5.89	1	52
NATY	nationality = Yugoslavia	0.20			
NATG	nationality = Greece	0.14			
NATI	nationality = Italy	0.21			
NATS	nationality = Spain	0.12			
SCHOOL	school attendance in Germany = 1	0.18			
SEX	male = 1	0.89			
YNET <sup>a)</sup>	net monthly family income in DM	3338	1482	500	12200

a) numbers for 1991

b) for positive transfers only

c) To recall, the percentage of null observations of transfers varies between 48 and 56 percent.

following, some information on the definition and importance for the estimation of variables necessitating further explanation are given.<sup>20</sup>

- The dependent variable *REMIT* combines annual transfers from the guest worker family to the respective emigration country in kind and cash. This

<sup>19</sup>Implicitly, freedom of money illusion is assumed. The price index used for deflation is calculated by the *Statistisches Bundesamt* (Source: Statistisches Bundesamt, Fachserie 17) as a cost-of-living index for all private households in West Germany.

<sup>20</sup>A detailed analysis follows in the presentation of the estimation results in section 4 below.

aggregate variable comprises transfers to support family members back home, to build up savings in the home country for later use and for other reasons.

- The explanatory variable *AGE* is squared to control for nonlinearities in the influence of the age of the household head on the remittance decision.
- In addition to the variable *CHILD* it was experimented with a variable *CHILDN* capturing the number of children living in the home country. This variable will be neglected later when the empirical results are presented as the additional empirical significance is rather low.

The data contains additional information on the number of children for which the migrant is entitled to child allowance. However, because of numerous adaptations of the relevant legal regulations which differentiate between EC and non-EC member countries it is impossible to directly conclude financial obligations towards a child in the home country from the fact that a migrant is entitled to child allowance in Germany or elsewhere.

- The dummy *EDUC<sub>LOW</sub>* takes the value of one when the foreigner reported to have completed a level of education equivalent to the German *Hauptschule* in Germany or elsewhere and zero otherwise, while the dummy variable *EDUC<sub>HIGH</sub>* is one for completed education above the level of the *Hauptschule*. The base category is the absence of any formal education.
- The dummy variable *SCHOOL* takes on a value of one if the foreigner attended school in Germany which implies that he or she was born in Germany or migrated at a fairly early age (realising family reunification). Thus, this variable may be interpreted as a proxy for foreigners of the second generation.
- Since the number of female household heads is rather low (on average only about 11 percent of the heads are female), no effort is made to interact this variable with the other explanatory variables. Instead, I control for sex by simply including a gender dummy as an explanatory variable in the model.
- Monthly net household income *YNET* besides other income sources comprises child allowance, social security benefits, housing allowances and transfers from diverse other sources minus taxes and social contributions. Thus it constitutes a comprehensive measure of disposable income for the household.

In addition to the variables presented in table 2 guest workers expected or planned duration of stay is included in the analysis. Guest workers are asked whether they intend to stay in Germany temporarily or permanently, and temporary migrants are questioned on their expected duration of stay in Germany. However, not all guest workers had an opinion on their expected duration of stay. On average about 20 percent of the temporary migrants gave no answer to this question. Although the variable is recorded in years, it is obvious that the answers are heavily bunched at certain years, which are multiples of five, thus contaminating it with measurement errors. Because of the rather low response rate and the likely measurement errors, I experimented with two alternative sets of dummy variables in the regression. First,



the answer for the planned number of years in Germany was divided into intervals with the definition of the intervals following two considerations: The occupation of the intervals has to be sufficiently dense and the choice of the interval should mirror the expectations concerning the different behavioural motivations of migrants.<sup>21</sup>

These considerations resulted in the choice of the following dummy variables:

$REMIG_1 = 1$  for migrants planning to return home during the following year,

$REMIG_2 = 1$  for migrants planning to return in between 1 and 10 years,

$REMIG_3 = 1$  for migrants planning to return in between 10 and 20 years, and

$REMIG_4 = 1$  for migrants with a planned duration of stay in Germany of more than 20 years, with the permanent stayers as base category.

