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Are Turkish migrants altruistic? Evidence from the macro data

by

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Abstract

We investigate in this paper whether the stable pattern of remittances over the last three decades can be explained by the altruistic behaviour. This possibility is tested by means of cointegration analysis, which is applied to Turkish remittances from Germany over the period 1962-2005. A single cointegrating relationship is found between the remittances of Turkish workers in Germany and the real Turkish GDP *per capita*, the real German GDP *per capita*, the stock of Turkish migrants in Germany, the real exchange rate, and the government instability. The negative coefficient associated with Turkish income and positive coefficients on the real exchange rate and political instability support the claim that Turkish remittances from Germany are altruistically motivated. In addition, we find that the coefficient on the stock of Turkish migrants to be equal to one.

Keywords: Migration; Remittances; Alturism; Cointegration

JEL classification: C22; F22; F24

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1 Introduction

Caring for the well-being of others has been a research topic in economics since Adam Smith (Smith (1759)). The most cited and influential work was done by Becker (1974), in which the welfare of others enters in utility functions. An altruist is willing to sacrifice own resources in order to improve the well-being of others. Altruism is a form of unconditional giving that might emerge from strongly feeling for others' feelings Gerard-Varet *et al.* (2000). However, the studies of determinants of private transfers in developed countries have generally rejected the pure altruism hypothesis, see Altonji *et al.* (1992, 1997). Likewise, most studies on the determinants of migrants' remittances rejected the pure altruism, Lucas and Stark (1985), despite of the Agarwal and Horowitz (2002)'s study. Agarwal and Horowitz (2002) based on micro data on Guyana find that per-migrant remittances are significantly and negatively related to the number of migrants from the same households. The support for the altruism motive in their study is rooted in the significance of this one variable. Altruism as a motive for remittances would have important economic consequences as altruism makes these flows stable. The Turkish nominal remittances underwent two stages in their development: first, they jumped up in the early 1960s and continued to grow steadily until the oil crisis of 1975 and then during the last 25 years they stabilized at the level of about 1 billion euros per year, (see the top left of the panel in Figure 1). In this paper we aim at explaining the stability of remittances of Turkish workers' residing in Germany. The explanation we suggest is based upon the altruistic motive as the only motive compatible with such a pattern.

In this paper we develop a model of altruism, in which migrants remit because they care for those they left behind. The implications of the theory are tested using the macro data on Turkish remittances from Germany covering the period of 1962-2005. Our estimation results are consistent with the altruistic motive. It implies that the amount of remittances depends on the economic activity in the host country and on the migrants' attachment to their home country.

The paper is structured as follows. Section 2 discusses different motives to remit and the evidence from the literature on the determinants of remittances. Section 3 develops a model of altruism, which explains the determinants of foreign workers' remittances. Section 4 gives the empirical model. In section 5 the theoretical model is checked against the empirical evidence on the Turkish remittances from Germany over the 1962-2005 period. Section 6 concludes.

2 Literature Review

The literature on the determinants of remittances both at the micro and at the macro level finds that remittances are affected by a mixture of motives to remit rather than by a single motive. The most influential study among those taking advantage of the micro level data is Lucas and Stark (1985). It explains the workers' remittances to Botswana using a variety of hypotheses ranging from pure altruism to pure self-interest. As an intermediate hypothesis they use that of tempered altruism, or enlightened self-interest. According to this hypothesis, the remittances are part of a self-enforcing contractual arrangement between migrant and his family that are of a mutual benefit. The main conclusion of Lucas and Stark (1985) is that only the mixture of motives offers an appropriate explanation of the Botswana's evidence. At the macro level, Katseli and Glytsos (1989) modelled remittances as a portfolio allocation choice, where the migrant decides on the proportion of wealth to remit to his country for the investment purposes. In this setup, the interest rates in home country and host country, the expectations about future exchange rate movements, and the degree of the migrants' risk aversion are assumed to determine remittances. Empirical evidence on the significance of these variables is rather mixed, Glytsos and Katseli (1986), Glytsos (1988, 1997), see Table 1.

Further studies concentrating on portfolio allocations, as exemplified by El-Sakka and McNabb (1999), Faini (1994), Lianos (1997), Aydas *et al.* (2005), Alper and Neyapti (2006), show that both the exchange rate and interest rate differentials are important for attracting remittances. In some studies only the interest rates are significant Katseli and Glytsos (1989), Glytsos (1997), Abdel-Rahman (2003) and Vargas-Silva and Huang (2006). Yet other studies demonstrate the importance of the black market exchange rate or premium, Elbadawi and Rocha (1992), El-Sakka and McNabb (1999), Aydas *et al.* (2005) and Freund and Spatafora (2005). In addition, Higgins *et al.* (2004) find the real exchange rate volatility rather than the real exchange rate itself to be significant in explaining remittances.

In contrast, Swamy (1981) and Straubhaar (1986) find little or no evidence that the financial variables do affect the remittances. Based on the empirical results, Swamy (1981) claims that the share of female in migrant population is important, whereas Straubhaar (1986) argues that the political instability in the host country is a statistically significant determinant of the remittances.

In general, at the macro level, the variables representing all the motives to remit — such as altruistic, exchange, and investment (portfolio) motives — are included in a regression at once, which therefore represents the mixture of motives. As seen from Table 1, the following variables are found to be significant in the literature: the number of migrants in the host country, the economic activity in the host country and the home country, the length of stay in the host country, interest rate differentials, exchange rate, black market premia, inflation rate in the home country, the ratio of females to the total migrant population, the education level of migrant, and political risk factors in the home country. However, as it can be observed from Table 1, there is a little consensus on the key macroeconomic determinants of remittances. One common finding is that the stock of migrants is the primary determinant of remittances.

The host country income as measured by the host country GDP *per capita* is also found to be significant in some studies. Nevertheless, Higgins *et al.* (2004) and Vargas-Silva and Huang (2006) argue that the host country income should approximated by the unemployment rate and the money supply.

If the home country income has a negative sign, then it is considered as a support for the altruistic hypothesis. Alternatively, if the home country income has a positive sign, then it is interpreted as an evidence of the investment or exchange motive. See Table 1.

If the inflation rate takes a positive sign, then inflationary pressures in the home country reduce real income and thereby lead to an increase in remittances according to the investment motive. If, in contrast, the inflation rate has a negative sign, then it means that the high inflation undermines the economic and political stability and therefore leads to a reduction in remittances. Both effects are considered in the following papers: Glytsos (1988), Katseli and Glytsos (1989) Elbadawi and Rocha (1992), Faini (1994), Lianos (1997), El-Sakka and McNabb (1999), Abdel-Rahman (2003), Aydas *et al.* (2005) and Alper and Neyapti (2006).

In a recent study Buch and Kuckulenz (2004) find that traditional variables such as economic growth, the level of economic development and proxies for the rate of return on financial assets are not significant in explaining remittances and argue that remittances might be influenced by social considerations. In addition, other recent studies showed that some additional variables such as money transfer fees (Freund and Spatafora (2005)), the education

level of migrants (Niimi and Özden (2006)), the income inequality, the availability of remittance services, and informal economy (Schiopu and Siegfried (2006)) can be important in determining remittances.

In this study, we will take another view and explore the determinants of Turkish workers' remittances from Germany within a context of altruistic motive. The hypothesis of altruistic motivation here is supported by our observation that the remittances in the recent years have been rather stable. This hypothesis is tested on the basis of the macro data.

3 Theoretical Model

The model in this section is closely related to Lucas and Stark (1985), Funkhouser (1995), and Stark (1995). We assume a separable utility function, according to which a migrant values his own utility, U_m and that of his family left behind in the home country, U_h:

$$U(U_m, U_h) = U_m(C_m) + V\{U_h(C_h), P\} \tag{1}$$

where C_m is the consumption of migrant; C_h is the consumption of his family in the home country; and P is the importance of the utility of the family left behind in the migrant's own utility, or the degree of migrant's attachment to home country. The utility function has the following properties: $U_m^{'} \succ 0$, $U_h^{'} \succ 0$, and $U_h^{''} \prec 0$, where U' denotes the first-order derivative of the utility function with respect to consumption and U'' denotes the second-order derivative.

The emigrant maximizes the separable lifetime utility function

$$\max_{R_t} U_m = \sum \frac{U_m\{C_m\}}{(1+\delta_u)^t} + \frac{V\{U_h(Y_{ht} + e_t R_t + N_{ht} e_t \overline{R}, P\}}{(1+\delta_v)^t} \tag{2}$$

subject to

$$C_{mt} = Y_{mt} - R_t \tag{3}$$

where C_{mt} is the consumption of the migrant at time *t*; Y_{mt} is the income of the migrant at time *t*; Y_{ht} is the income of the migrant's family in the home country; R_t is the nominal remittances expressed in the host country currency; e_t is the real exchange rate between the host and home country; $e_t \overline{R}_{ht}$ is the average remittances received from other migrant working in the host country and stemming from the same household; N_{ht} is the total number of migrants sent by this household to the host country (stock of migrants in the host country).

$\frac{1}{(1+\delta_u)^t}$ and $\frac{1}{(1+\delta_v)^t}$ are the discount rates applied to the migrant's own utility and to the utility of the migrant's family in the home country, respectively. The solution to the maximization problem is given by the reduced form equation for the determinants of remittances:

$$R_t = f(Y_{mt}, Y_{ht}, e_t, N_{ht}, P) \tag{4}$$

The model above has several testable implications, which are stated in Lucas and Stark (1985), Funkhouser (1995), and Rapoport and Docquier (2005):

1. Migrants with higher earnings remit more;
2. Low-income households receive more;
3. At the macro level, the more migrants the higher the total remittances.[1] At the micro level the relationship between the number of migrants stemming from the same family and amount of remittances can be either positive or negative.

We have two additional variables to test in this altruistic model:

4. Real exchange rate is expected to exert a positive impact on remittances;
5. Remittances increase with the degree of migrant's attachment to his family in the home country.

The positive relationship between the real exchange rate and remittances, given that the remittances are expressed in the home country's currency, is postulated in Faini (1994).

[1] In fact, following Swamy (1981), we expect the coefficient on the stock of migrants to be equal to one.

The measure of the migrant's attachment to his family left behind, *P*, can be related to the literature on transnationalism. Transnational migration represents immigrants that settle down and become well integrated in the host country but still maintain social, cultural, economic, and political ties with their home country, see Glick Schiller (1999) and Guarnizo (2003). In the literature on transnationalism, monetary remittances measure the strength of attachment the migrants feel towards their societies of origin. The main contribution of this paper is the empirical testing of the influence of the real exchange rate, migrant's attachment, and the stock of migrants on the remittances.

4 Empirical model

We model Turkish remittances from Germany as follows:

$$\ln\left(\frac{R_t}{Y_{ht}}\right) = \alpha_0 + \alpha_1 \ln pcY_{ht} + \alpha_2 \ln pcY_{ft} + \alpha_3 \ln S_t + \alpha_4 \ln e_t + P_t + \varepsilon_t \qquad (5)$$

In (5), $\ln\left(\frac{R_t}{Y_{ht}}\right)$ denotes the log of the share of nominal remittances of Turkish workers in Germany to the Turkish nominal GDP. The $\ln pcY_{ht}$ and $\ln pcY_{ht}$ are the log of the real Turkish GDP *per capita* and the log of the real German GDP *per capita*, respectively. We expect the sign of coefficient on home income to be negative if the Turkish workers are altruistic. The $\ln S_t$ is the log of the existing stock of Turkish migrants in Germany. $\ln e_t$ is the log of the real exchange rate. The exchange rate plays an important role in the portfolio, altruistic and exchange-related approaches. The portfolio approach suggests that the expectation of devaluation discourages remittances. Alturistic and exchange-related models predict that if the remittances are expressed in home country currency a real devaluation positively affects remittances. However, exchange-related models predict that the home country income would have a positive rather than a negative impact on remittances. Therefore, the negative sign on the home income together with a positive sign on real exchange rate supports the altruistic motive. P_t is the political instability, that is, the change in the government in Turkey, is added to the model to represent the degree of attachment to the home country. The corresponding dummy variable takes the value of 1, when there is government change in that year. We expect this variable to be significant and positive if the

Turkish migrants follow the altruistic motive.[2] Alternatively, if the estimated coefficient of political instability is negative, then it means that the investment motive is at work, as risky and unstable environment will discourage investments, see Ogbomienie Agbegha (2006).

The data on workers' remittances were obtained from the balance sheets of the Bundesbank, while the data on the per capita GDP of Germany and of Turkey were obtained from the World Market Monitor, and the Turkish Institute of Statistics, respectively. The stock of Turkish migrants is obtained from the Federal Statistical Office in Germany. The TL/euro exchange rate is obtained from the World Market Monitor. Data on government instability is constructed by Dr. Mehmet Asutay, Durham University.

5 The general to specific approach and econometrics results

Modelling based on the general-to-specific modeling approach that aims to build empirical models that economically sensible and statistically satisfactory, Hendry (1995), Campos and Ericsson (1999) and Hoover and Perez (1999). Although we have forty-two years of annual data, as shown in Akkoyunlu (1999) and Campos and Ericsson (1999), the sample size is only one of several factors which determine how much information is in the sample. Even our data sample is small, the data movements so large that are crucial for the information of data, see Figure 1. Therefore, over-parameterisation should not be a concern.

Therefore, we start with a general model which is probably over-parameterised with one lag for the log of the share of nominal remittances of Turkish workers in Germany to the Turkish nominal GDP, $\ln\left(\frac{R_t}{Y_{ht}}\right)$ and a set of explanatory variables (the log of the real *per capita* Turkish GDP, $\ln pcY_{ht}$, the log of the real *per capita* German, $\ln pcY_{ft}$, the log of the stock of Turkish migrants in Germany, $\ln S_t$, the log of the real exchange rate, $\ln e_t$, and the political instability, P_t). Thus, we allow for everything[3] at the outset that might be significant and then investigate whether and how this initial general model can be reduced without significant

[2] Likewise, Clarke and Wallsten (2003), based on evidence from Jamaica following hurricane Gilbert, find that remittances protect households against exogenous shocks. Yang (2006) also supports these findings. He studies the experience across the developing countries and figures out that in the poorer half of the sample, the hurricane exposure leads to substantial increases in migrants' remittances.

[3] We also tried including financial variables such as the home and host country interest rates and the home country inflation rates. However, all variables were insignificant, and further supported the altruistic motive.

loss of information about the parameters of interests. Economic theory information helps specify the vector of parameters of interest; however, the parameters of interest might come from a data-instigated model. However, theory consistency is essential, so that there is no evaluation conflict between the model and the theory interpretation. Hence, I aim to conclude with a parsimonious model which has orthogonal regressors as well as satisfying the necessary conditions for both congruence and encompassing.

However, the general-to-specific modelling *still* suffers from allegations that it mines the data pejoratively. These allegations are, as in Campos and Ericsson (1999):

I. *Repeated Testing:* Regressors are selected in an attempt to maximise *t*-ratios. Thus simply conducting multiple tests will induce significant outcomes by chance.

II. *Data Interdependence:* Non-constant coefficient might result due to an omitted regressor that is correlated with the included one, and this correlation changes over time due to regime changes that generate the system.

III. *Corroboration:* The regressors are chosen according to a criterion such as having sensible coefficient estimates. However, there might still be important omitted variables.

IV. *Over-parameterization:* If the model is over-fitted, it uses up many degrees of freedom.

However, this paper, during the building process of the empirical model, shows that these allegations can be refuted easily.

The annual data covers the period from 1962-2005 (see Figure 1, for the basic properties of the data).

Our first step is to obtain parsimonious unrestricted model. The results of the unrestricted general model are given in Table 2. Table 2 shows that the unrestricted model can adequately describe the data, since the misspecification tests show no serious departures from the underlying model assumptions.

The next step is to find the cointegrating relationship between variables. The solved long run equation, as well as the error correction mechanism (ECM) is given below. The test on the significance of the lag length suggests that the model should have one lag.

$$\ln\left(\frac{R_t}{Y_{ht}}\right) = 39.156 - 2.608 \ln pcY_{ht} - 4.046 \ln pcY_{ft} + 1.495 \ln S_t$$
$$(SE) \quad (3.595) \quad (0.521) \quad (0.765) \quad (0.094)$$
$$+ 0.448 \ln e_t + 0.127 P_t \qquad (6)$$
$$(SE) \quad (0.235) \quad (0.063)$$

$$ECM_t = \ln\left(\frac{R_t}{Y_{ht}}\right) - 39.156 + 2.608^* \ln pcY_{ht} + 4.046^* \ln pcY_{ft}$$
$$- 1.495^* \ln S_t - 0.448^* \ln e_t - 0.127^* P_t \qquad (7)$$

WALD test $\chi^2(5) = 623.279$ [0.00] **

Tests on the significance of each lag

Lag	
1	F(5,32) = 21.815 [0.00] **

It is immediately clear that this set cointegrates.[4] Thus, the residuals are innovations against the available information. The solved long run equation represents the cointegrating vector that enters in the conditional model as the error correction term.

In the long run equation, the real Turkish *per capita* GDP and the real German *capita* GDP contribute negatively to Turkish remittances from Germany, while the stock of Turkish migrants, the real exchange rates and the political instability contribute positively to Turkish remittances from Germany. The negative coefficient on the real Turkish *per capita* GDP is consistent with the altruistic theory. The stock of Turkish migrants enters with a unitary coefficient in the long-run equation. The long-run coefficient of the real exchange rate which is lower than one suggesting that a real depreciation leads to lower remittances in terms of foreign goods, see Faini (1994). However, in this study the dependent variable, remittances are expressed in home country currency (as a ratio to Turkish GDP). Therefore, the positive coefficient on the real exchange rate suggests that a 10 percent increase in the real exchange rates *increases* remittances by 4.48 percentage points- a significant effect. The positive and

[4] The graphics, regression output and residual diagnostic tests were all calculated using GiveWin 2.2, Pc-Give 10.2 and Pc-Gets 1.2, see Doornik and Hendry (2001a,b,c).

significant coefficient on the political instability suggests that migrants closely follow the developments and changes in the home country and react to these developments and changes.

The negative long-run coefficient on German GDP that we found in our estimations can be explained by an increase in income inequality that took place in the recent years in Germany, see Dustmann *et al.* (2006). The vast majority of Turkish workers are unskilled and therefore the growth rate of their income is very low (almost zero) and is certainly much lower than the overall economic growth in Germany. Hence the negative long-run relationship between remittances and German real GDP may reflect this sharp increase in income dispersion.

There are a few steps in the reduction of the final (conditional) model from the above general specification and these reductions are done automatically with Pc-Gets[5] (the corresponding standard errors and *t*-ratios reported in parentheses below the coefficient estimates).

$$\Delta \ln\left(\frac{R_t}{Y_{ht}}\right) = -0.033 - 1.346\ \Delta \ln pcY_{ht} + 2.083\ \Delta \ln pcY_{ft} + 1.131\ \Delta \ln S_t$$

(SE) (0.031) (0.433) (0.734) (0.087)

[t] [-1.07] [-3.11] [2.82] [13.00]

$$+ 1.022\ \Delta \ln e_t + 0.076\ P_t - 0.569\ ecm_{t-1} \qquad (8)$$

(SE) (0.151) (0.034) (0.071)

[t] [6.75] [2.21] [-8.06]

R^2 = 0.909 F(6,36) = 60.08 [0.00] $\hat{\sigma}$ = 0.103 DW = 1.77

RSS = 0.3849 for 7 variables and 43 observations

F_{ar} (2,34) = 0.448 [0.64] F_{arch} (1,34) = 2.134 [0.15]

χ^2_{nd} (2)= 0.32 [0.85] F_{hetero} (11,24) = 0.22 [0.99]

F_{reset} (1,35) = 0.36 [0.55] T = 43 (1963-2005)

The conditional model (equation (8)) is parsiomonious. The diagnostic tests are satisfactory, hence, the conditional model satisfies the *design criteria.* The data generating process (DGP) as a model satisfies the design criteria suggesting that the general-to-specific modelling is successful in creating a model that mimics the properties of DGP. The error-correction term is highly significant and has the expected sign. Figure 2 shows the actual and fitted values of the final model. The graphs show how well the final model explains the data and the residuals uncorrelated and normally distributed.

[5] The corresponding standard errors and t-ratios are reported in parentheses below the coefficient estimates.

The short-run impact of the German GDP on remittances is positive and the sum of coefficients on the home and host countries' income is equal to one which is consistent with the altruistic theory. The altruistic theory implies that an increase in the migrant's income by one euro, coupled with one-euro drop in the income of the migrant's family left behind, raises the amount transferred exactly by one euro. The unit coefficient on the stock of Turkish migrants is also confirmed by the econometric analysis. The negative coefficient on Turkish income with a positive coefficient on the real exchange rate further supports the altruistic theory. The coefficient on the real exchange rate that is larger than one indicates that real depreciation leads to higher remittances even when the remittances are expressed in terms of the host country's good, see Faini (1994). Furthermore, consistent with logic of transnational migration theory, the positive long-run as well as short-run impact of political instability suggests that Turkish migrants are altruistic. Thus, Turkish migrant responds positively to political and economic changes in the home country.