The categorisation is based on the expectation of a negative relationship between the planned duration of stay in Germany and the propensity to remit. Also, the hypothesis of a significantly higher remittance propensity shortly before remigration is testable with this specification.

Alternatively, the following dummy variables were tested in the regression:

$REMIG_{ST}$  for migrants planning to return within one year (in analogy to the variable  $REMIG_1$ ), and

$REMIG_{MT}$  for temporary migrants planning to stay in Germany for more than 1 year. Base category are again the permanent stayers. Experimentation with both sets of dummy variables seems to justify a slight preference for the latter.<sup>22</sup>

In addition to the possible explanatory variables presented so far *interaction terms* controlling for the joint influence of two determinants could be included in the regression. However, with the increase in the number of variables included a respective increase in the number of rows and columns of the weighting matrix  $V(\hat{\theta})$  is combined. This increase is technically feasible but, as discussed below, problems with the accuracy in the necessary inversions arise, so that the number of variables included should not be inflated beyond a certain scope.

In the data set of the SOEP there is no information on a guest workers expected earnings in the home country after remigration. The inclusion of simple measures of average earnings or macroeconomic indicators such as unemployment and inflation in the respective emigration countries, readily available for at least some of the countries of origin, do not seem to provide reliable information for the individual expectations. With respect to the fact that the remittance decision, being part of the overall savings decision, has to be interpreted in the context of a life-cycle analysis this constitutes a major shortcoming in the analysis necessitating more thorough consideration in related studies in the future. In addition to the residence of the spouse and children of a migrant, included as assimilation indicators, a variable reflecting the personal attachment to the home country and to the family members back home might be

<sup>21</sup>Steiner and Velling (1992) in their study on the return propensity of foreign guest workers decide to use a slightly different categorization, being influenced by the formulation of their research topic.

<sup>22</sup>For the sake of brevity in the presentation of the estimation results in section 4 only the most preferred set of dummy variables is reported and commented on.

decisive for the remittance decision of the individual migrant. The inclusion of the planned duration of stay and the years of residence seems to reflect more economic necessities or personal calculations (such as a comparison between the income possibilities in the host and home country and the degree of realization of a personal saving target) than personal attachment. There are two questions concerning the personal feelings toward the home country. The following formulations give the gist of the relevant questions asked for in the personal questionnaire of the SOEP:<sup>23</sup>

- (1) How many of your relatives live in your home country and how close is your contact with them?
- (2) What are your feelings when returning to your home country for a visit?

Unfortunately, the data does not contain any (as to the research topic) significant information. Differently specified variables did not show to be empirically significant for the explanation of the remittance decision.<sup>24</sup> In this context a study by Dustmann (1994a) should be mentioned designed to explain the savings behaviour of temporary migrants. He explains the attachment of a migrant to his host country among other variables, such as years of residence and a proxy for the separation from parts of the closer family, with the knowledge of the foreign language as a further indicator for the integration into the foreign society. However, I did not try to experiment with this sort of variable because, at least from the theoretical standpoint, family ties and the relationship to friends in the home country seem to be more decisive for the remittance decision than proficiency of the foreign language.

## 4 Empirical results

Following the two-stage estimation procedure outlined above I first estimated the Standard-Tobit models for each year separately and then restricted the parameters such that the coefficients are identical over the whole estimation period. Alternatively, the Random-Effects Tobit model was estimated to allow for comparisons between the estimated coefficients of the two specifications. The results for the latter specification

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<sup>23</sup>The original text of the questions is:

- (1) Nun eine Frage zu Ihrer weiteren Familie, die nicht hier im Haushalt lebt:  
Welche und gegebenenfalls wieviele der folgenden Verwandten haben Sie?  
Für die vorhandenen Personen sagen Sie bitte dazu, wie weit entfernt sie wohnen und wie eng Ihre Beziehung zu ihnen sind.
- (2) Wenn Menschen längere Zeit in Deutschland leben und sie kommen dann zu Besuch nach Spanien kann sich einiges gegenüber früher geändert haben.  
Wie ist das bei Ihnen? Welches Gefühl haben Sie in dieser Situation?

The questions quoted are taken from the personal questionnaire of waves *H* and *G*, respectively. The second question is modified according to the nationality of the migrant.

<sup>24</sup>The results are not reported, as all the variables in the different specifications were statistically insignificant.

are given in appendix A. As both estimation procedures yield qualitatively similar results the discussion of the estimated coefficients is restricted to the most preferred specification of the minimum distance estimator.

The optimal weighting matrix for the minimum distance estimation of the second step is, as explained above in 3.1, the inverse of the joint variance-covariance matrix of the estimated coefficients of the first step  $V(\hat{\theta}) = (\hat{J}'\hat{\Omega}^{-1}\hat{J})^{-1}$ . However, the use of  $V(\hat{\theta})$  might yield imprecise results for the estimated coefficients given the inaccuracy incurred by the inversion necessary to compute the weighting matrix. This possibility seems to be of some importance given the unfavourable condition of the relevant matrix  $\Omega$ .<sup>25</sup> I experimented with the use of normalized data but could not improve the condition of  $\Omega$  considerably. I also tried to restrict the number of exogenous variables by eliminating the variables with low significance in the first-stage estimations. The inversion did not seem to be of greater accuracy so that the original set of variables was used for estimation. Additionally, I experimented with the choice of the weighting matrix to be used in the second stage. Instead of using  $V(\hat{\theta})$  I used alternatively the diagonal matrix based on the diagonal of the asymptotically optimal weighting matrix or even the identity matrix. Both lead to consistent estimates but loose information on the relative precision of the first-stage estimates hidden in the cross products of the likelihood scores. Therefore, despite the possible imprecise estimation of  $V(\hat{\theta})$  estimation with the asymptotically optimal weighting matrix was preferred. The results, as summarized in table 3, are based on the use of  $V(\hat{\theta})$  as weighting matrix. The estimated parameter of a particular explanatory variable in this specification shows the relative effect of this variable on the propensity to remit. The empirical findings are mostly in correspondence with the theoretical expectations. Test statistics are marked by an asterisk if significant at the 5 percent level, t-values are in brackets. For the sake of comparison, estimation results for the first-stage estimations are given in appendix B.

Beginning with the personal characteristics of the household head and his family, the influence of age shows a bell-shaped course on the remittance preference with a maximum at about 46 years. Explained in the context of a life-cycle model, the results imply a decrease in the propensity to remit well before retirement age. The *effect of gender* is statistically significant in spite of the relatively small number of female household heads in the sample. A comparison with the results of the first stage estimation in appendix B indicates an obvious instability concerning the education parameters.

Relative to the reference category of the Turks national differences are significant for guest workers from Spain and Italy. The choice of the reference group was motivated by the consideration that the Turkish migrants belong to a non *EC* member country and because of cultural and religious differences might show a different remittance pattern. Additionally, compared to other emigration countries less favorable

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<sup>25</sup>The condition of a matrix describes the proportion between the largest and the smallest eigenvalue of a matrix. See also Golub and van Loan (1983).

Table 3: Determinants of migrants' remittances

Variable	Coefficient	Variable definition
CONSTANT	-27085.70* (12.69)	
SIGMA	8691.94* (21.10)	
personal characteristics		
AGE	956.11* (9.51)	years of age
AGESQ	-10.24* (9.22)	years of age squared
EDUC <sub>LOW</sub>	291.81 (0.32)	low education = 1
EDUC <sub>HIGH</sub>	-1094.45 (0.78)	high education = 1
HGR	-400.90* (5.02)	household size
NATG	-193.91 (0.51)	nationality = Greece
NATI	-3649.09* (10.08)	nationality = Italy
NATY	805.33 (0.74)	nationality = Yugoslavia
NATS	-2148.03* (2.27)	nationality = Spain
SEX	4010.92* (9.06)	male = 1
indicators of assimilation		
FAM	4348.13* (8.36)	spouse living in home country = 1
CHILD	3994.45* (11.01)	child(ren) in home country = 1
MIGY	-116.09 (-1.25)	years in Germany
REMIG <sub>ST</sub>	4188.55* (6.65)	remigration within one year = 1
REMIG <sub>MT</sub>	3988.17* (15.06)	temporary migration = 1
SCHOOL	-330.53 (0.71)	school attendance in Germany = 1
income variable		
YNET	0.81* (11.43)	net monthly family income in DM
no. of obs.	7982	