Figures 3, 4 and 5 plot the recursive estimates for the coefficients on the constant term, $\Delta \ln Y_{ht}$, $\Delta \ln Y_{ft}$, $\Delta \ln S_t$, $\Delta \ln e_t$, P_t, and ecm_{t-1}; their respective *t*-ratios; and the recursive residual sum of squares, one-step residuals, one-step Chow statistics, and break–point Chow statistics, respectively. Constant coefficients in Figure 3 in the presence of the large variations in the marginal process such as incomes and exchange rates imply super exogenous variables that counter the second sense of data mining. Further, the recursive *t*-ratios in Figure 4, increase in absolute value as the sample size increases countering the first sense of data mining. Hence, the nominal critical levels of test statistics are not affected. Even with forty-three observations and seven variables in the final model *t*-ratios are greater than three in magnitude suggesting that over-parameterisation is not a concern given information content in the data and refuting the fourth sense of data mining. Figure 5 shows that the recursive residual sum of squares increase over time and the recursive estimate of standard error $\hat{\sigma}_t$ declines over time rather than increase, hence countering the first sense of data mining. Furthermore, insignificant one-step and break-point Chow statistics support this refutation. Finally, the conditional model is able to accurately forecast Turkish remittances from Germany over the 2000-2005 period (see Figure 6 for the one-step ahead forecasts) and this aspect is supported by the forecast test ($\chi^2_{forecast}$ (6) = 2.89 (0.82)) , Kiviet (1986) and the

parameter constancy test over *k th* periods (F_{Chow} = 0.27 (0.94)), Chow (1960). The forecast results refute the first and second sense of data mining.

5 Summary

In this paper we develop an altruistic model of migrants' remittances to their home country and test this model using the 1962-2005 annual data and the cointegration technique on the remittances of Turkish workers staying in Germany. A single cointegrating vector is found among the remittances and the following variables: the home country income, the host country income, the stock of migrants, the real exchange rate and the political instability.

Based on the results of the cointegration analysis, a parsimonious single equation conditional error-correction model is developed. That is both congruent and parsimoniously encompasses the general model. The residuals are also innovations against the available information. The results further support the view that a constructive data mining *qua* general-to-specific modelling approach is productive as it has a high probability of locating the DGP.

The host country's income has a positive effect upon remittances in the short run, whereas the home country's income exerts a negative effect on remittances both in the short and long run. The unit coefficient on the stock of Turkish migrants is also confirmed by the data. Additionally, we found a positive impact from the real exchange rate and the political instability. The positive impact of the real exchange rate on remittances are especially important for the design of adjustment programmes that mainly aim at shifting resources toward the traded goods sectors by real exchange rate depreciation should also consider its impact on remittances.

Turkish migrants in Germany seem to be very sensitive to the economic and political situation in Turkey, since when there is a real devaluation and/or political instability they immediately react by sending more remittances. The results of our estimation support the altruistic model but are also consistent with the literature on transnationalism and offer interesting insights, because they allow explaining the recent trends in Turkish remittances from Germany. Thus, as long as Turkish migrants have altruistic motive and engage themselves in transnational activity, they will continue supporting the welfare of their home country and will maintain the remittances stable.

References

Akkoyunlu, S. (1999). *Turkish Consumption and Saving*. DPhil Thesis. University of Oxford.

Abdel-Rahman, A.-M. M. (2003). The determinants of foreign worker remittances in the Kingdom of Saudi Arabia. King Saud University, mimeo.

Agarwal, R. and A. W. Horowitz (2002). Are international remittances altruism or insurance? Evidence from Guyana using multiple-migrant households. *World Development* 30: 2033–44.

Alper, A. and S. Neyapti (2006). Determinants of workers' remittances: Turkish evidence from high frequency data. *Eastern European Economics* 44: 91–100.

Altonji, J. G., F. Hayashi, and L. J. Kotlikoff (1992). Is the extended family altruistically linked? Direct tests using micro data. *American Economic Review* 82: 1177–98.

Altonji, J. G., F. Hayashi, and L. J. Kotlikoff (1997). Parental altruism and inter vivos transfers: Theory and evidence. *Journal of Political Economy* 105: 1121–66.

Ayda¸s, O. T., K. Metin-Özcan, and B. Neyapti (2005). Determinants of workers' remittances: The case of Turkey. *Emerging Markets Finance and Trade* 41: 53–69.

Becker, G. S. (1974). A theory of social interactions. *Journal of Political Economy* 82: 1063–1093.

Buch, C. M. and A. Kuckulenz (2004). Worker remittances and capital flows to developing countries. ZEW Discussion Paper 04-31.

Chow. G. C. (1960). Tests of Equality Between Sets of Coefficients in Two Linear Regressions. *Econometrica* 28: 591-605.

Campos, J. and Ericsson N. R. (1999). Constructive Data Mining: Modelling of Consumers' Expenditure in Venezuela. *Econometrics Journal* 5: 226-240.

Clarke, G. R. and S. J. Wallsten (2003). Do remittances act like insurance? evidence from a natural disaster in Jamaica. Development Research Group, World Bank, mimeo.

Doornik, J. A. and H. Hansen (1994). An omnibus test for univariate and multivariate normality. Nuffield College Discussion Paper W4&91.

Dustmann, C., J. Ludsteck, and U. Schönberg (2007). Re-assessing trends in wage-inequality in Germany. University College London, mimeo.

Doornik, J. A. and D. F. Hendry (2001a). *GiveWin: An Interface to Empirical Modelling*. Timberlake Consultants Press: London.

Doornik, J. A. and D. F. Hendry (2001b). *Modelling Dynamic Systems Using PcGive*, Volume II. Timberlake Consultants Press: London.

Doornik, J. A. and D. F. Hendry (2001c). *Automatic Econometrics Model Selection Using PcGets*. Timberlake Consultants Press: London.

El-Sakka, M. I. T. and R. McNabb (1999). The macroeconomic determinants of emigrant remittances. *World Development* 27: 1493–1502.

Elbadawi, I. A. and R. Rocha (1992). Determinants of expatriate workers' remittances in North Africa and Europe. Policy Research WPS 1133, The World Bank.

Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. *Econometrica* 50: 987-1007.

Faini, R. (1994). Workers remittances and the real exchange rate: A quantitative framework. *Journal of Population Economics* 7: 235–45.

Freund, C. L. and N. Spatafora (2005). Remittances: Transaction costs, determinants, and informal flows. World Bank Policy Research Working Paper No. 3704.

Funkhouser, E. (1995). Remittances from international migration: A comparison of El Salvador and Nicaragua. *The Review of Economics and Statistics* 77: 137–145.

Gerard-Varet, L.-A., S.-C. Kolm, and J. M. Ythier (2000). *The Economics of Reciprocity, Giving, and Altruism*. Houndmills and London: Palgrave Macmillan and New York: St. Martins Press.

Glick Schiller, N. (1999). Transmigrants and nation-states: Something old and something new in U.S. immigrant experience. In *Handbook of International Migration: The American Experience*. C. Hirschman, J. DeWind, and P. Kasinitz (Eds.) New York: Russell Sage.

Glytsos, N. (1988). Remittances in temporary migration: A theoretical model and its testing with the Greek-German experience. *Weltwirtschaftliches Archiv* 124: 524–548.

Glytsos, N. and L. T. Katseli (1986). Theoretical and empirical determinants of international labour mobility: A Greek-German perspective. CEPR Discussion Papers 148.

Glytsos, N. P. (1997). Remitting behaviour of "temporary" and "permanent" migrants: The case of Greeks in Germany and Australia. *Labour* 11: 409–435.

Godfrey, L. G. (1978). Testing for higher order serial correlation in regression equations when the regressors include lagged dependent variables. *Econometrica* 46: 1303-1313.

Guarnizo, L. E. (2003). The economics of transnational living. *International Migration Review* 37: 666–699.

Gupta, P. (2005). Macroeconomic determinants of remittances: Evidence from India. IMF Working Paper 05/224.

Hendry, D. F. (1995). *Dynamic Econometrics: Advanced Texts in Econometrics*. Oxford University Press: Oxford

Higgins, M. L., A. Hysenbegasi, and S. Pozo (2004). Exchange-rate uncertainty and workers' remittances. *Applied Financial Economics* 14: 403–411.

Hoover, K. D., and Perez, S. J. (1999). Data Mining Reconsidered: Encompassing and the General-to-Specific Approach to Specification Search. *Econometric Journal* 2: 167-191.

Katseli, L. T. and N. P. Glytsos (1989). Theoretical and empirical determinants of international labour mobility: A Greek-German perspectives. In *European Factor Mobility: Trends and Consequences*. I. Gordon and A. P. Thirlwall (Eds.), pp. 95–115. New York: St. Martin's Press.

Kiviet, J. F. On the Rigour of Some Misspecification Tests for Modelling Dynamic Relationships. *Review of Economic Studies* 53: 241-261.

Lianos, T. P. (1997). Factors determining migrant remittances: The case of Greece. *International Migration Review* 31: 72–87.

Lucas, R. E. B. and O. Stark (1985). Motivations to remit: Evidence from Botswana. *Journal of Political Economy* 93: 901–18.

Niimi, Y. and C¸ Özden (2006). Migration and remittances: causes and linkages. Policy Research Working Paper Series 4087, The World Bank.

Ogbomienie Agbegha, V. (2006). Does political instability affect remittance flows? Master's thesis, Graduate School of Vanderbilt University.

Ramsey, J. B. (1969). Tests for specification errors in classical linear least squares regression analysis. *Journal of the Royal Statistical Society*, B, 31:350-371.

Rapoport, H. and F. Docquier (2005). The economics of migrants' remittances. IZA Discussion paper 1531.

Russell, S. S. (1986). Remittances from international migration: A review in perspective. *World Development* 14: 677–696.

Schiopu, I. and N. Siegfried (2006). Determinants of workers' remittances - Evidence from the European neighbouring region. Working Paper Series 688, European Central Bank.

Smith, A. (1759). The Theory of Moral Sentiments. London: Printed for A. Millar, in the Strand and A. Kincaid and J. Bell in Edinburgh. Reprinted 1982.

Stark, O. (1995). *Altruism and Beyond*. Oxford and Cambridge: Basil Blackwell.

Straubhaar, T. (1986). The determinants of workers' remittances: The case of Turkey. Weltwirtschaftliches Archiv 122: 728–740.

Swamy, G. (1981). International migrant workers' remittances: Issues and and prospects. World Bank Staff Working Paper 481.

Vargas-Silva, C. and P. Huang (2006). Macroeconomic determinantsof workers' remittances: Hostversus home country's economic conditions. *Journal of International Trade and Economic Development* 15: 81–99.

White, H. (1980). A heteroscedastic-consistent covariance matrix estimator and a direct test for heteroscedasticity. *Econometrica* 48: 817-838.

Yang, D. (2006). Coping with disaster: The impact of hurricanes on international financial flows, 1970-2002. NBER Working Paper 12794.

Table 1: The literature on determinants of remittances

Paper	Host countries	Home countries	Sample	Dependent variable	Regressors (sign)	Estimation method
Swamy (1981)	Germany	Yugoslavia, Turkey & Greece	1962-1979	Remittances & remittances per migrant worker	Number of workers (+); host country income (+), ratio of females in migrant population (--)	Panel data estimation
Straubhaar (1986)	Germany	Turkey	1963-1982	Change in real remittances	Relative change in real wages in Germany (+); relative change in employment in Germany (+) and dummy variable for frequent change in government in Turkey (--)	Time series estimation
Glytsos (1988)	Germany	Greece	1960-1982	Remittance per migrant	Remittances from Germany: per capita income in the host country expressed in home country's currency (+); inflation rate (--); exchange rate (--); time (+). Remittances from USA: per capita income in the host country (+); per capita income in the home country (--); two year lagged dependent variable (+); inflation rate (+); time (--).	Time series estimation
Katseli and Glytsos (1989)	Germany	Greece	1961-1982	Remittances per migrant	Income per capita in the host country (+); income per capita in Greece (+); interest rates in Germany (--); inflation rate (--); ratio of consumption of durables to total	Time series estimation

					durables (--).	
Elbadawi and Rocha (1992)	Total	Algeria, Morocco, Portugal, Tunusia, Turkey & Yugoslavia	1977-1989	Real remittances, real remittances per migrant worker & real remittances per migrant	Host country income (+); length of stay (--); inflation (--); black market premium (--)	Panel data estimation
Faini (1994)	Total	Morocco, Portugal, Tunisia, Turkey & Yugoslavia	1977-1989	Real remittances in home country currency	Stock of migrant population (+); host country income (+); home country income (--); real exchange rate (+); expected devaluation adjusted interest rates differentials between the host and home country (+); time (--); inflaton (--)	Seemingly unrelated regression
Glytsos (1997)	Germany and Australia	Greece	1960-1993	Remittances per migrant in drachmas	Remittances from Germany: per capita income in the host country (+); per capita income in the home country (--). Remittances from Australia: per capita income in host country (+); per capita income in home country (--); number of Greek migrants (--); interest rates in the host country (--).	Time series estimation

Lianos (1997)	Germany, Belgium and Sweeden	Greece	1961-1991	Remittances	GDP per capita in the host country (+); industrial hour wages in host country (+); Greek migrant population in host country (+); exchange rate (--); host country real interest rates (--); home country real interest rates (+); inflation rate in Greece (+); unemplyment rate in host country (--).	Time series estimation
ElSakka and McNabb (1999)	Total	Egypt	1967-1991	Remittances	Real per capita income in the host country (+); inflation rate (+); real domestic interest rates to host country interest rate (+); difference between the official and black market exchange rates (--).	Time series estimation

Abdel-Rahman (2003)	The Kingdom of Saudi Arabia	Bangladesh, Eqypt, India, Pakistan & Phillipines	1975-2001	Change in remittances per worker	Long run: GDP per capita in the host country (+); wage rate in the host country (+); nominal and real interest host country (--) or ratios of host country to home country interest rates (--); differential parity condition in host relative to home country (-); degree of govenment stability and the law & order indicators (--); composite socio-political stability indicator (--). Short run: change in host country GDP (+); change in host country per capita GDP (+); change in host country wage rate (+); change in inflation (+); change in differential parity condition (--); change in composite soci-political stability indicator (--); the long run solution (--).	ECM
Buch and Kuckulenz (2004)	Total	87 developing countries	1970-2000	Remittances over GDP and remittances per migrant	GDP per capita in home country (--); share of female in labor force (--); dependency ratio (--); illiteracy (+).	Panel data estimation
Higgins *et al.* (2004)	US	9 Latin American countries	1970-1997	Remittances per migrant	The real home country income per capita (+); the unemployment rate in USA (-) and uncertainty in real exchange rates (--).	The fixed effects IV and non-IV technique

Aydas *et al.* (2005)	Total	Turkey	1965-1993	Change in remittances & change in remittances per migrant	Host country GDP per capita (+); home country GDP per capita (--); real Turkish GDP growth (+); change in black market premium (--); inflation rate (--); change in real overvaluation (--); change in exchange rate depreciation adjusted interest rate differentials (+); dummy for military interventions (--).	Time series estimation
Freund and Spatafora (2005)	Total	104 countries	1995-2003	Remittances, remittances per migrant & remittances per capita	Stock of migrant workers (+); service fee (--); unofficial exchange rate (--).	Panel data estimation
Gupta (2005)	US	India	1975-2002	Changes in real remittances	Percent change in non-agricultural employment in the US (+); dummy for drought years (+); change in LIBOR (+); dummy for Asian crisis (--).	Panel data estimation
Niimi and Özden (2006)	Total	85 Countries	2000	Remittances, remittances over GDP & remittances per migrant	Stock of migrants (+); bank deposits over GDP (+), bank credits over GDP (+); home country GDP (+); home country GDP per capita (--); indicator of tertiary education among migrants (--).	Cross-section

VargasSilva and Huang (2006)	US	Mexico	Quaterly data: 1981:1-2004:4	Nominal remittances	US Federal Fund rate (+); US money supply (+); US consumer price index (+); US unemployment rate (+).	VECM
Alper and Neyapti (2006)	Total	Turkey	Monthly Data: 1991:1-2003:12	Nominal remittances	Long run: 1-year Turkish lira depost rate (+); consumer price index (--); exchange rate (+); long-run home country's manufacturing production (+). Short run: change in manufacturing production index (--); inflation (+); change in exchange rate (--); change in 1-year Turkish lira deposit rate (--).	VECM
Ogbomienie Agbegha (2006)	Total	Latin America, Caribbean & Sub-Saharan Africa	1970-2003	Remittances per capita	The host country GDP per capita (+); home country GDP per capita (--); political stability (--).	Panel data estimation

Schiopu and Siegfried (2006)	21 West Europe countries	Algeria, Egypt, Morocco, Tunusia, Croatia, FYR of Macedonia, Serbia and Montenegro, Romania & Russia	2000-2005	Remittances per migrant	Income differentials between the host and the home countries (+); fraction of unskilled people in total stock of migrants (--); fraction of low and medium skilled people in total stock of migrants (--); income inequality (+); availability of remittance services in both sending and receiving countries (+); informal economy (--).	Panel data estimation

Table 2: Least squares estimates of the unrestricted altruistic model, $\ln\left(\frac{R_t}{Y_{ht}}\right)$ (Equation 5):

Lag j	0		1	
Variables		[t]		[t]
Constant	22.2790			
	(3.306)	[6.74]		
$\ln\left(\frac{R}{Y_h}\right)_{t-j}$	_____		0.431	
			(0.082)	[5.27]
$\ln pcY_{ht-j}$	-1.122		-0.362	
	(0.479)	[-2.34]	(0.549)	[-0.66]
$\ln pcY_{ft-j}$	2.334		-4.636	
	(0.862)	[2.71]	(0.840)	[-5.52]
$\ln S_{t-j}$	1.445		-0.294	
	(0.161)	[7.12]	(0.177)	[-1.66]
$\ln e_{t-j}$	1.085		-0.829	
	(0.170)	[6.38]	(0.187)	[-4.43]
P_{t-j}	0.072		_____	
	(0.038)	[1.89]		

R^2 = 0.986 F(10,32) = 225.1 [0.00]** $\hat{\sigma}$ = 0.106 DW = 1.86
RSS = 0.3631 for 11 variables and 43 observations
F_{ar} (2,30) = 0.55 [0.58] F_{arch} (1,30) = 1.44 [0.24]
χ^2_{nd} (2) = 0.19 [0.91] F_{reset} (1, 31) = 5.13 [0.03] T = 43 (1963-2005)

R^2 is the squared multiple correlation, $\hat{\sigma}$ is the residual standard deviation. The diagnostic tests are the form $F_j(k,T-1)$ which denotes an approximate *F*-test against the alternative hypothesis *j* for: k^{th} -order serial correlation F_{ar}, Goldfrey (1978), k^{th} -order autoregressive conditional heteroscedasticity F_{arch}, Engle (1982), heteroscedasticity F_{hetero}, White (1980), the functional form RESET test F_{reset}, Ramsey (1969) and a chi-square test for normality χ^2_{nd} (2), Doornik and Hansen (1994).

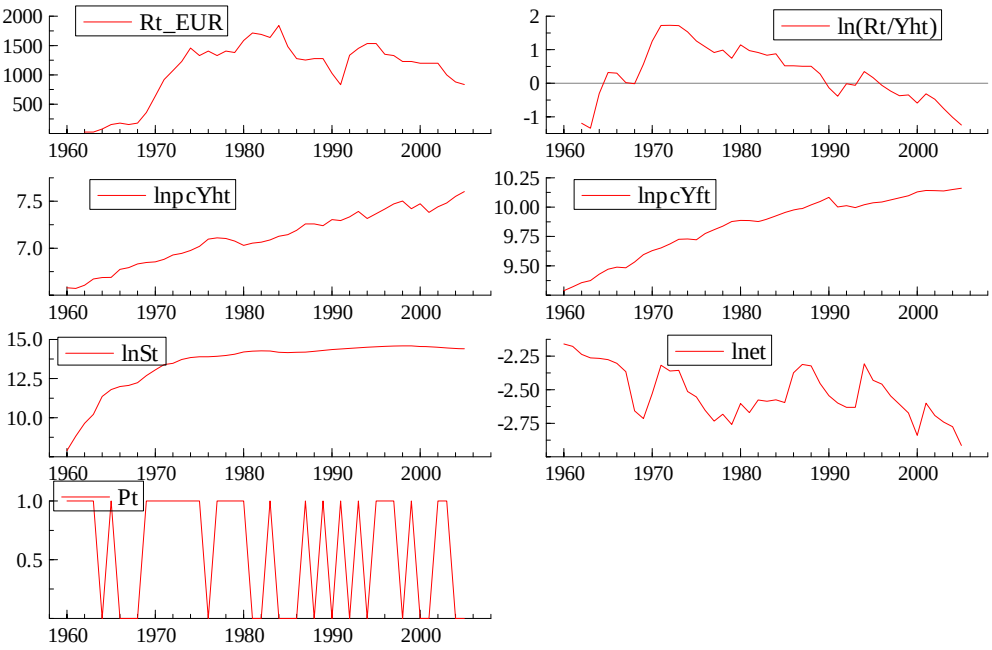

Figure 1: The basic properties of data: 1969-2004

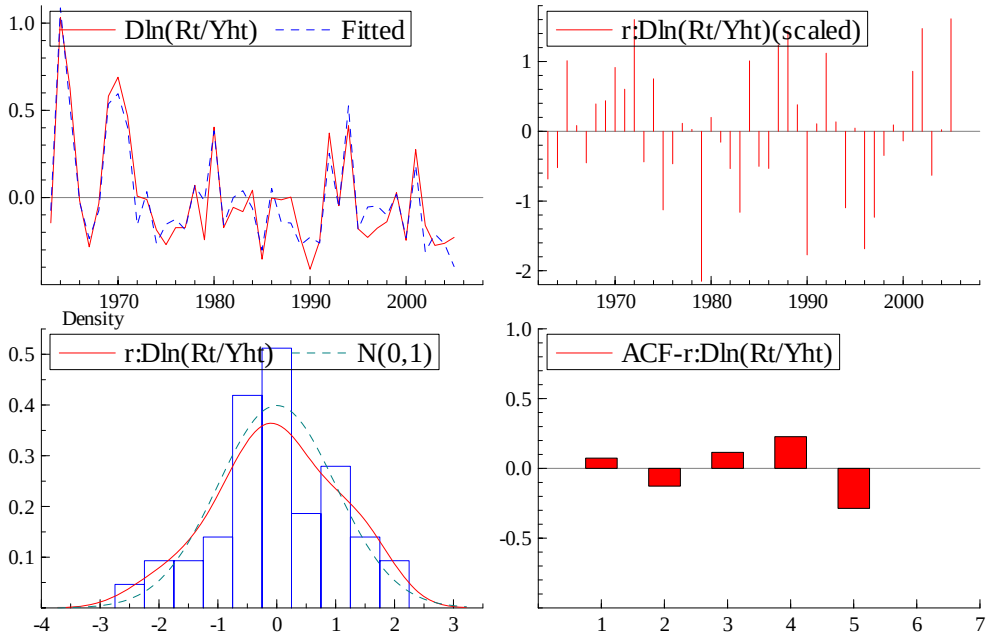

Figure 2: Actual and fitted values of migration model from Equation (8), residuals, the histogram and estimated density of the residuals and their correlogram

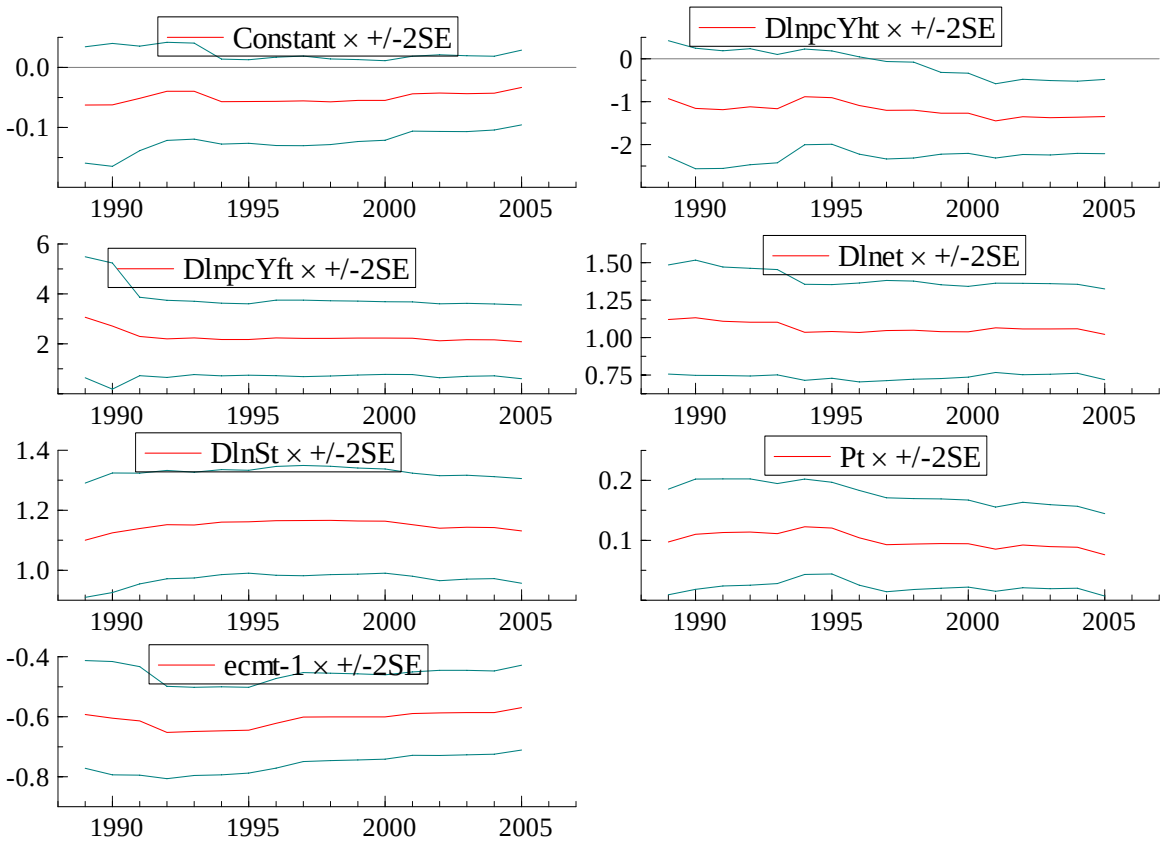

Figure 3: Recursive coefficients of consumption model (Equation 8) with ± SE

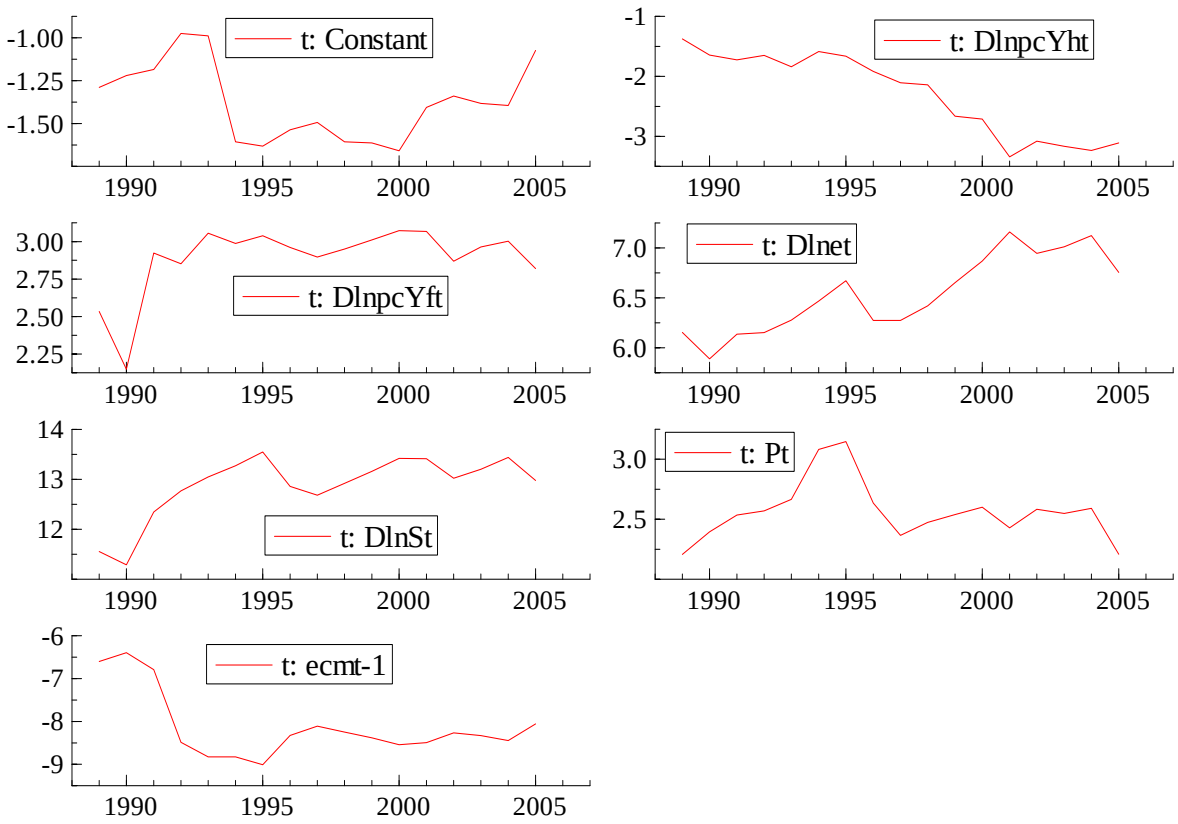

Figure 4: The recursive *t*-ratios

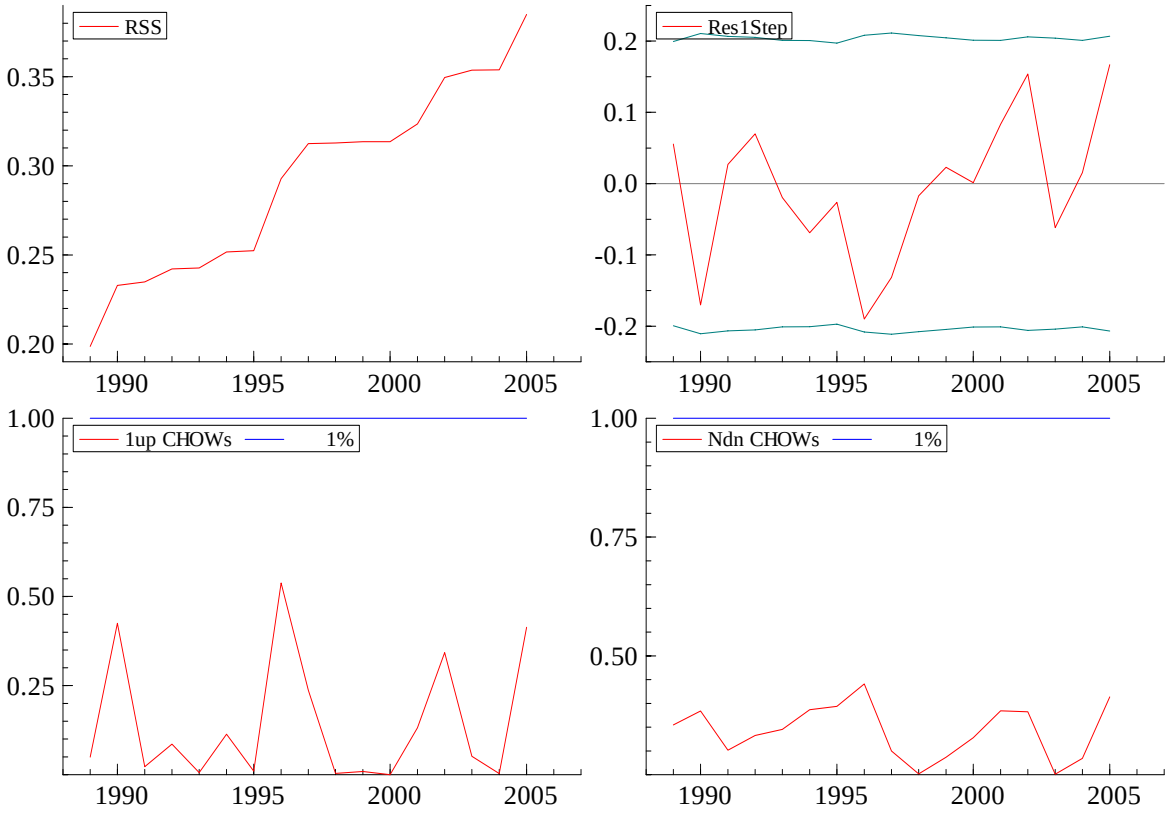

Figure 5: The residual sum of squares (RSS), one-step residuals and $0 \pm 2\hat{\sigma}_t$, one-step Chow statistics and breakpoint Chow statistics

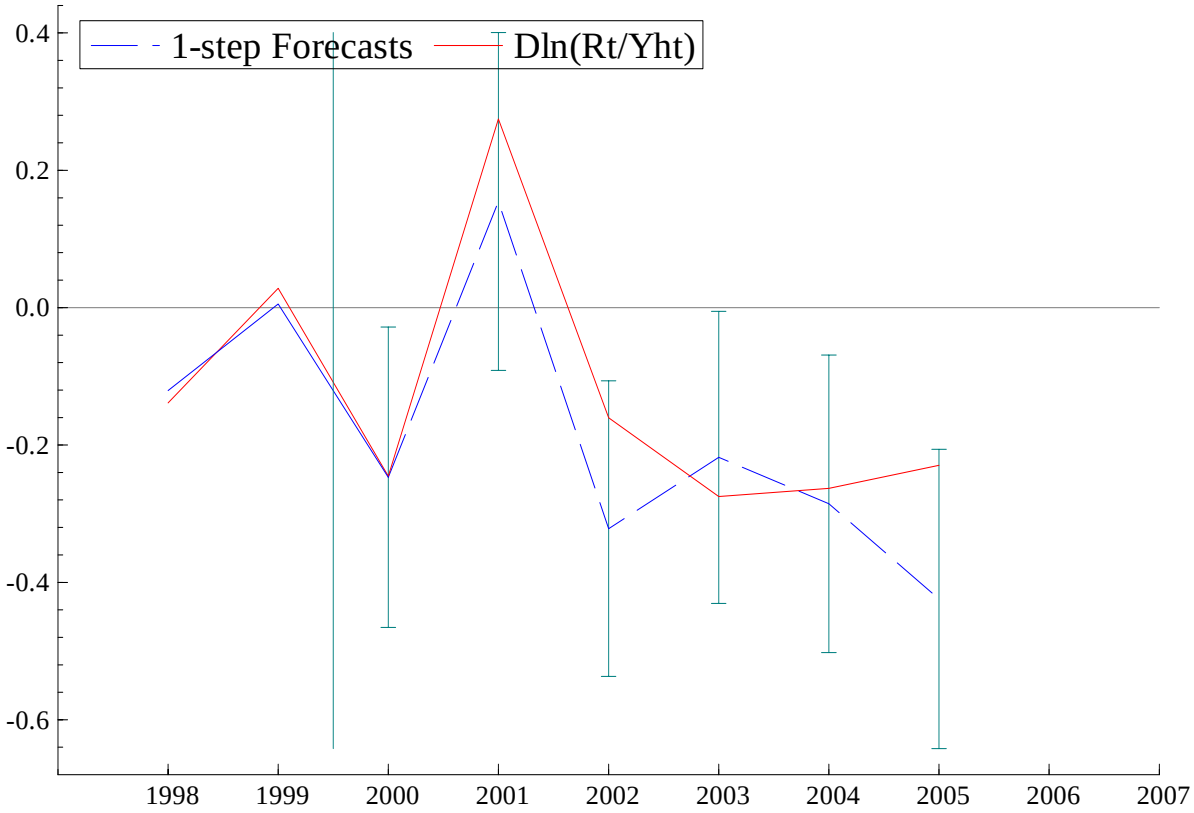

Figure 6: 1-step (ex-post) forecasts (dashed) for conditional model (8)

A Link Between Workers' Remittances and the Business Cycles in Germany and Turkey*

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Abstract

In this paper we examine the cyclical interactions between the remittances of the Turkish workers in Germany and the output both in Turkey and in Germany. In our analysis we introduce a new data set covering 1962-2004, which was never before used in the research literature and which we consider as a more reliable source than the data sets used in the other studies. By dividing the original sample into "recruitment", "family re-unification", and "naturalization" periods, we show that duration of migrants' stay in the host country affects the direction and strength of the relationship between remittances and the host and home country's business cycle.

Keywords: Migration; remittances; Turkey; Germany.

JEL classification: F22; J61; E32

1 Introduction

Turkish workers' official remittances from Germany constitute a large share (60% in 2002, before methodological change of the series of total workers' remittances to Turkey) of total official remittances to Turkey. During the 1970s and 1980s, total official remittances reached 4% of Turkish GDP, whereas official remittances from Germany comprised 3% of Turkish GDP — see panel (b) of Figure 1 — making Turkey one of the ten largest remittance receiving countries in the absolute terms. Despite a certain decrease that they have experienced during the last decades, remittances continue to play a very important role in the Turkish economy. They are not only one of the major sources of foreign exchange, but also a relatively stable source of foreign exchange compared to foreign direct investment and other private capital flows. Thus, during the period 1964-2005, Turkish workers' remittances from Germany totaled 47.5 billion euros, whereas the capital inflows and foreign direct investments from Germany only totaled 17.8 billion euros and 4.2 billion euros, respectively. In general, Ratha (2003) shows that in contrast to capital flows, the remittances are significantly higher in countries that are characterized by high risk and have a high level of debt relative to GDP.

The magnitude of remittances makes them an important factor affecting the cyclical fluctuations of the home country's economy. Clearly, the countercyclical (with respect to Turkish output) remittances help to alleviate the consequences of negative shocks, such as the economic crises of 1994 and 2001, while the procyclical remittances tend rather to magnify the adverse effects of such shocks and contribute to macroeconomic instability. It is, therefore, important to know whether remittances respond positively or negatively to movements of the home country's GDP. Although the fluctuations of remittances can hardly affect the output in the host country, the latter can exert a non-negligible impact upon the former and, in turn, upon the home country's output. Hence we also investigate the relationship between the host country's output and workers' remittances.

The contribution of this paper is twofold. First, we introduce a new time series of official remittances from Germany to Turkey stemming from the Deutsche Bundesbank. The other

authors, like Sayan (2004), Sayan (2006), and Sayan and Tekin-Koru (2007a,b), construct the remittances series based on a rather restrictive assumption that the share of Turkish workers' remittances from Germany remains constant over time. To the best of our knowledge, nobody else has used these data before to analyze the link between remittances and the business cycles in Germany and Turkey. The only paper that uses these data and that we know of is Köksal and Liebig (2005), but it is of a purely descriptive nature.

Secondly, we test the hypothesis that the cyclical characteristics of Turkish remittances from Germany may have changed over time by using a new, three-period classification. In fact, remittances may be pro-, counter- or acyclical during different periods, depending on the duration of migrants' stay in the host country. This argument was made before by such authors as Swamy (1981), Aydaş et al. (2005), and Sayan (2006). Sayan (2006) himself argued that remittances sent by Turkish workers in Germany were probably countercyclical until 1994 but turned procyclical afterwards. Sayan and Tekin-Koru (2007a) identified the turning point as 1992 rather than 1994. We further refined this analysis by considering three subperiods in the history of Turkish migration to Germany, which we call "recruitment", "family re-unification", and "naturalization" periods.

Section 2 describes different motives underlying the remitting behavior of the migrant workers. In section 3, our data set is introduced, whereas section 4 contains the econometric analysis of the data. Finally, section 5 concludes the paper.

2 Motives of the remitting behavior

The size and dynamics of the remittances depend on the decisions made by the workers. Therefore, their motivation is of crucial importance for the analysis of the cyclical interactions between the income of host and home countries, on the one hand, and remittances, on the other.

There are a number of theories, which try to identify the principal incentives of the workers sending remittances home. Most of these theories were documented in Lucas and Stark (1985) and Rapoport and Docquier (2005). We summarized their predictions with regard to the effects of the income in host and home countries upon the remittances in Table 1. The different theories of the motivation of the guest workers are listed in the rows, while the explanatory variables affecting the remittances are reported in columns. "+" ("–") means that the corresponding explanatory variable positively (negatively) affects the size of remittances, " ± " means that the influence can be both positive and negative, whereas "0" means that no influence exists. Below we consider these theories in more detail.

The most common motivation to remit is that migrants care about those left behind. This "altruistic" transfer increases with the migrant's income and decreases with the recipient's income. One extreme version of the altruistic model is the so-called "remittance maximization" approach Bhattacharyya (1985), where migrants are assumed to send a maximum amount of remittances back to their family. In this model, the level of income in the home country should not play any role in the remittance choice. The amount of remittances would depend almost entirely on the emigrants' own income in the host country.

The remittances may also be used in exchange for a wide range of services provided by the migrant's relatives living in the home country, such as taking care of migrant's assets. In this case the migrant has the intention to eventually return home. This is the "exchange" motive to

remit. The central prediction of the exchange motive theory is that an increase in the recipient's income leads to an increase in the remittances.