economic conditions in their home country could explain differences in their remittance decision. However, the estimation results show that the group of Italian and Spanish guest workers transferred significantly less. This result may be attributed to their closer assimilation into the German economy as compared to the other guest workers. The finding could not be expected when compared with the amount of per capita remittances for 1992, as given in table 1, and can only partly be explained by the obvious temporal instability of the parameters *NATI* and *NATG*, as given in table 4. In contrast, in the study by Merkle and Zimmermann (1992), already cited above, a nationality dummy for migrants of Turkish origin proves to be significant with a negative influence on savings and remittances.<sup>26</sup>

Turning to the assimilation indicators, the estimates indicate that those guest workers who are separated from their family remit significantly more. These findings are plausibly explained by the strong connections (especially in the form of financial obligation) towards the family at home. Both variables are strongly correlated so that we may identify the joint influence of the variables *FAM* and *CHILD* as the effect of the migrant having left part of his closer family back home. Contrary to intuition that *guest workers of the second generation* are integrated more closely into their host country and consequently remit less, the dummy variable *SCHOOL* shows no significant influence on the propensity to remit. A comparison with the first stage results makes it obvious that the estimated parameters are extremely unstable and vary in the positive as well as the negative range.

As expected, temporary migrants transferred significantly more than permanent guest workers with no intention to remigrate. Both coefficients for migrants planning to return home within the following year and migrants who plan to stay for up to over 20 years showed an increased transfer probability of about the same magnitude. A test for the hypothesis of identical coefficients of the two parameters could not be rejected as is shown in the last row of table 4. Thus, intuition proposing increased transfers shortly (within a year) before the planned remigration could not be validated by the data. This finding, however, must be interpreted cautiously considering the fact that guest workers might take with them their savings when realizing their remigration, a fact I cannot control for because of lack of data.

Next, I will concentrate on the effect of disposable income. As expected, there exists a significantly positive relationship between the propensity to remit and net household income. On the other hand, the influence of household size was negative. This finding may be explained plausibly by the increasing cost of living in Germany and is in harmony with the finding of the Deutsche Bundesbank (1974). An increase in the number of children living in the household especially will lead to a downward adaptation of the saving target as well as the propensity to transfer savings to the home country.

The distance statistic indicates to what extent the restrictions on the parameters

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<sup>26</sup>Merkle and Zimmermann's (1992) study is based on data for 1988, only.

are valid. Therefore, the statistic informs on the temporal stability of the structural model. As shown in the first row of table 4 the assumption of stability of the whole set of parameters has to be rejected.

Table 4: Specification tests

H <sub>0</sub> -hypothesis	$\chi^2$ -statistic	d.o.f.	p-value in percent
stability of the structural parameters	267.84	133	0.00
temporally invariant constant	13.01	7	7.18
temporal invariance of the parameter for the variable NATI	17.84	7	1.27
temporal invariance of the parameter for the variable NATG	17.74	7	1.32
temporal invariance of the parameter for the variable NATS	7.95	7	3.36
temporal invariance of the parameter for the variable NATY	2.56	7	9.22
temporal invariance of the parameter for the variable YNET	23.95	7	0.12
temporal invariance of the error term	118.42	7	0.00
identical parameters for REMIG <sub>ST</sub> and REMIG <sub>MT</sub>	0.11	1	73.78

As mentioned before, the difference of two distance functions is  $\chi^2$ -distributed so that it is possible to test alternatively for temporal heteroscedasticity and trend effects against the most general specification of stability of the whole set of parameters over time. As can be seen in table 4 the hypothesis of a stable constant cannot be rejected at least when testing at the 5 percent significance level whereas the hypothesis of temporal homoscedasticity was rejected by the data.