The "strategic" motive arises when migrants are heterogeneous in skills and individual productivity, which is not perfectly observable on the labor market of the host country. The skilled migrants bribe their unskilled compatriots in order to convince them to stay in the home country. In this way they can avoid the unnecessary competition that would drive their wages down. As in the case of altruistic transfers, the level of remittances is expected to be positively related with the migrants' pre-transfer income and to be negatively related with the recipients' pre-transfer income.

Due to the structural and technological characteristics of most developing countries, the income volatility plays an important role in the rural regions. In addition to this, imperfect credit and insurance markets in most developing countries cause a range of informal inter-and intra-familial coinsurance arrangements. Hence, provided that incomes in home and home countries are not positively correlated, it is beneficial to send some members of the family abroad. In this way, the remaining members of the family will be insured against drops in rural incomes. In reciprocation, they will provide assistance to the migrant in case of unemployment. If this Pareto-improving arrangement is not self-enforced by altruism, then different retaliation strategies can be imposed, such as denying the migrant's rights to future family solidarity, inheritance, or return to the village for retirement. This is the "insurance" motive and it gives similar predictions as the altruistic motive with respect to the sign of the effect that the income in the home country exerts upon remittances.

Hoddinott (1994) argues that there is a minimum amount of money that each migrant is expected to remit. Parents can encourage transfers above this minimum level by offering a "reward" in form of land or any other inheritable asset. In this "inheritance" motive theory, the remittances are seen as a pure strategy of investment in inheritance on the side of the migrant and as an enforcement device to secure remittances on the side of the family. The main prediction of this model is that the amount of remittances increases with migrant's wealth and income, but should be independent of the recipients' income.

Remittances are used as repayments on loans for investments in education and/or migration, according to the "investment" motive theory. If investments are the main familial motivation for sending migrants away, then the family will continue sending migrants as long as family income is increasing. However, migration costs and liquidity constraints limit the number of migrants that can be sent by a given family and that richer, but not too rich families are more likely to take advantage of the investment opportunities.

However, the literature finds that a combination of different motives explains the remitter's behavior better than a single motive. For example, Lucas and Stark (1985) explain the positive relationship between the level of remittances and the income in the home country by the mixture of exchange, investment, and inheritance motives. On the other hand, the response of the remittances to the short-run shocks to recipients' income is explained by either altruism or insurance motives. This complex mixture of motives can be described best of all by such concepts as "impure altruism" (Andreoni (1989)) or "enlightened selfishness" (Lucas and Stark (1985)).

The "macroeconomic" model of remittances explains the amount of remittances sent to the home country by the levels and fluctuations of economic activities in the host and home countries. The output per capita represents the general level of the development of a country.

The higher the development level of a country the more likely a negative relationship between the remittances and output per capita in the home country and a positive relationship between the remittances and output per capita in the host country exists. When economic conditions in the home country are favorable, the living standards of the migrant's relatives are improved and hence his willingness to send them remittances decreases. On the other hand, the improved economic well-being in the host country will increase the employment and earnings opportunities of the migrants and therefore encourage them to send more remittances. However, the short-run effect of the home country's income is ambiguous, as this variable captures the attractiveness of investing to the country. High income growth in the home country might reduce incentive to migrate and hence the remittances to the countries with high income growth will be smaller. At the same time, the migrants might want to invest in their high-growth home country and hence the remittances to this country will be bigger.

Most of the studies on determinants of remittances find that the host country income has a positive effect on remittances, see Swamy (1981), Straubhaar (1986), Katseli and Glytsos (1989), Elbadawi and Rocha (1992), Faini (1994), Hoddinott (1994), Lianos (1997), El-Sakka and McNabb (1999) and Aydaş et al. (2005). However, the regression of remittances on the home country's income delivers mixed results. While Lucas and Stark (1985), Ilahi and Jafarey (1999), Higgins et al. (2004) and Sayan (2004) favor the exchange and investment motives, Alper and Neyapti (2006) argue for the investment motive dominating in the long run and consumption-smoothing motive prevailing in the short run, Faini (1994), Katseli and Glytsos (1989), Glytsos (1997), Lianos (1997), and Agarwal and Horowitz (2002) support the altruistic motive, whereas Aydaş et al. (2005) indicate the importance of both altruistic and investment motives. In addition, some studies find the income in the host country to be statistically insignificant, see Lianos (1997) and El-Sakka and McNabb (1999). The most interesting results are obtained by Glytsos (1988) and Glytsos (1997): in Glytsos (1988) the domestic current and lagged per capita income in Greece have a positive sign for the 1960-1982 period supporting the self-interest motive. However, using a similar equation but with data for the period 1960-1993, Glytsos (1997) finds that the sign of Greek income per capita turns from positive to negative, suggesting an altruistic motive. He explains these results by the fact that after the early 1980s, many Greek temporary migrants in Germany turned into the permanent residents. Hence, the self-interest motive subsided and the altruistic motive became dominant. The migrants in Germany are behaving in the same way as their counterparts in the USA and Australia, whose remittances are negatively related to the Greek per capita income.

3 Data

We conduct our statistical analysis using the annual data covering the period 1962–2004. The data were taken from the databases of the Turkish Statistical Institute, Deutsche Bundesbank, OECD, and World Market Monitor and are listed in Table 2. The series of remittances to Turkey expressed in euros[1] were computed from the available data as shown in Table 2 and depicted in Figure 1.

Following Sayan (2004), as a proxy for the host country's income we use GNP, whereas as a measure of the home country's income we apply GDP. The logic behind this decision is the following: GNP is defined as GDP plus NFI (net factor income from abroad). NFI includes net remittance receipts and hence German GNP and Turkish GDP exclude remittances sent to Turkey by Turkish workers in Germany.

Although the data on workers' remittances are very difficult to measure, given the variety of legal and illegal transmission channels, we believe that the data we use do reflect the main tendencies.

It is worth stressing that, unlike in Sayan (2004), Sayan (2006), and Sayan and Tekin-Koru (2007a,b), our data are not constructed based on the authors' assumptions, but are directly measured and come from a reliable and accurate source such as the Deutsche Bundesbank. As far as we know, these data are employed for the business cycle research purposes for the first time in the literature. The only paper that also uses these data and that we are aware of is Köksal and Liebig (2005), but it has a purely descriptive nature. By contrast, previous studies used a remittance series, which was constructed from the official Turkish data on total remittances to Turkey. In these studies, the series of Turkish workers' remittances from Germany was constructed as a product of the total amount of remittances to Turkey and the share of Turkish workers residing in Germany in the total stock of migrant workers from Turkey. This share was set equal to 60% for all years, which implies quite a strong assumption that the share of remittances from Germany in total remittances remained unchanged. However, as one can see in Köksal and Liebig (2005), the share is far from being constant and has been varying from 24.3% to 139.3%[2] . Secondly, as Gallina (2006) mentions, the data from the official Turkish sources (Central Bank of Turkey), have undergone in 2003 a major methodological change, as result of which the pre-2003 data cannot be directly compared with the post-2003 data. From 2003 on the remittances series does not include anymore the transfers from the Turkish workers going to Germany with tourist visas but with an objective to earn money. This important component of remittances is now reported in the Balance of Payments under "tourism income" heading, see Gallina (2006). By contrast, data on remittances coming from the Deutsche Bundesbank are consistent over the whole period starting in 1962.

The official German indicator of the remittances, or transfers, by the workers to their country of origin (here Turkey), which is used in our study is calculated according to the balance of payments statistics. For this purpose guest workers are regarded as residents — they stay in Germany more than one year and are economically active. For the individual transfers the amount should be below 12,500 euros. Remittances to countries of origin are estimated using various statistical sources. For example, monthly collective reports on bank transfers are available for individual countries of origin, some of which also include payments below the reporting threshold. In addition, the Federal Employment Agency provides up-to-date data on the number and origin of employed and unemployed foreigners living in Germany who are subject to social security contributions. Furthermore, until 2002 the MARPLAN research society's annual report provided an indication of transfers to five of the most important countries of origin: Turkey, Italy, Spain, Greece, and the former Yugoslavia. The institute questioned 2000 foreigners living in Germany about transfers to their countries of origin. Additional estimates, complementing the bank transfers actually reported, are based on the information about the cash taken to those countries and about the amounts below the reporting threshold, which are not covered in the collective reports. In individual cases, the amount of remittances that appears in the collective reports can be reduced, if there are indications that these payments were made for other purposes.

The different transformations of the remittances from Turkish workers in Germany to Turkey are presented in Figure 1. The nominal remittances in euros shown in panel (a) attained their peak in 1984 and since then have been slowly declining. The decline is much more pronounced when the share of nominal remittances in the nominal Turkish GDP (panel (b)) is considered. The share achieved its maximum of 3.4% in 1973 and by 2004 it decreased

almost tenfold. The real remittances declined sharply after the peak of 1973 (see panel (c)), whereas the real remittances per migrant have been constantly decreasing since the beginning of 1960s with short interruption in the first half of 1970s (see panel (d) of Figure 1).

4 Econometric Analysis

The possible relationships between the business cycles in the host and home countries and real remittances sent to the home country by the Turkish workers in Germany are analyzed in a twofold way. First, the cross-correlations between the German real GDP and the Turkish real GDP, on the one hand, and real remittances expressed in euros, on the other hand, at different lags and leads were estimated. Secondly, the bivariate VARs were used in order to investigate the hypothesis of Granger causality between the German GNP/Turkish GDP and remittances. The VAR approach was chosen in order to take into account possible endogeneity problem. Although in case of Germany the remittances to Turkey can hardly affect the host country's income, in case of Turkey they play a much more important role and thus can influence the income of the home country. Unlike Aydaş et al. (2005) and Alper and Neyapti (2006), we do not use the regression analysis and follow the methodology of Sayan (2006) to investigate business cycle. We do not make a cross-country analysis since this might mask important cyclical characteristics of remittances received by each individual country, as suggested by Sayan (2006).

The analysis is undertaken using both the annual growth rates and the cyclical components. The annual growth rates were computed as the first differences of the logarithms of the original data. The cyclical components both of German GNP, Turkish GDP and of remittances were approximated, as in Sayan (2004), Sayan (2006), and Sayan and Tekin-Koru (2007a,b), by the Hodrick-Prescott filter with smoothing parameter $\lambda = 100$ applied to the logged series. We have also tried other values of this parameter suggested in the literature, namely: 6.25 as in Ravn and Uhlig (2002) and 400 as in Cooley and Ohanian (1991). However, the qualitative conclusions turned out to be the same regardless of the λ's value. Therefore, we report only the results obtained for $\lambda = 100$.

All the series were tested for unit-root stationarity, see Table 3. For testing purposes, Augmented Dickey-Fuller (ADF) test and Phillips-Perron test are employed. The specification of these tests includes four lags, a constant, and no trend. The tests were conducted using STATA 9.2. For the levels of almost all the series the null hypothesis of unit root cannot be rejected. The only exception is the real German GNP per capita, for which the null is rejected by the ADF test at 10% significance level and by Phillips-Perron even at 1% significance level. For the growth rates and cyclical components of the variables considered in this paper the null hypothesis can be rejected at conventional significance levels. ADF, however, accepts the null for the growth rate of real German GNP per capita and growth rate of real remittances. Nevertheless, given the short sample size and rejection of the null by the Phillips-Perron test we assume that these variables are stationary.

Across the whole period 1962-2004, a positive and significant cross-correlation between the German real GDP and real remittances expressed in euros is found at lag 1 — see Table 4. It implies that the German real GNP leads the remittances to Turkey by one year. This finding is robust to two types of transformations used in this paper: first-order differencing (growth rates) and application of Hodrick-Prescott filter (cyclical component). By contrast, the cross-correlations between the growth rate of the German real GNP and the growth rates of the real remittances per migrant are never significant implying no relationship between these two series.

A positive and significant correlation over the period 1962-2004 was only found between the growth rate Turkish GDP and growth rate of real remittances at lag 2 — see Table 4. All other cross-correlations are not significant.

The unrestricted bivariate VAR[3] estimated for the growth rates and cyclical components of the German GNP and remittances in euros across the whole period confirm the results of the cross-correlation analysis — see Table 7. The impulse-response analysis, conducted for the VARs based both on the growth rates and cyclical components, shows that after a positive impulse in German GNP the real remittances increase and their response remains positive and significant for about four years before converging to zero. These results do not change when the German unification dummy, which is equal to 1 in 1991 and to zero otherwise, is introduced in the estimation.

Neither the unrestricted bivariate VAR, including the growth rates of the real remittances per Turkish migrant in Germany and the growth rates of the German real GNP, nor the VAR, including the real remittances per Turkish migrant in Germany and the growth rates of the German real GNP per capita, show any Granger causality between these two variables.

The unrestricted bivariate VARs estimated for the growth rates and cyclical components of the Turkish real GDP and real remittances to Turkey expressed in euros over period 1962-2004 also lead to a rejection of Granger causality between the Turkish GDP and the remittances — see Table 8.

Likewise, no Granger causality is found, when the unrestricted bivariate VAR, which includes the growth rates of the real remittances per Turkish migrant in Germany and the growth rates of the Turkish real GDP, and the VAR, which includes the growth rates of the real remittances per Turkish migrant in Germany and the growth rates of the Turkish real GDP per capita, are estimated.

All this stands in a remarkable contrast to the findings of Sayan (2004) who found, using the quarterly data that covered the period 1987:1 to 2001:4, a positive relationship between cyclical components of the remittances of Turkish workers living in Germany and the business cycles in Turkey (i.e., cyclical components of the Turkish GDP), but no relationship between cyclical components of these remittances and those of the German GNP.

Such contradicting results were also obtained by other researchers examining workers' remittances to Turkey. For example, using annual data obtained from the Central Bank of Turkey, Aydaş et al. (2005) examined two different periods: 1965-1993 and 1979-1993. They came to a conclusion that the growth rate of Turkish GDP has a positive impact on official remittances of Turkish workers employed abroad. Furthermore, according to Aydaş et al. (2005), the growth rate of Turkish GDP exerts no significant impact upon the official remittances in per capita terms. By contrast, Alper and Neyapti (2006), who use monthly data from the Central Bank of Turkey covering the period from January 1992 to December 2003, conclude that the growth rate of Turkish GDP negatively affects official remittances of Turkish workers living abroad. Therefore, the difference in period under study and in the frequency of the data may yield different results.

Hence it might be meaningful to consider different subsamples. We decided to divide the whole period into three subperiods using the changes in the institutional environment of Turkish migrants in Germany as a criterion.

The first period is 1960-1974. It can be called a "recruitment" period, since from the beginning of 1960s and up to 1974, Turkish workers were massively recruited by Germany in order to fill the labor shortages in certain sectors caused by the very fast economic growth. In 1974, after the first oil shock took place, this growth was halted and Germans stopped recruiting Turkish workers. During this period, the Turkish workers migrated to Germany as guest-workers and their main aim was to save as much as they could in a short period of time and remit their savings home (maximization motive). Therefore, their remittances strongly depended on their wages and hence on the German income. As Tables 5 and 6 show, remittances were positively correlated with both German GNP and Turkish GDP. However, the maximum cross-correlation with German GNP is achieved at lag 0, whereas that with Turkish GDP — at lead 2. It means that German GNP affected the remittances, which, in turn, exerted an impact on the Turkish GDP. These results are confirmed by the Granger-causality analysis — see Tables 9 and 10. It shows that the German GNP was Granger-causing the remittances of Turkish workers, while between (cyclical component of) remittances and Turkish GDP there was a two-way causal relationship. This latter outcome can be easily explained, given a prominent role played by the workers' remittances in the Turkish economy at that period. Indeed, according to Köksal and Liebig (2005), in 1973, the total remittances of Turkish workers accounted for more than 4% of Turkish GNP and over 90% of Turkish exports.

The second period is from 1975 to 1990. It can be called a "family re-unification" period. During this period Turkish workers in Germany reunited with their families, which came from Turkey. This implied that there was no need for them anymore to send any remittances to Turkey. As can be seen in Köksal and Liebig (2005), already in 1976 the share of total remittances in Turkish GNP experienced more than a double decline, whereas that in Turkish exports dropped to about 50%. After 1975, the remittances from Germany have been constantly declining. The cross-correlations between German GNP and remittances were mostly not significant, except the cross-correlation between German GNP per capita and remittances per migrant, which is significantly negative. The cross-correlations between Turkish GDP and remittances are negative and significant. This counter-cyclicality can be explained by the fact that Turkish migrants moved by the altruistic motive continued to send money to the rest of their relatives in Turkey, whose living standards suffered a lot from the economic crises in the 1970-1980s. These results are consistent with Sayan (2006) and Sayan and Tekin-Koru (2007a,b) who found, using the quarterly data from 1987:1 through 1992:4, that the remittances were acyclical with respect to German GNP and counter-cyclical with respect to Turkish GDP.

The third period covers the data from 1993 to 2004. We shall call it a "naturalization period". A citizenship law adopted by Germany in 1992 facilitated acquisition of German citizenship by the Turkish residents in Germany. It thus led to "weakening the bonds of those who chose to become German citizens with any relatives that might have been left in Turkey, and changing their decisions about the length of stay in Germany", see Sayan and Tekin-Koru (2007b)[4]. The results in Tables 9 and 10 show that the remittances were positively, however, not always significantly correlated with German GNP. This pro-cyclicality with respect to the host country's income is a conventional finding. Aggregate remittances are positively but not significantly correlated with Turkish GDP, whereas remittances per migrant are negatively and significantly correlated with Turkish GDP per capita. The positive correlation between Turkish GDP and remittances in the third period is also found in Sayan (2006) and Sayan and Tekin-Koru (2007a,b). However, their correlations are significant. The differences between their results and ours can be explained by the difference in the data sets. They use quarterly

data covering the period 1987:1-2003:4 and their measure of remittances is different. Sayan (2006) and Sayan and Tekin-Koru (2007a,b) argue that such a switch from counter- to pro-cyclicality can be explained by a host of factors, including the major economic and financial crises of the 1994 and 2001, which negatively affected the workers' remittances. By contrast, our data cover an additional year 2004, which was relatively prosperous for Turkey and might have contributed to the improvement of the investment environment. Therefore, negative effects on remittances in 1990-2001 might be offset by the positive effects in 2002-2004. Moreover, the above mentioned studies do not use the per capita magnitudes. The significantly negative correlation that we observe between Turkish GDP per capita and remittances per migrant can be explained by the fact that in 1990s the growth of Turkish population in Germany had decelerated compared to 1970-1980s when the family re-unification took place. Therefore while the Turkish GDP per capita during these two periods grew with basically the same rate (around 2%), the growth rate of remittances per migrant from Germany became much less negative (-8.5% in 1975-1990 and -4.8% in 1993-2004). Hence, the negative cross-correlation in the third period. The results of the cross-correlation analysis are also supported by the Granger-causality test. As Tables 9 and 10 show, the German GNP is many cases Granger-causing remittances, while Turkish GDP is almost never Granger-causing remittances.

5 Conclusions

The aim of this paper was to determine whether the workers' remittances are counter-, pro- or acyclical with respect to the output in the host country (Germany) and home country (Turkey).

When considering the whole period from 1962 through 2004 we came to a conclusion that remittances positively respond to changes in the economic activity in the host country and are acyclical to the changes in the economic activity in the home country.

However, one must be careful when interpreting these results. It should be taken into account that the remitting behavior may change over time depending on the duration of migrants' stay in the host country. Therefore, we divided the whole sample in three subperiods: 1962-1974, 1975-1990, and 1993-2004. The first period that we called a "recruitment period" ended when Germany stopped recruiting the Turkish workers. The second period, or "family re-unification period", was characterized by the Turkish workers reunited with their families in Germany. Finally, the third period, or "naturalization period", started when Germany adopted a citizenship law, which facilitated the naturalization of Turkish residents in Germany.

In the first period, the Turkish workers considered themselves as guests in the host country and thus were trying to maximize their remittances to Turkey. This is confirmed by our findings, which show that German output was positively affecting remittances, which, in turn, exerted a positive impact upon Turkish output. In the second period, when the families have been already reunited the remittances became acyclical both to host and to home country's output, although Turkish workers kept sending relatively small amount of remittances out of pure altruism. In the third period, the naturalization of Turkish residents in Germany and economic and financial turmoil in Turkey made the remittances procyclical to German output and acyclical to that of Turkey.

References

Agarwal, R. and A. W. Horowitz (2002). Are international remittances altruism or insurance? Evidence from Guyana using multiple-migrant households. World Development 30, 2033–44.

Alper, A. and S. Neyapti (2006). Determinants of workers' remittances: Turkish evidence from high frequency data. Eastern European Economics 44, 91–100.

Andreoni, J. (1989). Giving with impure altruism: Applications to charity and Ricardian equivalence. Journal of Political economy 82, 1121–66.

Aydaş, O. T., K. Metin-Özcan, and B. Neyapti (2005). Determinants of workers' remittances: The case of Turkey. Emerging Markets Finance and Trade 41, 53–69.

Bhattacharyya, B. (1985). The role of family decision in internal migration. Journal of Development Economics 18, 51–66.

Cooley, T. F. and L. E. Ohanian (1991). The cyclical behavior of prices. Journal of Monetary Economics 28 (1), 25–60.

El-Sakka, M. I. T. and R. McNabb (1999). The macroeconomic determinants of emigrant remittances. World Development 27 (8), 1493–1502.

Elbadawi, I. A. and R. Rocha (1992). Determinants of expatriate workers' remittances in North Africa and Europe. Policy Research WPS 1133, The World Bank.

Faini, R. (1994). Workers remittances and the real exchange rate: A quantitative framework. Journal of Population Economics 7, 235–45.

Gallina, A. (2006). The impact of international migration on the economic development of countries in the Mediterranean basin. mimeo.

Glytsos, N. P. (1988). Remittances in temporary migration: A theoretical model and its testing with the Greek-German experience. Weltwirtschaftliches Archiv 124 (3), 524–548.

Glytsos, N. P. (1997). Remitting behaviour of "temporary" and "permanent" migrants: The case of Greeks in Germany and Australia. LABOUR 11 (3),
409–435.

Higgins, M. L., A. Hysenbegasi, and S. Pozo (2004). Exchange-rate uncertainty and workers' remittances. Applied Financial Economics 14 (6), 403–411.

Hoddinott, J. (1994). A model of migration and remittances applied to Western Kenya. Oxford Economic Papers 46, 459–476.

Ilahi, N. and S. Jafarey (1999). Guestworker migration, remittances and the extended family: Evidence from Pakistan. Journal of Development Economics 58, 485–51.

Katseli, L. T. and N. P. Glytsos (1989). Theoretical and empirical determinants of international labour mobility: A Greek-German perspectives. In I. Gordon and A. P. Thirlwall (Eds.), European Factor Mobility: Trends and Consequences, pp. 95–115. The MacMillan Press.

Köksal, E. and T. Liebig (2005). Principal channels and costs of remittances: The case of Turkey. In Migration, Remittances and Development, pp. 103–122. OECD.

Lianos, T. P. (1997). Factors determining migrant remittances: The case of Greece. International Migration Review 31, 72–87.

Lucas, R. E. B. and O. Stark (1985). Motivations to remit: Evidence from Botswana. Journal of Political Economy 93, 901–18.

Rapoport, H. and F. Docquier (2005). The economics of migrants' remittances. IZA Discussion paper 1531.

Ratha, D. (2003). Workers' remittances: An important and stable source of external development finance. In Global Development Finance: Striving for Stability in Development Finance, pp. 157–175. World Bank.

Ravn, M. O. and H. Uhlig (2002). On adjusting the Hodrick-Prescott filter for the frequency of observations. The Review of Economics and Statistics 84, 371–380.

Sayan, S. (2004). Guest workers remittances and output fluctuations in host and home countries: The case of remittances from Turkish workers in Germany. Emerging Markets Finance and Trade 40, 68–81.

Sayan, S. (2006). Business cycles and workers' remittances: How do migrant workers respond to cyclical movements of GDP at home? IMF Working Papers 06/52, International Monetary Fund.

Sayan, S. and A. Tekin-Koru (2007a). Business cycles and remittances: A comparison of the cases of Turkish workers in Germany and Mexican workers in the US. In R. Lucas, L. Squire, and T. Srinivasan (Eds.), The Impact of Rich Country Policies on Developing Countries. London: Edward Elgar. forthcoming.

Sayan, S. and A. Tekin-Koru (2007b). Remittances, business cycles and poverty: The recent Turkish experience. International Migration. forthcoming.

Straubhaar, T. (1986). The determinants of workers' remittances: The case of Turkey. Weltwirtschaftliches Archiv 122, 728–740.

Swamy, G. (1981). International migrant workers' remittances: Issues and and prospects. World Bank Staff Working Paper No. 481.

Footnotes:

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Footnote 1: All the variables, which are measured in euros, were taken in such a form from the statistical sources mentioned in Table 2. For the periods preceding the introduction of the euro they were converted into euro using conversion rates between corresponding currencies and ECU.

Footnote 2: The share is computed by dividing the German series of remittances from Germany over the Turkish series of total remittances, both expressed in US dollars. Therefore, due to the differences in the composition of the numerator and denominator the share is sometimes bigger than 100%.

Footnote 3: The lag order for each VAR was determined based on the standard information criteria.

Footnote 4: We have purposefully dropped the years 1991 and 1992. The former was strongly affected by the German re-unification and it is reflected in a sudden jump in the growth rate of German GDP. In 1992 the adoption of the citizenship law led to a one-time jump in the remittances, which did not persist in the following years. Thus, both years can be treated as outliers.

The effect of economic reforms of 1980s and of the Customs Union 1996 upon the Turkish intra-industry trade[¶]

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Abstract

In this paper we analyze the impact of the economic reforms implemented in 1980s and of the Custom Union Agreement of 1996 on the intra-industry trade in Turkey. Using the panel data for 15 trading partners of Turkey and the sample period from 1970 until 2005, we record the positive impact of both reforms with the former reforms exercising stronger influence on the intra-industry trade measured either by the Grubel-Lloyd or the Brülhart's indices. We also control for other factors like economic size, difference in income per capita and in economic size between Turkey and its trading partners in our empirical regressions.

Keywords: Intra-industry trade; Customs Union Agreement; panel data estimation.

JEL classification: C23; F14

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1 Introduction

In this paper we are trying to assess the effect of two major trade liberalizing reforms, which took place in Turkey in 1980s and 1996, upon the intra-industry trade between Turkey and the European Union.

The first reform package was implemented in the early 1980s when the profound revision of the earlier pervasive growth strategy based on import substitution and which was characterized by fixed exchange rates, import regulation based on quotas, and high protection measures of the domestic industries was undertaken. In response to the severe economic crises during the period of 1978-1980, which led to the political and social tensions in the society, the Turkish government adopted the export-led growth strategy accompanied by gradual import liberalization, more flexible exchange rate regime, and more effective export incentive programs. Other measures such as reduction of nominal tariff rates, substantial reduction of quantitative import restrictions and of bureaucratic controls over imports were introduced gradually during 1983-1984. An excellent and very detailed account of these reforms is given in Arıcanlı and Rodrik (1990) and in Krueger and Aktan (1992).

The export performance of the Turkish economy following these reforms was impressive. It manifested itself not only in rapidly expanding total volume of exports (2.9 billion USD in 1980 and 11.7 billion USD in 1988) but also in significant changes in the export decomposition in favor of manufac-

tured goods (share of manufactured goods in total export rose from 36% in 1980 to 79% in 1988). The impact of the reform package introduced in 1980 not only on trade but on the whole Turkish economy is well documented in Arıcanlı and Rodrik (1990) and in Krueger and Aktan (1992) using purely descriptive analysis. Utkulu et al. (2004) using the error-correction models with step dummy for 1980 analyze the effect, which the reforms of 1980s had exerted on the export supply, and come to a conclusion that these reforms were indeed successful in encouraging Turkish exports.

The second major reform aimed at economic liberalization was put in action on January 1, 1996 when a bilateral Customs Union Agreement (CUA), pursuant to the 1963 EU-Turkey Association Agreement, came into force. This agreement constitutes another important milestone on the long path of Turkey to economic integration with the countries of the European Union (EU) and to the ultimate goal of acquiring the membership in EU. According to the CUA, Turkey has abolished all custom duties, quantitative restrictions, and charges having equivalent effect to quantitative restrictions for industrial products and the processed components of agricultural products in trade with EU. Moreover, a common external tariff policy against third countries imports was adopted. The CUA also promoted further integration measures undertaken by Turkey such as the adoption of the EU commercial policy towards third countries as well as of the free trade agreements with all the EU's preferential trade partners. Also a number of legislative changes affecting such areas as agriculture, restrictions on trade in services, compe-

tition policy, state aid, anti-dumping, intellectual and industrial property rights, public procurements and technical barriers to trade were introduced with the purpose of harmonization of those with those of the European Community (Seymen, 1998).

The CUA had also noticeable effect on Turkish trade with EU. This mainly manifested itself in a tenfold increase in imports from EU-10 and a more than fivefold increase of Turkish exports to EU-10 over 1996-2005, both figures being significantly higher than the increase in total imports and exports of Turkey. The investigation of the overall effect of the CUA on Turkish economy (e.g., welfare, production, and employment) has been mainly conducted using the general equilibrium models (Mercenier and Yeldan, 1997; Harrison et al., 1997; Togan, 1997; De Santis, 2001, *inter alia*). The specific effect of CUA upon the Turkish exports and imports is analyzed in Neyaptı et al. (2004). When estimating the exports and imports equations, apart from the standard independent variables, they use two step dummies: one for the reforms of the 1980s and another for the CUA of 1996. Neyaptı et al. (2004) conclude that the Customs Union between Turkey and the EU has led to a significant increase in the Turkish trade.

Thus, there exists a vast literature that measures the impact of these two trade liberalization reforms on the Turkish export and import performance as well as on the Turkish economy as a whole. At the same time, there is rather limited number of studies that go a step further in analysis of the (changing) trade pattern in Turkey by assessing the impact of these reforms

on the intra-industry trade (IIT), as one can see from Table 1.

Based on the empirical evidence for the developed countries one would expect that trade liberalization between the economic partners leads to a closer economic integration and as a consequence promotes the intra-industry rather than inter-industry trade (Balassa, 1966; Grubel and Lloyd, 1975). A rising share of intra-industry trade suggests that the adjustment costs incurred during the structural changes in the foreign trade will be smaller. This is because the large share of IIT means that the trade partner countries are specialized in different varieties of the same goods rather in completely different goods. When the trade structure changes, capital and labor, which were formerly employed in the declining firms, can relatively easier move to expanding firms within the same industry as compared to moving to the firms in the other expanding industries. Thus, an increase in the IIT share in the aftermath of the liberal trade reforms implies that the balance between the costs and benefits of these reforms would be more beneficial for the liberalizing country.

The tendency of the IIT to increase in the wake of economic integration is known as the "smooth adjustment hypothesis" — see Greenaway and Milner (2006) — and has special importance for Turkey. Like in Europe in 1960s the creation of the European Economic Community raised concerns about the potential adjustment frictions, the current economic integration between Turkey and European Union may lead Turkish public to fear that the economic toll of this integration may be so high that the game will not be worth

the candles. Our objective is to investigate whether these concerns are justified by checking the hypothesis that the economic reforms of 1980s and Customs Union Agreement of 1996 led to a significant increase in the IIT.

To the best of our knowledge, there are only two studies that assess the impact of the economic reforms of 1980s on the Turkish intra-industry trade. Kösekahyaoğlu (2002) uses the 1975-1990 data in order to investigate the changes in the intra-industry trade brought about by the reform of the 1980s. For this purpose, he uses the Grubel-Lloyd (GL) index and Brülhart's index A. His main conclusion is that the reform resulted in increase not only of the level but also of the proportion of the intra-industry trade. Erlat and Erlat (2003) elaborate further on the analysis of Kösekahyaoğlu (2002) considering much wider selection of the indices that measure the extent of the intra-industry trade, like the unadjusted GL, weighted GL, Brülhart's weighted A, B, C indices, and the Menon's index for unmatched changes in trade (UMCIT), as well as the horizontal and vertical IIT measures. Their main results can be summarized as follows: 1) According to the aggregated GL index, the rate of IIT is greater in the post-1980 period, but the Turkey's trade has still an inter-industry nature. 2) According to the aggregated Brülhart's A index, there had been a significant change in marginal IIT (MIIT) between the pre- and post-1980 periods. The number of sectors with Brülhart's index B exceeding 0.5 in absolute value has considerably increased since 1980 and for most of these sectors the increase in exports dominates the increase in imports. 3) For the sectors with the highest MIIT, it is found

that decrease in adjustment costs after 1980 due to changes in IIT, measured by the Brülhart's C index, was larger than the increase in these costs due to changes in net trade, measured by UMCIT.

Note that these two studies present their conclusions about the impact of the reform of 1980s on the intra-industry trade based on the purely descriptive analysis of the calculated indices for the pre- and post-reform periods. In doing so, they do not control for other factors that might have influenced the developments of the IIT, e.g., relative economic size of the trading partners, per capita income difference, distance, etc. (for the detailed overview of the potential factors see Ekanayake (2001)). Moreover, these two studies do not investigate the consequences of the CUA 1996.

In addition to the literature that tries to detect the changing pattern of the IIT in the aftermath of the trade liberalizing reforms, there also exists a number of studies that address the determinants of the intra-industry trade between Turkey and its partners, represented by Çepni and Köse (2003), Emirhan (2002, 2005), and Türkcan (2005), *inter alia* — see Table 1. These studies employ the panel data estimation techniques in order to determine factors shaping the IIT pattern. However, none of these studies tries to measure the impact of the trade liberalization reforms initiated either in 1980s or in 1996 or both on the pattern of the intra-industry trade for Turkey. Given that these reforms might have caused changes in the pattern of the IIT – as argued in Kösekahyaoğlu (2002) and in Erlat and Erlat (2003) –, not allowing for this possibility on the *a priori* grounds may be questionable.

Thus, the novelty of this paper is that it constitutes the first attempt in the related literature on Turkish trade that carries out the econometric analysis in order to test the statistical hypotheses on whether the trade liberalization reforms of the 1980s and the CUA of 1996 had any impact on the pattern of the intra-industry trade of Turkey with its trading partners. For this purpose, we employ the panel data estimation techniques used also in previous studies but, in addition, we allow for the existence of structural breaks in the pattern of the IIT that might have been caused by these two major reforms. We employ the panel data that cover Turkish external trade with the OECD countries (12 EU countries plus Canada, Japan, and USA) for the period from 1970 through 2005.

The rest of the paper is organized as follows. Section 2 discusses the measures of the IIT that will be employed in this study. In section 3 a brief review of the literature on the IIT in Turkey is made. Section 4 contains the description of the econometric model, which we apply to assess the effects of the trade reforms of the 1980s and of the CUA upon the Turkish IIT, and the estimation results. Finally, section 5 concludes the paper.

2 IIT measures

The intra-industry trade is defined as the difference between the total trade (sum of exports and imports) and the absolute value of the net trade, or

inter-industry trade. More formally:

$$IIT_{it} = (X_{it} + M_{it}) - |X_{it} - M_{it}| \tag{1}$$

where X_{it} and M_{it} are respectively the exports and imports of industry i in period t, $X_{it} + M_{it} \equiv TT_{it}$ is the total trade, and $|X_{it} - M_{it}| \equiv NT_{it}$ is the net trade.

There exist several static and dynamic measures of the degree of intra-industry trade. We are going to concentrate here on two of them: the Grubel-Lloyd index (static measure) suggested by Grubel and Lloyd (1975) and the Brülhart's A index (dynamic measure) proposed by Brülhart (1994).

The **unadjusted Grubel-Lloyd index** (GL index) is defined as:

$$GL_{it} = 1 - \frac{|X_{it} - M_{it}|}{X_{it} + M_{it}} \tag{2}$$

By construction the Grubel-Lloyd index varies in the interval between 0 and 1. An index value of 0 indicates complete inter-industry trade. In this case either the value of exports or imports is zero. Higher index values are associated with greater proportion of the intra-industry trade in total trade. When the index value is equal to 1, the exports and imports are equal.

Below, in our empirical model we use the **aggregated Grubel-Lloyd index** encompassing several industries and which is computed as the weighted average of the industry indices formulated in (2), where the weights are based

on the share of each particular industry in total trade:

$$GL_t = 1 - \frac{\sum_{i=1}^{I} |X_{it} - M_{it}|}{\sum_{i=1}^{I} (X_{it} + M_{it})} \tag{3}$$

where I is the number of industries or commodities. This number reflects the level of aggregation used to identify the industries, for which the individual GL indices are to be computed. As Vona (1991) shows, the magnitude of the aggregated GL index depends on the level of aggregation. This is known as categorical aggregation problem and may lead to the wrong conclusions (under- or overestimation of the level of IIT) if the industries are not properly defined.

The literature, especially that concerned with the Turkish IIT, also uses the so-called **adjusted GL index**. It is adjusted for the trade imbalances, i.e., for the overall trade deficits. The need of such an adjustment was justified by Grubel and Lloyd (1975) and Aquino (1978), who came up with two different adjusted indices. However, as Vona (1991) argued, the correction for the trade imbalance is not needed at all because it "raises more empirical problems than it solves and does not present any clear link with theoretical considerations..." (Vona (1991), p. 690). Therefore in our analysis we will confine ourselves only to the unadjusted GL index.

The second IIT measure we are going to use in this paper is the marginal IIT index of Brülhart, or more specifically **Brülhart's index A**, which was

suggested in Brülhart (1994) and is formulated as:

$$BA_{it} = 1 - \frac{|\Delta^h X_{it} - \Delta^h M_{it}|}{|\Delta^h X_{it}| + |\Delta^h M_{it}|} \tag{4}$$

where Δ^h is the difference operator of order h, that is, $\Delta^h X_{it} = X_{it} - X_{it-h}$.

BA_{it} also varies between 0 and 1 and has similar interpretation to that of the Grubel-Lloyd index, i.e., the higher (lower) is this index the more (less) important is the intra-industry trade compared to the inter-industry trade. Brülhart (1994) claims that GL index is "static", that is, its changes between two period do not necessarily imply corresponding changes in the intra-industry trade, since they can be also caused by the changes in the inter-industry trade. By contrast, his index is "dynamic" and comparing its values across different periods conveys trustworthy information about the evolution of the intra-industry trade. In fact, by taking into account the changes in trade the Brülhart's index A measures IIT in new trade.

The aggregated Brülhart's index A, that is used below in our empirical model, can be obtained as a weighted average of the individual Brülhart's A indices:

$$BA_t = \sum_{i=1}^{I} \left[BA_{it} \times \frac{|\Delta^h X_{it}| + |\Delta^h M_{it}|}{\sum_{i=1}^{I} \left(|\Delta^h X_{it}| + |\Delta^h M_{it}| \right)} \right] \tag{5}$$

Oliveras and Terra (1997) found that like the aggregated GL index the aggregated Brülhart's index A is also subject to the categorical aggregation

problem. However, unlike the GL index it is not necessarily growing with the level of aggregation. The effect of the aggregation level upon the value of aggregated index can be either positive or negative depending on the signs of the subsector indices and of the changes in exports and imports.

3 Empirical studies of Turkish IIT

The up-to-date studies concerning the Turkish IIT have been summarized in Table 1. The table reports the time span, the range of traded commodities, Turkish trade partners, measures, and methodologies, which have been used in the studies, as well as the final results, which were obtained by the researchers.

From the technical point of view, most of the papers on Turkish IIT listed in Table 1 (7 out of 12) are of a descriptive nature. It means that they are simply computing various IIT measures explained in section 2 and comment on them. (Emirhan (2002) run simple linear regression using IIT as dependent variable and trying to identify its determinants, whereas Çepni and Köse (2003)) use for the same purpose the fixed effects panel data model. (Erlat and Erlat (2006)) estimate the dynamic panel data model using GMM, where IIT plays a role of independent variable, to figure out if IIT does really affect the employment in the related industries. Finally, there are two papers (Emirhan (2005) and Türkcan (2005)) that take advantage of the cross-section and time dimensions of the available data and estimate

the panel data models in order to determine the variables affecting IIT as a whole as well as horizontal and vertical IIT.

From the viewpoint of data used, most of the papers deal with the exports and imports data classified according to the SITC. 2 papers use the 5-digit data, 6 papers use the 3-digit data, whereas the remaining 4 papers work with the 2-digit data. Most of the papers consider all the industries (from 0 to 8), while few papers concentrate exclusively on the manufacturing (groups 5-8 of SITC).

The coverage of the trade partners of Turkey included into analysis varies substantially. However, most (8 of 12) of the papers examine the IIT between Turkey and some or all the EU members. This reflects the importance of Europe for Turkish foreign trade.

The earliest period considered in all these papers is 1965, whereas the latest is 2002.

Finally, most of these studies agree upon a general increase of the IIT in Turkey over the last years.

4 Panel data estimation

The paper uses the 3-digit SITC annual data on Turkish imports and exports with 15 industrialized countries — 12 EU countries (Austria, Belgium-Luxemburg, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, and United Kingdom) plus three developed economies out-

side of Europe (Canada, Japan, and USA) — over the period 1970-2005. In addition, the data on the real GDP of Turkey and its trade partners are used. The data are described in Table 2.

The selection of the countries was motivated based on several grounds. First, all these countries enter the list of the top 40 trade partners of Turkey and account together for about 50% of Turkish trade, according to the 2005 data available at the website of the Turkish Undersecretariat of the Prime Minister for Foreign Trade. Second, most of them belong to the EU, which is important, since the CUA was signed between Turkey and the EU and is expected to be a step towards the integration of Turkey into the EU, whereas other countries were taken to represent the rest of the world. Third, all these countries are developed economies, which guarantees certain homogeneity of the sample and controls for the level of economic development.