## 5 Final remarks

Through temporary as well as permanent migration long-term economic links are established between the home and the host country as can be seen by the officially published figures on the amount remitted between Germany and the major emigration countries. Based on theoretical considerations concerning the microeconomic

explanation of the remittance decision some determinants are isolated as potential explanatory factors being used for estimation. The nature of the data as a panel allows individual effects to be taken into account. Dependent variable is the aggregate amount remitted in kind and cash to support the family at home, to build up savings in the home country for later use and for other reasons. Estimation results largely support the theoretical considerations. The results show that, besides certain personal characteristics, in particular age and gender of the household head, the planned duration of stay has an important influence on the amount remitted. Indicators for the degree of the guest worker's assimilation into German society, such as family context and nationality also show a decisive influence on the remittance decision. On the other hand, I find that the higher family net income the higher the propensity to consume. Test statistics indicate that the hypothesis of a stable set of structural parameters has to be rejected whereas the stability of certain explanatory factors could not be rejected by the data.

Obviously, the set of variables included in the regression is not yet complete. As compared to the postulated four broad categories of decisive factors, firstly, more thorough research is necessary to explain the influence of policies by the home countries, designed to attract remittances. Additionally, macroeconomic or financial variables should be included in the empirical analysis to model the portfolio allocation choice. With the help of these additional variables it should be possible to answer the question of what determines the individual propensity to save and to remit. On an aggregate level, the attempt will be made to use these microeconomic results to estimate the overall amount of remittances for the five major groups of migrants residing in Germany.

## A Das Random-Effects Tobit Modell

Variable	Coefficient	Variable definition
CONSTANT	-28024	
SIGMA <sub><math>\alpha</math></sub>	5788	
SIGMA <sub><math>\epsilon</math></sub>	5213	
personal characteristics		
AGE	954	years of age
AGEQ	-10.39	years of age squared
EDUC <sub>LOW</sub>	-323	low education = 1
EDUC <sub>HIGH</sub>	2342	high education = 1
HGR	-534	household size
NATG	-2311	nationality = Greece
NATI	-3947	nationality = Italy
NATY	-23	nationality = Yugoslavia
NATS	-2843	nationality = Spain
SEX	4183	male = 1
indicators of assimilation		
FAM	5654	spouse living in home country = 1
CHILD	4298	child(ren) living in home country = 1
MIGY	-423	years in Germany
REMIG <sub>ST</sub>	3989	remigration within one year = 1
REMIG <sub>MT</sub>	3244	temporary migrant = 1
SCHOOL	-290	school attendance in Germany = 1
income variable		
YNET	0.06	net monthly family income in DM



**B Determinants of migrants' remittances: Standard-Tobit Model, 1984-1989**

Variable	1984	1985	1986	1987	1988	1989	1990	1991
CONSTANT	-25980	-27789	-30386	-27788	-29387	-30489	-28482	-27735
AGE	776	730	1233	934	1289	1419	973	842
AGESQ	-8.15	-7.77	-14.02	-10.00	-14.16	-14.08	-10.41	-8.86
EDUC <sub>LOW</sub>	-130	309	825	80	-101	408	1098	722
EDUC <sub>HIGH</sub>	-1142	-971	-582	-2064	-1717	-400	-1421	-728
HGR	-317	-304	-490	-418	-712	-662	-933	-346
NATG	314	-260	-312	535	597	-134	-2135	-1214
NATI	-3125	-3007	-1483	-4974	-4176	-5338	-6784	-4291
NATY	649	1473	926	338	161	622	-1614	1413
NATS	-1801	-2277	-1546	-5432	-2681	-3178	-3383	-797
SEX	3994	5250	4099	3995	4374	2880	3534	3114
FAM	3771	3587	4480	4797	2491	5122	5474	6971
CHILD	3552	4288	4002	5494	4690	4250	4058	3054
MIGY	-84	-85	-42	-59	-39	-186	-126	-187
REMIG <sub>ST</sub>	5293	2769	4549	5317	5769	2758	712	3099
REMIG <sub>MT</sub>	4241	4153	4871	4581	3476	4265	5221	2960
SCHOOL	-1430	-1758	974	-617	1412	1687	-2716	211
YNET	0.68	0.63	1.04	1.18	1.04	1.35	1.32	0.91
SIGMA	8731	7670	9401	10327	8991	9544	11330	6974

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