Consider first the overall dynamics of the IIT as measured by the GL and Brülhart's A[1] indices — see Table 3. The IIT measures for the 12 EU countries are slightly higher than those for the whole sample. In addition, the GL and Brülhart's A indices computed for the manufacturing goods trade only (groups 5-8) are higher than those computed for the whole trade. It can also be concluded from the table that the IIT, regardless of the index used, has been increasing from 1970 until 2005. The increase was not, however, steady and was interrupted two times: in the 1970s — most probably due

[1]Brülhart's A index was computed using the first differences of logs of trade data, that is, on the annual growth rates.

to the oil shocks — and in the early 1990s — due to the 1994 crisis that hit Turkish economy. After 1995 there has been a remarkable increase in the IIT, which far exceeded its development during the preceding 25 years. Thus, the increasing importance of IIT in the Turkish foreign trade stresses the utility of the econometric analysis that we are going to undertake.

The model we used to assess the impact of the two liberalization episodes — the reforms of the 1980s and the Customs Union Agreement — contains both the country determinants of the IIT and the dummy variables controlling for the economic reforms in 1980s, CUA 1996, and membership in the EU. The country determinants are as those in Ekanayake (2001), where probably the most comprehensive list of determinants is presented, except that our model does not include the trade orientation, common language, and common language variables. The original model is defined as follows:

$$ln(\frac{IIT_t^i}{1 - IIT_t^i}) = \beta X_t^i + \epsilon_t^i \tag{6}$$

where IIT_t^i is a measure of IIT between Turkey and its trade partner i. Since the dependent variable is bounded within the interval between 0 and 1, we had to apply to it the logit, or log-odds, transformation as in left-hand side of equation (6). This transformation is common in the literature and is used, for instance, in Balassa and Bauwens (1988). It is applied because the original IIT index is bounded within the interval [0,1], whereas the predictions of the model on the right-hand side in principle are not bounded. We do not use

here the logit or probit model, which are suggested as an alternative to log-odds transformation in Balassa and Bauwens (1988), because the dependent variable in these models is binary and thus they are inappropriate in our case.

Four different dependent variables were constructed: two GL indices (one for the whole Turkish trade covering the SITC categories 0 through 8 and one for the Turkish manufacturing trade covering the SITC categories 5 through 8) and two BA indices (one for the whole trade and one for the manufacturing trade).

X_t^i is the matrix of regressors and it contains the following independent variables:

1. $RGDP_t^i$ is the real GDP of the Turkey's trade partner i;

2. $Size\_Ineq_t^i$ is the size inequality between Turkey and its trade partner i defined as in Balassa and Bauwens (1988) to take values between 0 and 1: $Size\_Ineq_t^i = 1 + \frac{w_t ln(w_t) + (1-w_t) ln(1-w_t)}{ln(2)}$, where $w_t = \frac{RGDP_t^{TUR}}{RGDP_t^{TUR} + RGDP_t^i}$;

3. $RGDP\_PC_t^i$ is the real GDP per capita of the Turkey's trade partner i;

4. $Income\_Ineq_t^i$ is the indicator of income inequality between Turkey and its trade partner i defined in exactly the same way as the size inequality variable with $w_t = \frac{RGDP\_PC_t^{TUR}}{RGDP\_PC_t^{TUR} + RGDP\_PC_t^i}$;

5. $TINT_t^i = \frac{X_t^i + I_t^i}{X_t + I_t}$ is the trade intensity variable for the trade partner i;

6. $DIST_t^i = DIST\_KM_t^i \times \frac{RGDP_t^i}{\sum_j RGDP_t^j}$, where $DIST\_KM_t^i$ is the distance in kilometers between Ankara and the capital city of its trade partner i.

7. $SD1980$ is the step dummy variable capturing the reforms of 1980s, which is equal to 0 up to 1979 and 1 otherwise;

8. $SD1996$ is the step dummy capturing the Customs Union Agreement, which is equal to 0 up to 1995 and 1 otherwise;

9. SD_EU_i is the step dummy variable for EU membership of the Turkey's trade partner i, which is equal to 1 since the moment this particular country entered the EU and is equal to 0 otherwise (obviously, for Canada, Japan, and USA this variable is always equal to 0).

10. $EU\_SD1996 = SD1996 \times SD\_EU_i$ is the step dummy capturing the effect of CUA upon the EU countries.

The model (6) was estimated using the panel data regression with fixed effects. All the estimations were conducted using the panel data module of PcGive 10.3 — see Doornik and Hendry (2001).

The results of estimation of the corresponding four models are reported in Table 4. The model specification includes three economic variables[2] and two step dummy variables. The former group of variables corresponds to the economic determinants of the level of the intra-industry trade, whereas

[2]The economic variables $TINT_i$ and $DIST_i$ turned out to be insignificant and were left out from the model specification.

the latter group of variables captures the effects of the economic reforms undertaken in early 1980s and in 1996.

The coefficient estimates of the real GDP of Turkey's trade partner, size inequality, and income inequality appear to be different from zero at the usual significance levels and that holds true for all model specifications reported in Table 4, whereas the real GDP per capita of Turkey's trade partner, trade intensity, distance, and the dummy variable SD_1996 turned out to be statistically not significant. The signs of the estimates are as implied by the economic theory. Thus, our estimation results suggest that the greater the discrepancy in per capita incomes between Turkey and its trading partners the lower intra-industry trade will be observed. The large difference in per capita incomes correspondingly indicates large differences in demand structure and/or in the resource endowments and, as a consequence, the diminishing scope for the intra-industry trade potential between these countries. Next, the average country size is positively correlated with the level of the intra-industry trade. Thus, a larger country has more possibilities to explore economies of scale in production of the differentiated goods, and because of its size it may also have greater demand for foreign differentiated goods. Both these factors exert promoting influence on the potential for the intra-industry trade. Lastly, the difference in the economic sizes of Turkey and its trading partners exerts negative influence on the level of the intra-industry trade. As there is larger scope for the intra-industry trade when both trading partners are large economies. Hence, differences in economic

size tend to yield lower volume of intra-industry trade. Our results largely correspond to those reported in Emirhan (2002, 2005); Türkcan (2005) for Turkey.

The estimates of the second group of the variables (step dummies) are positive and they are also significantly different from zero either at the 5% or the 10% levels, depending on the type of index and on the industries used. This is an important result as it provides the first statistical evidence that the economic reforms of 1980s and the CUA enforced in 1996 had a profound positive impact not only on the total volume of trade of Turkey with its partners but also they spurred significant increase in the intra-industry trade. Thus, our findings confirm the earlier reported results of the descriptive studies such as Kösekahyaoğlu (2002); Erlat and Erlat (2003), who investigated the impact of the reform of 1980s on the IIT in Turkey. Moreover, our further contribution to the literature is that we show that omitting the effects of the CUA of 1996 while investigating the determinants of the intra-industry trade of Turkey with its trading partners seems to be unwarranted and may have biased the results reported in Çepni and Köse (2003); Emirhan (2002, 2005); Türkcan (2005).

The comparison of the absolute sizes of the estimates of the coefficients that correspond to the step dummies SD1980 and EU_SD96 reveals that the reforms of 1980s exercised more profound effect on the level of the intra-industry trade than the latter reform. This observation conforms with the fact that the reforms of 1980s have been more radical in their nature as the

former growth strategy based on the import substitution was abolished and instead an export-led growth strategy was promoted which resulted in rapid growth not only of the total trade volume but also of the intra-industry trade. The impact of the reforms of 1980s may appear more noticeable because they were the first reforms that lifted the intra-industry trade from the initial rather negligible levels that prevailed during the pre-reform period to the levels that would match the development of the Turkish economy. From this perspective, it is no longer surprising that the positive effect that the Custom Union Agreement exerted on the development of the intra-industry seems to be somewhat lower than that of the reforms of 1980s. For the CUA can be considered as the natural consequence of and the follow-up to the reforms of 1980s, which were already rather successful.

5 Conclusions

In this paper we have provided the first statistical evidence based on the panel data regression model that the economic reforms of 1980s and the Customs Union Agreement of 1996 exerted positive impact on the intra-industry trade between Turkey and its trading partners. Furthermore, we find that the impact of the former reforms is more strong as it affects the intra-industry trade of Turkey with all partners, whereas the impact of the CUA is only noticeable in the IIT with the EU member states, as expected.

We also find that, although the CUA covers mainly the industrial goods,

it appears to exert similar effect upon the IIT computed both for the whole trade and for the trade in manufacturing goods only.

The drastic increase in IIT after 1980s and especially after 1996 confirms the "soft adjustment hypothesis" implying that the ongoing economic integration between the EU and Turkey is accompanied by the decreasing adjustment costs. It justifies thus the further integration of Turkey into the European market.

References

Aquino, A. (1978). Intra-industry trade and inter-industry specialization as concurrent sources of international trade in manufactures. *Weltwirtschaftliches Archiv 114*, 275–296.

Arıcanlı, T. and D. Rodrik (1990). *The Political Economy of Turkey: Debt, Adjustment and Sustainability*. Macmillan.

Balassa, B. (1966). Tariff reductions and trade in manufactures among the industrial countries. *American Economic Review 56*, 466–473.

Balassa, B. and L. Bauwens (1988). *Changing Trade Patterns in Manufacturing Goods: An Econometric Investigation*. Elsevier.

Brülhart, M. (1994). Marginally intra-industry trade: Measurement and relevance for the pattern of industrial adjustment. *Weltwirtschaftliches Archiv 130*, 600–613.

Çepni, E. and N. Köse (2003). Intra-industry trade patterns of Turkey: A panel study. *G.Ü.I.I.B.F. Dergisi 3*, 13–28.

De Santis, R. A. (2001). The 1990 trade liberalisation policy of Turkey: An applied general equilibrium assessment. *International Economic Journal 15*, 115–132.

Doornik, J. A. and D. F. Hendry (2001). *Econometric Modelling Using Pc-Give Volume III*. Timberlake Consultants Ltd.

Doğaner Gönel, F. (2001). How important is intra-industry trade between Turkey and her trading partners? Yildiz Technical University mimeo.

Ekanayake, E. M. (2001). Determinants of intra-industry trade: The case of Mexico. *The International Trade Journal 15*(1), 89–112.

Emirhan, P. N. (2002). Intra-industry trade dynamics of Turkey. European Trade Study Group Fourth Annual Conference, Institut für Volkswirtschaftslehre, September 13-15 2002, Kiel, Germany.

Emirhan, P. N. (2005). The determinants of vertical intra-industry trade of Turkey: Panel data approach. Dokuz Eylül University, Discussion paper series No. 05/05.

Erlat, G. and H. Erlat (2003). Measuring intra-industry and marginal intra-industry trade: The case for Turkey. *Emerging Markets Finance and Trade 39*, 5–38.

Erlat, G. and H. Erlat (2006). Intra-industry trade and labor market adjustment in Turkey: Another piece of puzzling evidence? *Emerging Markets Finance and Trade 42*, 5–27.

Erzan, R. and S. Laird (1984). Intra-industry trade of developing countries and some policy issues. Seminar Paper No. 289, Institute for International Economic Studies, University of Stockholm.

Greenaway, D. and C. R. Milner (2006). Recent developments in the intra-industry trade: Introduction by guest editors. *Weltwirtschaftliches Archiv 142*, 425–432.

Grubel, H. G. and P. J. Lloyd (1975). *Intra-Industry Trade: The Theory and Measurement of International Trade in Differentiated Products*. Macmillan: London.

Harrison, G. W., T. F. Rutherford, and D. G. Tarr (1997). Economic implications for Turkey of a customs union with the European Union. *European Economic Review 41*(3-5), 861–870.

Kösekahyaoğlu, L. (2002). Does trade liberalization matter?: An analysis of intra-industry trade for Turkey and EU. *Marmara Journal of European Studies 10*, 113–135.

Krueger, A. O. and O. H. Aktan (1992). *Swimming Against the Tide: Turkish Trade Reform in the 1980s*. International Center for Economic Growth.

Lohrmann, A.-M. (2002). A dynamic analysis of Turkey's trade with the European Union in the 1990s. *Russian and East European Finance and Trade 38*, 44–58.

Mercenier, J. and E. Yeldan (1997). On Turkeys trade policy: Is a customs union with Europe enough? *European Economic Review 41*, 871–880.

Neyaptı, B., F. Taskin, and M. Üngör (2004). Has European Customs Union Agrement really affected Turkey's trade? Departmental Working Papers 0404, Bilkent University, Department of Economics.

Oliveras, J. and M. I. Terra (1997). Marginal intra-industry trade index: The period and aggregation choice. *Weltwirtschaftliches Archiv 133*, 170–179.

Schüler, M. K. (1995). The path of intra-industry trade expansion: The cases of Spain and Turkey. *METU Studies in Development 22*, 79–99.

Seymen, D. (1998). The effects of the CustomsUnion on Turkish foreign trade. One day conference on: European Unions policy towards Turkey aftermath of the Luxemburg summit, University of Birmingham, October.

Togan, S. (1997). Opening up the Turkish economy in the context of the customs union with EU. *Journal of Economic Integration 12*(2), 157 – 179.

Türkcan, K. (2005). Determinants of intra-industry trade in final goods and intermediate goods between Turkey and selected OECD countries. *Ekonometri ve Istatistik Sayi 1*, 20–40.

Utkulu, U., D. Seymen, and A. Arı (2004). Export supply and trade reform: The Turkish evidence. mimeo.

Vona, S. (1991). On the measurement of intra-industry trade. *Weltwirtschaftliches Archiv 127*, 678–700.

Appendix

Table 1: Literature review

Paper	Data (indicator, period, & country)	Tools (measure & model)	Results
Erzan and Laird (1984)	1) SITC 3-digit, industries 5-8 2) 1965, 1970, 1975, 1980 3) 9 principal developing exporters of manufactures (including Turkey) vs. the ASEAN countries, the developed market economies, the socialist countries of Eastern Europe, and other developing countries.	1) The unadjusted GL index and Aquino index 2) Descriptive analysis of IIT measures	Turkey's IIT was the highest among the DMECs, followed by the other developing countries.
Schüler (1995)	1) SITC 5-digit, industries 5-8, excl. 68 2) 1973-1991 3) World, EU-12, developing countries, and other OECD countries	1) The unadjusted GL index 2) Descriptive analysis of IIT for consumer, investment, and intermediate goods	1) In the first phase of industrial development IIT expanded primarily in trade of intermediates with industrial countries. 2) In a later phase intra-industry trade expanded in consumer goods.

Table 1: Literature review (continued)

Paper	Data (indicator, period, & country)	Tools (measures & models)	Results
Doğaner Gönel (2001)	1) SITC 3-digit industries 0-8 2) 1992-1997 3) EU, Central Asia Turkic republics, and world	1) The unadjusted GL, adjusted GL, and Acquino indices 2) Descriptive analysis of IIT measures	1) Turkey's share of IIT in total trade is lower with the EU than with the world for whole period. 2) Turkey's trade with the EU is still of inter-industry type. 3) The increase in adjusted GL index is more pronounced than in other two indices. 4) In trade with EU iron and steel as well as manufactures have the highest unadjusted GL index.
Kösekahyaoğlu (2002)	1) SITC 2-digit, industries 0-8 2) 1975-1990 3) EU-12	1) The unadjusted GL and Brülhart A indices. 2) Descriptive analysis of IIT for non-manufactured, manufactured goods, and overall trade.	1) Not only the level (GL index) but also the proportion of IIT (measured by marginal IIT index) has increased over the period. 2) The liberalization attempt in the 1980s was a step in the right direction and the further liberalization of trade (i.e. joining the EU) may lead to further reductions in adjustment costs.
Lohrmann (2002)	1) SITC 2-digit, industries 5-8 2) 1991, 1995, and 1999 3) EU	1) The unadjusted GL, Brülhart A and B indices; HIIT and VIIT measures. 2) Descriptive analysis of IIT measures.	1) The GL index shows an increase in IIT during the 1990s for Turkey vis-à-vis the EU, but the MIIT indicators reveal a much lower level of IIT and a negative performance in many sectors classified as human-capital intensive. GL index underestimates the adjustment cost. 2) The pattern of specialization shows that the most part of Turkey's trade with the EU is vertical.

Table 1: Literature review (continued)

Paper	Data (indicator, period, & country)	Tools (measures & models)	Results
Emirhan (2002)	1) SITC 3-digit transformed into ISIC 2-digit, industries 1-8 2) 1999 3) 44 developed and 35 developing countries	1) The unadjusted GL index 2) OLS estimation of determinants of IIT using country- and industry-specific variables and OLS estimation of determinants of HIIT and VIIT	1) The share of the IIT in Turkey bilateral trade is highest for EU members, which are followed by EU candidates. 2) While the industry specific variables exert very big influence on horizontal IIT, they do not have any impact on vertical IIT. 3) Vertical IIT levels are affected by country-specific variables and these variables have only a limited impact on horizontal IIT.
Çepni and Kösel (2003)	1) SITC 2-digit, industries 0-8 2) 1988-1998 3) Canada, China, Egypt, France, Germany, Greece, India, Italy, Israel, Japan, Russia, South Korea, Spain, UK, and USA.	1) The adjusted GL index 2) Panel data estimation of determinants of IIT using country-specific variables	1) Turkey's IIT is the highest with the EU (around 50%). The IIT with other countries ranges between 20% (Russia) to 40% (USA). 2) The average and relative per capita income, distance, trade orientation, and economic integration are all important factors explaining trends of IIT for Turkey. 3) Difference of per capita income variable has a wrong sign and is statistically significant.

Table 1: Literature review (continued)

Paper	Data (indicator, period, & country)	Tools (measures & models)	Results
Erlat and Erlat (2003)	1) SITC 3-digit (Rev.3), industries 0-8 2) 1969-1999 3) World	1) The unadjusted GL, weighted GL, Brülhart A, weighted A, B, C indices, and the UMCIT index for unmatched changes in trade; HIIT and VIIT measures. 2) Descriptive analysis of IIT measures.	1) According to aggregated GL index, the rate of IIT is greater in the post-1980 period, but the Turkey's trade has still an inter-industry nature. 2) According to aggregated A index, there had been a significant change in MIIT between the pre- and post-1980 periods. The number of sectors with $B < -0.5$ or $B > 0.5$ has considerably increased since 1980 and for most of these sectors the increase in exports dominates the increase in imports. 3) For the sectors with the highest MIIT, it is found that decrease in adjustment costs after 1980 due to changes in IIT, measured by the C index, was larger than the increase in these costs due to changes in net trade, measured by UMCIT.
Emirhan (2005)	1) SITC 3-digit, industries 3-8 2) 1989-2002 3) Belgium, France, Germany, Greece, Italy, Netherlands, Spain, UK, USA	1) The unadjusted GL index 2) Panel data estimation of determinants of VIIT	A positive relationship is found between the levels of VIIT and GDP levels and per capita GDP differences among Turkey and selected countries. International transportation costs are found to discourage vertical IIT.

Table 1: Literature review (continued)

Paper	Data (indicator, period, & country)	Tools (measures & models)	Results
Türkcan (2005)	1) SITC 4-digit (Rev.2), industries 0-8 2) 1985-2000 3) Selected OECD countries	1) The adjusted GL index 2) Panel data estimation of determinants of IIT with country- and industry-specific variables.	1) The determinants of IIT for final goods are not much different from those for intermediate goods 2) Country-specific factors are the most important determinants of IIT between Turkey and OECD in final and intermediate goods between.
Erlat and Erlat (2006)	1) ISIC 3-digit (Rev.2), industries 0-8 2) 1969-2001 3) World	1) The unadjusted GL, weighted GL, Brülhart A, and weighted A indices. 2) Panel data estimation of the employment changes regressed on IIT measures to test the smooth adjustment hypothesis.	1) Both IIT and MIIT indices increase, and the primary mover is the manufacturing. 2) A significant negative relationship between employment changes and IIT was found.

Table 2: Data

Variable	Description	Source
Exports	SITC 3-digit exports per countries and per commodities, US $	Turkish Statistical Institute
Imports	SITC 3-digit imports per countries and per commodities, US $	Turkish Statistical Institute
GL	aggregated unadjusted Grubel-Lloyd index	own calculations
BA	aggregated Brülhart's index A	own calculations
Real GDP	Gross domestic product (expenditure approach); US $, constant prices, constant exchange rates, OECD base year, millions	OECD
Population	1000 persons	World Market Monitor
Real GDP per capita	1000 × Real GDP / Population	own calculations

Table 3: Alternative IIT measures of Turkish trade with industrialized countries, 1970-2005

Year	All 15 countries				EU-12 countries			
	GL total	GL 5-8 total	BA total	BA 5-8	GL total	GL 5-8	BA total	BA 5-8
1970	0.04	0.10	0.02	0.08	0.04	0.12	0.03	0.12
1975	0.05	0.03	0.03	0.01	0.05	0.03	0.03	0.02
1980	0.07	0.08	0.02	0.02	0.06	0.07	0.02	0.02
1985	0.16	0.17	0.10	0.10	0.16	0.18	0.11	0.11
1990	0.18	0.20	0.12	0.11	0.19	0.21	0.12	0.12
1995	0.22	0.13	0.18	0.06	0.24	0.13	0.21	0.06
2000	0.29	0.28	0.16	0.16	0.30	0.29	0.16	0.16
2005	0.37	0.38	0.24	0.27	0.39	0.40	0.28	0.30

Table 4: Estimation results:
Fixed effects panel data model, 1970-2005

Dep. variable / Regressors	GL total	GL 5-8	BA total	BA 5-8
Income_Ineq	-8.18***	-8.93***	-7.15***	-6.26**
	(2.95)	(2.71)	(2.64)	(2.51)
GDP	2.42***	2.50***	1.95***	2.28***
	(0.44)	(0.35)	(0.42)	(0.40)
Size_Ineq	-5.70**	-5.89**	-6.44***	-5.28**
	(2.35)	(2.85)	(2.18)	(2.14)
SD1980	0.69***	0.65***	0.90***	0.76***
	(0.23)	(0.23)	(0.22)	(0.24)
EU_SD1996	0.67**	0.45*	0.56*	0.45*
	(0.28)	(0.26)	(0.26)	(0.27)
R^2	0.50	0.47	0.49	0.42

Notes: 1) numbers in parentheses denote the heteroskedasticity corrected standard errors; 2) ***, **, and * indicate that the corresponding coefficient is significant at 1%, 5%, and 10% levels, repectively.

Remittances as a Harbinger of Migration: An Empirical Macroeconomic Causal Link

by

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Abstract

Whereas it is well established that migration from an economy is followed by remittances to the economy, this paper asks whether remittances to an economy are the harbinger of migration from the economy. Liquidity constraints, signalling, portfolio revision, and other considerations raise the possibility that an economy that receives more remittances will generate more migration. This possibility is tested by means of cointegration analysis. The analysis is applied to migration from Turkey to Germany during the period 1964-2004. A single cointegrating relationship is found between migration inflows and the relative income ratio between Germany and Turkey, the unemployment rates in Germany and in Turkey, a trade intensity variable, and workers' remittances (relative to Turkish GDP). In particular, remittances are found to significantly explain migration in the short run, as well as in the long run. The findings support the hypothesis that remittances fuel migration.

Keywords: Remittances; Turkish-German migration; Cointegration analysis

JEL classification: C32; F22; J61

1. Introduction

While it is nearly an axiomatic postulate that migration is tracked by remittances, we inquire in this paper whether remittances to an economy (in our case, remittances from Germany to Turkey) are the harbinger of migration from the economy (in our case, migration from Turkey to Germany). Microeconomic theory provides several arguments why remittances are made, and how remittances confer a variety of benefits upon their recipients. If migration is to occur in the wake of remittances, the migration type that is coming readily to mind is return migration: when migration by a family member and the remittances that he sends achieve their objective (for example, risk reduction that facilitates the start up of an initially high-return yet high-risk economic activity, the acquisition of capital, or the building of a house), return migration will take place. If several members of a family rather than only one member are in the host country, the amount of remittances per unit of time could rise, the duration of migration per a family member could become shorter, and return migration will be expedited. And if the effect of remittances is to raise incomes in the economy of origin, a factor that induces migration (the inter-economies income differential) is weakened. However, it is also possible, if hitherto little explored, that for a variety of reasons remittances induce migration. Suppose that migration is financed by resources that are pooled together at origin and are lent to a migrant in support his move. Migrants who remit upon stating to work at destination not only pay back loans incurred to facilitate their move, they also replenish the coffers that provided them with financial support, thereby rendering it possible for a subsequent migration to be financed. Moreover, remittances can signal success at destination, luring additional workers to pursue migration. Indeed, remittances could well be aimed at directly supporting additional migration from a family as the optimal composition of the portfolio of the familial demographic-labor assets prompts reallocation in favor of a rewarding component. The sum total of these liquidity constraints, signaling, portfolio revision, and similar considerations raises the possibility that an economy that receives more remittances could generate more migration. We seek to test this possible causality.

To this end, we investigate the effects of remittances on the migration from Turkey to Germany during the period 1964-2004. We analyze the short-run as well as the long-run effects of remittances on migration, applying recent econometric techniques to the longest time series available to us. We attend to the non-stationarity of the long time series of the macroeconomic

variables. We develop a parsimonious, stable-coefficient time-series error correction model for migration that incorporates remittances. In addition to the economic variables that are typically considered as determinants of international migration (host country - home country income differentials, unemployment rates in the host country and in the receiving country), we add a variable that captures the intensity of economic interaction between Germany and Turkey viz. the share of total trade (the sum total of exports and imports) between the two countries in the total trade of Turkey. We find that the conventional variables are significant explanatory variables of migration, and that so too are the trade intensity variable *and* remittances.

In the next Section we present background information on Turkish migration to Germany, as well as on remittances from Germany to Turkey. In Section 3 we sketch an empirical model. In Section 4 we implement our chosen econometric methodology and present our results. Concluding comments are offered in Section 5.

2. Turkish migration to Germany, and remittances from Turkish migrants in Germany: a brief overview

The purpose of this section is threefold: to provide a background overview of remittances from Germany to Turkey; to depict the process of migration from Turkey to Germany; and to argue that to a considerable extent, the latter process fed on its own momentum and logic, the regulatory environment notwithstanding.

Over the four decades 1964-2004 remittances from Turkish workers in Germany constituted a large share (80 percent) of the total remittances to Turkey. During the 1970s and 1980s, total remittances were equivalent to 4 percent of the Turkish GDP; remittances from Germany were equivalent to 3 percent of Turkish GDP. Turkey was amongst the world's top ten largest remittance- receiving countries.

During the 1964-2004 period, remittances from Turkish migrants in Germany totaled 45 billion Euros. During the same period, capital inflows and foreign direct investment from Germany summed up to 16 billion Euros, and to 4 billion Euros, respectively. Remittances were

not only a major source of foreign exchange; they were also a relatively stable source of foreign exchange, helping the Turkish economy to buffer the negative shocks during the economic crises of 1994 and 2001.

Starting with Turkey's first five-year development plan (1962-1967), successive Turkish governments encouraged labor migration. The first development plan maintained that the "export" of excess unskilled labor to Europe will alleviate unemployment, and channel in remittances thereby reducing balance of payment difficulties. By means of attractive foreign exchange deposits, special import privileges, premium exchange rates, and special investment schemes in Turkey for workers living abroad, the Turkish government sought to entice migrants to remit. In the 1960s and 1970s, workers' remittances indeed helped greatly to overcome the deficit in the Turkish balance of payments. In 1974, remittances were equivalent to as much as 90 percent of the total value of Turkish exports.

Recruitment agreements between Germany and Turkey shaped the initial migratory flows. Subsequent migratory movements were built, however, on their own dynamics and mechanisms. In the wake of the 1973 oil crisis, the increase in the official foreign recruitment in all Western European countries, including Germany, came to an abrupt halt. However, in the subsequent two years, only 11-14 percent of the migrants in Germany returned to their home countries. This limited way-back migration can be attributed to "the Law of Family Reunification," which first came into effect in March 1974. The law allowed foreign workers to reunite with their families in the host country. Consequently, Turkish migration assumed the form of family re-unification, and migration increased in the 1970s. The top left panel of Figure 1, in which $\ln M_t$ represents the log of the gross inflows of Turkish migrants to Germany expressed as a share of the home population, displays the increase in migration in the early and late 1970s. In addition, guest workers' agreements, the so-called "rotation model," met from the outset with considerable disapproval from employers who complained that they have to train repeatedly new workers. In 1971, the renewal of residence permits was made easier. The residency status of the guest workers was changed, and foreign employees were allowed to bring their families. By May 1972, 40 percent of all the guest workers residing in Germany benefited from the residency permit scheme.

The increase in migration since 1982 was not independent of the increase in asylum applications. The annual average number of Turkish citizens officially registered as asylum seekers increased from about 10,000 in the early 1980s to 80,000 in the late 1980s and the early 1990s. In response, the Bundestag (the Lower House of the German Parliament) enacted in 1993 the "asylum compromise," making applying for political asylum in Germany considerably more difficult. Consequently, the number of applications for asylum declined continuously. However, in 1995 and 1996, the number of applications slightly increased again, but since then the numbers stayed at fairly low levels. In addition to regional conflicts, the increase in asylum applications stemmed from the fact that would-be migrants resorted to this entry channel due to the restrictive migration policies. Compared to the number of applicants, the number of accepted asylum-seekers from Turkey has been relatively low, however.

Joppke (1998) argues that with the halt of recruitment in 1973, migration took the form of a chain migration, prompted by family unification and asylum seeking, and that this "restructuring" was, in fact, orthogonal to the German no-migration policies. Own momentum together with moral obligations help explain the continuation of migration.

Thus, in spite of restrictive migration policies over the four-decade period, migration patterns and migration pressures appear to have been determined mainly by the interplay between supply-push factors, income differentials, and employment opportunities in Germany.

A particular interesting observation is that remittances and gross migration inflows exhibited similar patterns. This simple observation leads us to wonder whether remittances could have played a role in the process of migration (see the top left and the bottom right panels of Figure1 where, respectively, gross migration inflows and remittances appear to move in tandem during the study period).[6] Of course, whether causality runs from remittances to migration or from migration to remittances is, as noted in the Introduction, an open issue. In the econometric specifications that follow, we will address this issue by means of exogeneity tests.

[6] We have also compared the time series patterns of the stock of Turkish migrants in Germany and of the net flows of Turkish migrants in Germany with remittances. The stock of Turkish population in Germany and remittances exhibit no correlation. The net flows of Turkish migrants and remittances reveal no co-movement either.

3. An empirical model

We model Turkish migration to Germany as follows:

$$\ln M_t = \alpha_0 + \alpha_1 \ln(Y_{ft} / Y_{ht}) + \alpha_2 U_{ft} + \alpha_3 U_{ht} + \alpha_4 \ln T_t + \alpha_5 \ln R_t + \varepsilon_t \qquad (1)$$

In equation (1), $\ln M_t$ denotes the log of the gross inflow of Turkish migrants to Germany[7], expressed as a share of the home population. Brücker and Schröder (2006) argue that migration stocks, rather than the (net) migration rate, should be used in migration estimation, since an equilibrium relationship between migration stocks and the explanatory variables arises in the long run, while the net flows tend to zero. However, in this study we use the gross migration rate (as is done, for example, in Borjas (1987, 1999), Hatton (1995), Clark et al. (2002), Pedersen et al. (2006), Péridy (2006), and Mayda (2007)), not the stock of Turkish migrants. We test the hypothesis that remittances trigger additional migration. Typically, migrants of different cohorts exhibit different remittance behavior. For example, migrants tend to pay the debt that they incurred in financing their migration during the first year or so following their migration, and over time, upon bringing their families to Germany, they remit less than more recent migrants. This variation implies different remittance behavior for the cohorts that sum up to the stock of Turkish migrants. Therefore, we use as the dependent variable the gross migration rate rather than stocks. In addition, and as explained below, we incorporate the trade intensity as an independent variable, which requires us to work with flows rather than with the stock of migrants. Moreover, initial data analysis did not reveal any significant relationship between the stocks and the explanatory variables, especially not between the stocks and workers' remittances.

The term $\ln(Y_{ft} / Y_{ht})$ is the log of the income in the host country divided by the income in the home country, measured each as per capita GDP in purchasing power parity terms. This variable captures the pecuniary incentive to migrate that arises from the income differential.

U_{ft} is the unemployment rate in Germany. German migration policies have become more restrictive during periods of high unemployment in Germany (Mayda and Patel (2004)).

[7] An analysis of Turkish gross migration inflows net of Turkish asylum seekers yielded similar results..

The U_{ht} term is the unemployment rate in Turkey. It represents a simple push factor. The unemployment rate enters the empirical model individually rather than as a difference term, in line with (for example) Borjas (1987, 1999), Hatton (1995), Clark et al. (2002), Pedersen et al. (2006), Péridy (2006), and Mayda (2007).

The term $\ln T_t$ is a proxy for the intensity of economic cooperation between Turkey and Germany, calculated as the log of the share of the trade volume (sum of exports and imports) between the two countries in the total trade volume of Turkey with all its trading partners. In general, the volume of trade between two economies could measure a variety of links between the economies. The higher the volume, the more intensive the links. Bilateral links co-shape the migration "infrastructure" or environment. It stands to reason that an increase in the total volume of trade between Germany and Turkey can alleviate the financial and informational constraints associated with migration from Turkey to Germany, thereby lowering the cost of migration, particularly for low-skill workers with low incomes and with limited access to credit. Trade can serve as an indicator of the level of business deals and transactions between economies, which in turn lower informational costs and reduce uncertainty, thereby impinging on the migration "climate." In addition, trade could impact on migration in more subtle ways. For example, and in our case, when the volume of trade between Turkey and Germany is high, Turkey will be less likely to allow appreciation of its currency - exporters could suffer if it did - and is more likely to tilt in the direction of depreciation of its currency. For a given stock of Turkish migrants in Germany, a depreciation of the Turkish currency could prompt migrants to increase their remittances.

Finally, $\ln R_t$ is the log of the ratio between workers' remittances and Turkish GDP.

The data used by us were obtained from several sources. Data on workers' remittances were obtained from the balance sheets of the German Federal Bank (the Bundesbank). Data on the per capita GDP of Germany and of Turkey were obtained from the OECD. Data on Turkish unemployment, population, and trade were collected from the Turkish Institute of Statistics. Data on Turkish migration and German unemployment were obtained from the Federal Statistical Office in Germany.

4. An econometric analysis

In modeling Turkish migration to Germany, we follow the general-to-specific approach advocated in Hendry (1995). We start with an unrestricted VAR(p) model in which all variables are treated as endogenous. The VAR model that we initially adopt can be written in the familiar error-correction form, in terms of stationary variables, as follows:

$$\Delta x_t = \Pi x_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta x_{t-i} + \gamma + \varepsilon_t, \varepsilon_t \sim N_n(0, \Sigma) \qquad (2)$$

where γ denotes a constant drift term, and x_t is the k x 1 vector of variables. The vector of variables is $x_t = (\ln M_t, \ln(Y_{ft} / Y_{ht}), U_{ft}, U_{ht}, \ln T_t, \ln R_t)'$. The long-run part of the model allows for linear feedback from the lagged stationary equilibrium errors, $\Pi x_{t-1} = \alpha\beta' x_{t-1}$, where β is a p x r matrix of full rank, containing the r cointegration vectors, and α is a p x r matrix of full rank, containing the adjustment coefficients (the factor loadings). This formulation assumes that x_t is I(1), that is, that the components of the vectors are either I(0) or I(1), (see Johansen (1988)). The annual data covers the period from 1964 until 2004 (see Figure 1, where the raw data pertaining to the right hand side variables of (1) are depicted).

We first test for cointegration. Subsequently we impose the implied reduced rank restrictions on the unrestricted VAR model. We then test for the long-run exogeneity of the system variables. The results of the weak exogeneity tests are used to build a parsimonious time series model for migration that passes satisfactorily all diagnostic tests, displays constant coefficients, and is capable of forecasting accurately the within-sample migration flows.

Our first step is to determine the lag length of an unrestricted VAR(p) model. In this initial stage, we seek to obtain a parsimonious model. This is quite challenging, given the relatively small number of observations (T = 41) compared to the number of explanatory

variables (k = 6). In Table 2, it is shown that the VAR(1) model can adequately describe the data when the lag length n = 1 is chosen, since the misspecification tests report no serious departures from the assumptions that underlie the model. [8]

Having found the adequate unrestricted model, we next seek to find the cointegration rank of the estimated system by imposing restrictions on the unrestricted model. To this end, we use the Johansen Full Information Maximum Likelihood (FIML) procedure (Johansen (1992)). Table 3 reports the results of the trace and λ-max tests for the cointegration rank. Both tests indicate the presence of one cointegrating relation in the system.

We therefore impose the cointegration rank r = 1 on the system (equation (2)) and proceed with testing for (trend-)stationarity, long-run exclusion, and long-run weak exogeneity of the variables. The test for stationarity of the variables in the model is based on Juselius (2006). This is a multivariate version of the Augmented Dickey-Fuller test with the null hypothesis of stationarity, in contrast to the standard univariate tests where the null is non-stationary. Since any linear combination of I(1) variables that is I(0), or I(0) variables themselves, can form the cointegration space, the purpose of this test is to find whether any of the variables in our model alone belongs to the cointegration space. The test has an asymptotic χ^2 distribution with (k - r) = 5 degrees of freedom.

The test for the long-run exclusion (Juselius (2006)) investigates whether any of the variables in our model can be excluded from the cointegrating vector. This test has an asymptotic χ^2 distribution with r = 1 degrees of freedom. Finally, the test for the long-run weak exogeneity investigates whether the dependent variable adjusts to the equilibrium errors represented by a cointegrating relation (see Engle et al. (1983)).

[8] The univariate as well as the multivariate model diagnostic tests comprise of: *FAR* (a test of no residual autocorrelation (see Godfrey (1978)); χ^2 *Norm* (a test for the normally distributed residuals (see Doornik and Hansen (1994)); *FHetero* and *FHetero-X* (White (1980) tests for heteroscedasticity based on the original and squared regressors, and their cross-products); *FARCH* (Engle (1982) test of no residual autoregressive conditional heteroscedasticity). The graphics, regression output, and residual diagnostic tests were all calculated using GiveWin 2.2 and Pc-Give 10.2 (cf. Doornik and Hendry (2001a), (2001b)).

Tables 4, 5, and 6 report the results of the tests for (trend-) stationarity and long-run exclusion, which are performed on the matrix of the long-run coefficients, and the tests for the long-run weak exogeneity which are performed on the matrix of the adjustment coefficients. According to the stationarity test, the null hypothesis that each variable is either I(0), or I(0) around a linear deterministic trend, is rejected decisively. The tests for the long-run exclusion reject at the 1 percent significance level the null hypothesis that $\ln M_t$, U_{ft}, U_{ht} and $\ln T_t$ can be excluded from the cointegrating vector, and at the 10 percent significance level that the variable $\ln R_t$ can be excluded from the cointegrating vector. At the same time, we cannot reject the null hypothesis that the relative income variable $\ln(Y_{ft}/Y_{ht})$ could be omitted from the cointegrating relationship. The plausible reason for this result is that the relative income ratio fluctuated more or less around the same magnitude in the period of investigation (the middle right panel of Figure 1). However, we have chosen to retain this variable since there is a strong analytical argument in support of its presence in a migration function and, arguably, its persistence has been and, given its magnitude, is still the major pulling factor of Turkish migration to Germany. In addition, it turns out that after imposing the joint long-run weak exogeneity restrictions, we are no longer able to reject the null hypothesis of the long-run exclusion of the relative income variable at the 10 percent significance level, as explained below.

According to the univariate long-run weak exogeneity test results (Table 6), we can accept the null hypothesis that all the variables other than the $\ln M_t$ variable are individually weakly exogenous at any conventional significance level. The main contribution of this result is that *causality runs from remittances to migration* and from trade to migration, and not from migration to remittances and from migration to trade. Moreover, the joint test for the long-run weak exogeneity also confirms this finding with the log likelihood ratio test statistic of 3.973 (p=0.553). In order to check whether this result is robust to a change in the sample size, we present in Figure 2 the value of the recursive test statistics of the joint null hypothesis, scaled by the 1 percent critical value. The figure offers visible support for the hypothesis that the five variables $\ln(Y_{ft}/Y_{ht})$, U_{ft}, U_{ht}, $\ln T_t$, and $\ln R_t$ are weakly exogenous with respect to the long-run parameter values for all sample sizes (with only one exception). Hence, this restriction is acceptable, and in our analysis we treat these five variables as weakly exogenous with respect to the long-run parameters.

Imposing the long-run weak exogeneity restrictions on the $\ln(Y_{ft}/Y_{ht})$, U_{ft}, U_{ht}, $\ln T_t$, and $\ln R_t$ variables results in the following cointegrating vector, with the corresponding standard errors reported in parentheses below the coefficient estimates:

$$\ln M_t = 1.646 \ln\left(\frac{Y_{ft}}{Y_{ht}}\right) - 0.216 U_{ft} + 0.102 U_{ht} + 1.492 \ln T_t + 0.205 \ln R_t + cons + ecm_t \quad (3)$$
$$\qquad (0.862) \qquad (0.016) \quad (0.029) \quad (0.281) \quad (0.055)$$

All the coefficient estimates have the expected signs, and all the estimates are significantly different from zero at the conventional significance levels. Relative income, the unemployment rate in Turkey, the trade intensity, *and workers' remittances* contribute positively to migration from Turkey to Germany, while unemployment in Germany contributes negatively to migration from Turkey to Germany. Thus, in the long run, supply and demand factors jointly shape migration flows. The relationship that is of most concern to us is quite vivid. We find that a 10 percent increase in remittances *increases* the gross migration inflows by 2.05 percentage points - a significant effect. The positive and significant effect of remittances in the long run supports the hypothesis that remittances fuel migration. We also find a large effect from the trade intensity variable: a 10 percent increase in trade will increase the gross migration inflows by 14.92 percentage points. This is a large effect, especially when compared to the finding reported in other studies (Pedersen et al. (2006) and Péridy (2006)). The result may be related to the fact that Germany is Turkey's biggest trading partner.

As shown in Juselius (2006), the long-run weak exogeneity of variables allows us to reformulate the model (equation (2)) in terms of a conditional model, where the conditioning is on the current and past values of the weakly exogenous variables, and on the error correction term. After removing the variables that have turned out to be insignificant, the estimated conditional model for $\ln M_t$ is as follows:

$$\Delta \ln M_t = \underset{(0.073)}{0.407}\Delta \ln R_t - \underset{(0.034)}{0.144}\Delta \ln R_{t-1} - \underset{(0.034)}{0.283}\Delta U_{ft} - \underset{(0.092)}{0.624} ecm_{t-1} - \underset{(0.166)}{0.527} D99 - \underset{(1.077)}{7.219}$$

$$\hat{\sigma} = 0.15,\ \mathrm{R}^2 = 0.85,\ \mathrm{T} = 41,\ \mathrm{F}_{\mathrm{AR(1\text{-}4)}} = 0.579\,(0.874) \tag{4}$$
$$\mathrm{F}_{\mathrm{ARCH(1\text{-}4)}} = 0.262\,(0.899),\ \chi^2_{\mathrm{Norm}}(2) = 0.218\,(0.897)$$
$$\mathrm{F}_{\mathrm{Hetero}} = 3.24\,(0.954)$$

with the corresponding standard errors reported in parentheses below the coefficient estimates.[9]

The conditional model (equation (4)) is parsimonious, and at the same time the diagnostic tests show no signs of misspecification. The error-correction term is highly significant and has the expected sign. It is worth noting that remittances and the German unemployment rate are also significant in the conditional model, with the expected signs, and exert promoting and dampening effects on Turkish migration to Germany, respectively. Thus, a 10 percent increase in the change in remittances will increase the change in gross migration inflows by 4.07 percentage points. This is a large short-run effect, considering the coefficients on other short-run variables, and it is almost as large as the error-correction term. Hence, the significance of remittances in the short run as well as in the long run is consistent with the prediction that remittances nourish migration: remittances trigger additional migration in the short run as well as in the long run. In addition, the German unemployment rate is also significant in the short run as well as in the long run. The significant effects from the supply side suggest that the restrictive migration policies have not been binding for Turkish migration inflows; it is the German unemployment rate that impacts on the inflows.

The conditional model has a very good explanatory power, as can be assessed by looking at the actual values and at the regression fitted values, as well as at the regression residuals (Figure 4). The coefficient estimates are well determined and exhibit remarkable stability according to the recursive Chow stability tests and the one-step ahead residuals (Figure 5), as

[9] The dummy variable is included to prevent a failure of the normality test.

well as recursively estimated coefficients[10] (Figure 6). Finally, the conditional model is able to accurately forecast gross migration inflows to Germany over the period 2000-2004 (see Figure 7 for the one-step ahead forecasts), and this aspect is supported by the Chow parameter constancy forecast *F*-test statistic which takes the value 0.420 (p=0.831).

5. Concluding comments

We investigated whether remittances trigger migration. We developed and implemented an empirical model of Turkish migration to Germany. Using the cointegration technique, we tested the model for the period 1964-2004,. A single cointegrating vector is found among the gross migration inflows and the following explanatory variables: the relative income ratio between Germany and Turkey; the unemployment rates in Germany and Turkey; the trade intensity variable; and remittances as a ratio of Turkish GDP. Based on the results of the cointegration analysis and the imposed long-run weak exogeneity restrictions, a parsimonious single equation conditional error-correction model is developed that has a good in-sample explanatory power and possesses well-defined and stable coefficients. The significance of the remittances variable in the short run as well as in the long run supports the hypothesis that remittances fuel migration.

By including the trade variable in the empirical function of migration, our study contributes to a better understanding of the relationship between the trade intensity between countries and migration. By relaxing financial constraints as well as by lowering various adjustment and informational costs that are associated with the decision to migrate, business connections between two economies significantly facilitate the mobility of people between the economies.

Our findings support the idea that workers' remittances can trigger additional migration and thereby foster a migration chain. Remittances may be interpreted as messages of financial success, and this signal may induce would-be migrants to actually migrate. Our findings are also consistent with an "implicit loan" idea: high initial migration costs that are especially binding for

[10] This further suggests to us that the multiple appearance of the Turkish GDP in the definitions of the variables inflicts no harm on the econometric procedure.

unskilled migrants with low incomes and low access to credit encourage the development of kin networks in which a migrant and his extended family enter into an informal, mutually beneficial credit contract to pay for the costs of migration. This arrangement could lead to an obligation on the part of the migrant to help extended family members to follow in his steps. Thus, transfers from family members facilitate migration, and remittances from a migrant facilitate additional migration.

Students of migration have for long been fascinated by the often-observed momentum, continuity, and dynamics of migration flows. A variety of explanations are on offer. Perhaps our inquiry serves to identify a new explanation: migration is followed by remittances which prompt migration which in turn results in remittances, and so on. Reflecting further on the interplay between remittances and migration as a perpetuator of migration is an intriguing topic for future research.

References

Borjas, G. (1987). Self selection and the earnings of immigrants. *American Economic Review* 77: 531-553.

Borjas, G. (1999). The Economic analysis of immigration. In: O. Ashenfelter and D. Card (eds.), *Handbook of Labour Economics*, chapter 28, pages 1697-1760. Amsterdam: Elsevier Science (North Holland).

Brücker, H. and P. J. H. Schröder (2006). International migration with heterogeneous agents: Theory and evidence. IZA Discussion Paper 2049.

Clark, X., T. J. Hatton, and J. G. Williamson (2002). Explaining US immigration, 1971-1998. Centre for Economic Policy Research Discussion Paper 453.

Doornik, J. A. and H. Hansen (1994). An omnibus test for univariate and multivariate normality. Nuffield College Discussion Paper W4&91.

Doornik, J. A. and D. F. Hendry (2001a). *GiveWin: An Interface to Empirical Modelling*. Timberlake Consultants Press: London.

Doornik, J. A. and D. F. Hendry (2001b). *Modelling Dynamic Systems Using PcGive*, Volume II. Timberlake Consultants Press: London.

Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. *Econometrica* 50: 987-1007.

Engle, R. F., D. F. Hendry, and J.-F. Richard (1983). Exogeneity. *Econometrica* 51: 277-304.

Godfrey, L. G. (1978). Testing for higher order serial correlation in regression equations when the regressors include lagged dependent variables. *Econometrica* 46: 1303-1313.

Hatton, T. J. (1995). A model of UK migration, 1870-1913. *Review of Economics and Statistics* 77: 407-415.

Hendry, D. F. (1995). *Dynamic Econometrics: Advanced Texts in Econometrics*. Oxford University Press: Oxford

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control* 12: 231-154.

Johansen, S. (1992). Testing weak exogeneity and the order of cointegration in the UK money demand. *Journal of Policy Modelling* 14: 313-334.

Joppke, C. (1998). Why liberal states accept unwanted immigration. *World Politics* 50: 266-293.

Juselius, K. (2006). *The cointegrated VAR model: methodology and applications*. Oxford University Press: Oxford.

Mayda, A. M. (2007). International migration: a panel data analysis of the determinants of bilateral flows. CREAM Discussion Paper 07/07.

Mayda, A. M. and K. Patel (2004). OECD countries migration policies changes. Appendix to International migration: A panel data analysis of economic and non-economic determinants. (http://www.georgetown.edu/faculty/amm23/.)

Pedersen, P. J., M. Pytlikova, and N. Smith (2006). Migration into OECD countries 1990-2000. In: C. A. Parsons and T. M. Smeeding (eds.), *Immigration and the transformation of Europe*. New York: Cambridge University Press.

Péridy, N. (2006). Welfare magnets, border effects or policy regulations: What determinants drive migration flows into the EU. University of Nantes, mimeo.

White, H. (1980). A heteroscedastic-consistent covariance matrix estimator and a direct test for heteroscedasticity. *Econometrica* 48: 817-838.

Table 1: VAR model: Multivariate tests

Multivariate tests		
$F_{AR(1-2)}(72,103)$	1.321	[0.097]
$\chi^2_{Norm}(12)$	23.495	[0.024*]
$F_{Hetero}(252,52)$	0.425	[1.000]

Table 2: VAR model: Univariate tests

Univariate tests	$\ln M_t$	$\ln (Y_{ft}/Y_{ht})$	U_{ft}	U_{ht}	$\ln T_t$	$\ln R_t$
AR 1-2 test: F(2,32)	3.356	0.807	1.6783	1.828	0.828	3.8081
	[0.048]*	[0.418]	[0.203]	[0.177]	[0.435]	[0.8081]
Normality test: $\chi^2(2)$	8.0503	1.5146	0.094	4.033	0.449	1.228
	[0.018]*	[0.469]	[0.954]	[0.133]	[0.799]	[0.541]
ARCH 1-1 test: F(1,32)	0.275	0.311	0.445	5.173	0.024	0.249
	[0.604]	[0.581]	[0.510]	[0.030]*	[0.878]	[0.621]
Hetero test: F(12,21)	0.527	1.3425	0.628	1.676	0.961	0.694
	[0.874]	[0.268]	[0.796]	[0.145]	[0.512]	[0.740]
Hetero-X test: F(27,6)	1.252	1.016	0.235	1.746	0.334	0.362
	[0.421]	[0.545]	[0.996]	[0.252]	[0.977]	[0.968]

Table 3: VAR model: cointegration tests

Rank	Trace test	[Prob]	Max test	[Prob]
0	101.56	[0.017]*	39.81	[0.050]*
1	61.76	[0.185]	25.77	[0.346]
2	35.98	[0.402]	22.54	[0.199]
3	13.44	[0.869]	8.15	[0.887]
4	5.29	[0.777]	5.14	[0.726]

Table 4: VAR model: tests for (trend-)stationary

$\ln M_t$	$\ln (Y_{ft}/Y_{ht})$	U_{ft}	U_{ht}	$\ln T_t$	$\ln R_t$	trend	χ^2 (v)	*p*-value
Stationary								
.	0	0	0	0	0		31.544	[0.000]**
0	.	0	0	0	0		22.798	[0.000]**
0	0	.	0	0	0		27.974	[0.000]**
0	0	0	.	0	0		22.703	[0.000]**
0	0	0	0	.	0		31.628	[0.000]**
0	0	0	0	0	.		25.325	[0.000]**
Trend-stationary								
.	0	0	0	0	0	.	25.734	[0.000]**
0	.	0	0	0	0	.	20.407	[0.000]**
0	0	.	0	0	0	.	32.769	[0.000]**
0	0	0	.	0	0	.	27.222	[0.000]**
0	0	0	0	.	0	.	32.464	[0.000]**
0	0	0	0	0	.	.	16.111	[0.000]**

Notes: '0' denotes the zero restriction on the coefficient of the corresponding variable; '.' denotes unrestricted coefficient in the 5 x 1 cointegration vector when testing for the stationary and in the 6 x 1 cointegration vector when testing for trend-stationary of the variables. The number of degrees of freedom *v* in the χ^2 tests corresponds to the number of the imposed restrictions.

Table 5: VAR model: tests for long-run exclusion

$\ln M_t$	$\ln (Y_{ft}/Y_{ht})$	U_{ft}	U_{ht}	$\ln T_t$	$\ln R_t$	χ^2 (v)	*p*-value
0	.	.	.	.	.	14.011	[0.000]**
.	0	.	.	.	.	0.623	[0.430]
.	.	0	.	.	.	12.936	[0.000]**
.	.	.	0	.	.	6.708	[0.009]**
.	.	.	.	0	.	12.143	[0.001]**
.	.	.	.	.	0	5.476	[0.019]*

Notes: '0' denotes the zero restriction on the coefficient of the corresponding variable, '.' denotes unrestricted coefficient in the 5 x 1 cointegration vector when testing for the long-run exclusion of the variables. The number of degrees of freedom *v* in the χ^2 tests corresponds to the number of the imposed restrictions.

Table 6: VAR model: tests for long-run exogeneity

$\ln M_t$	$\ln (Y_{ft}/Y_{ht})$	U_{ft}	U_{ht}	$\ln T_t$	$\ln R_t$	χ^2 (v)	*p*-value
0	.	.	.	.	.	7.8233	[0.005]
.	0	.	.	.	.	0.0769	[0.781]
.	.	0	.	.	.	1.2818	[0.257]
.	.	.	0	.	.	0.347	[0.555]
.	.	.	.	0	.	0.003	[0.956]
.	.	.	.	.	0	0.523	[0.469]
0	0	0	0	0	0	3.973	[0.553]

Notes: '0' denotes the zero restriction on the adjustment coefficient of the corresponding variable, '.' denotes unrestricted coefficient in the 6 x 1 cointegration vector of the adjustment coefficients. The number of degrees of freedom *v* in the χ^2 tests corresponds to the number of the imposed restrictions.

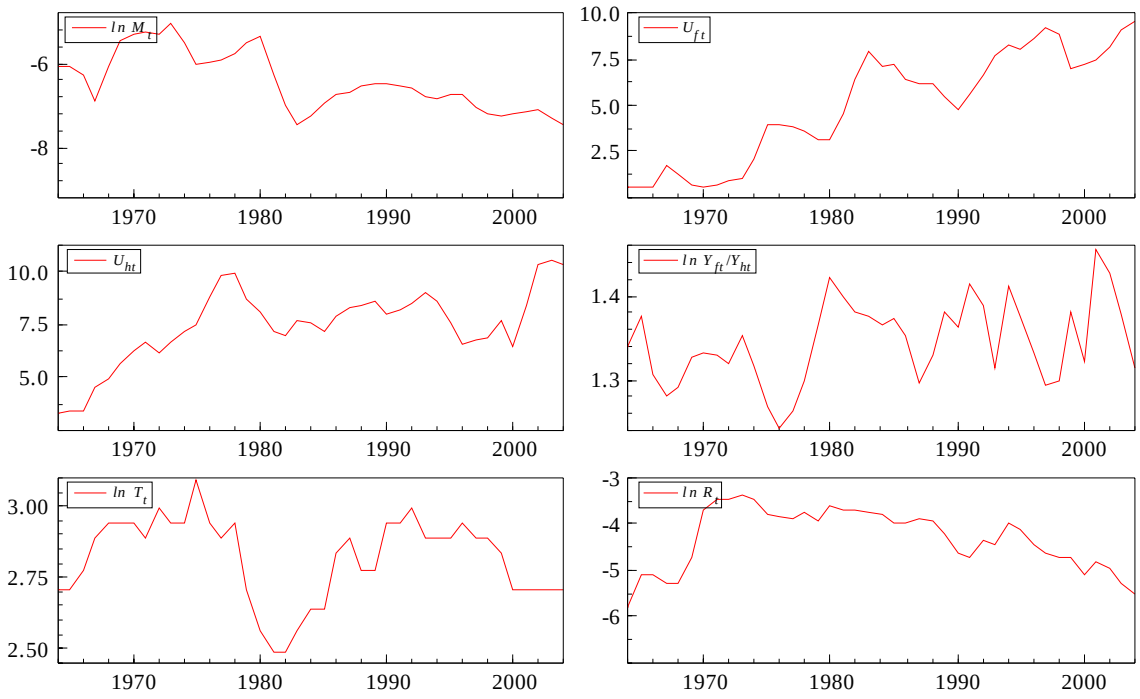

Figure 1: The basic properties of the data: 1963-2004

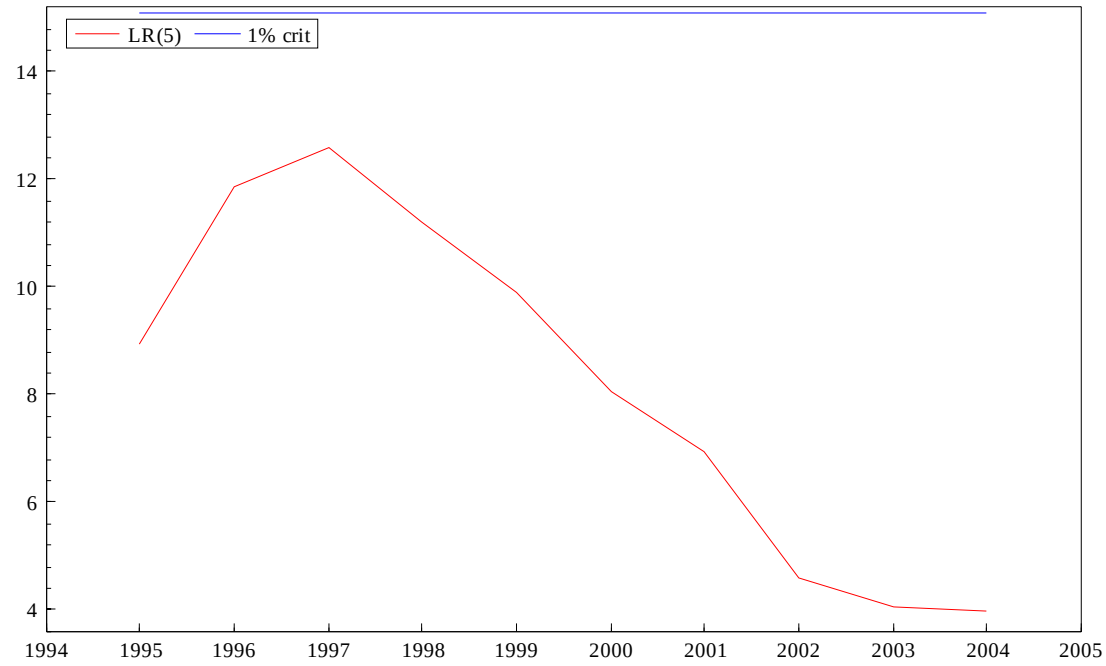

Figure 2: Recursive test statistics for long-run weak exogeneity of $\ln(Y_{ft}/Y_{ht})$, U_{ft}, U_{ht}, $\ln T_t$, and $\ln R_t$ scaled by the 1 percent critical value

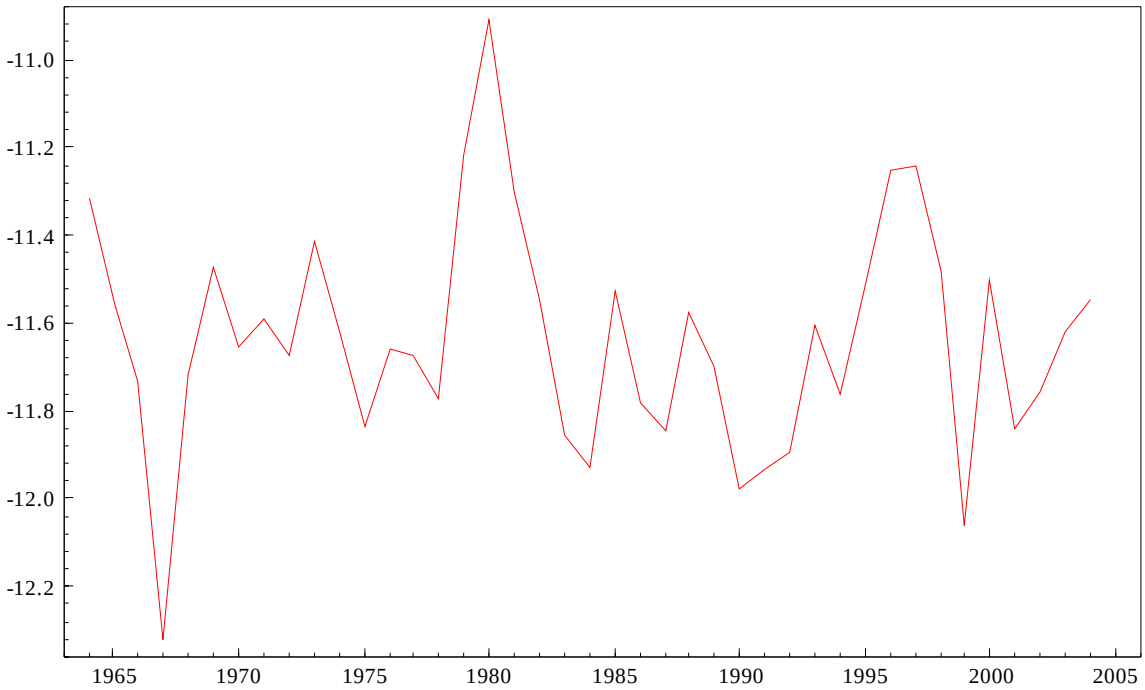

Figure 3: Cointegrating relation (equation (8))

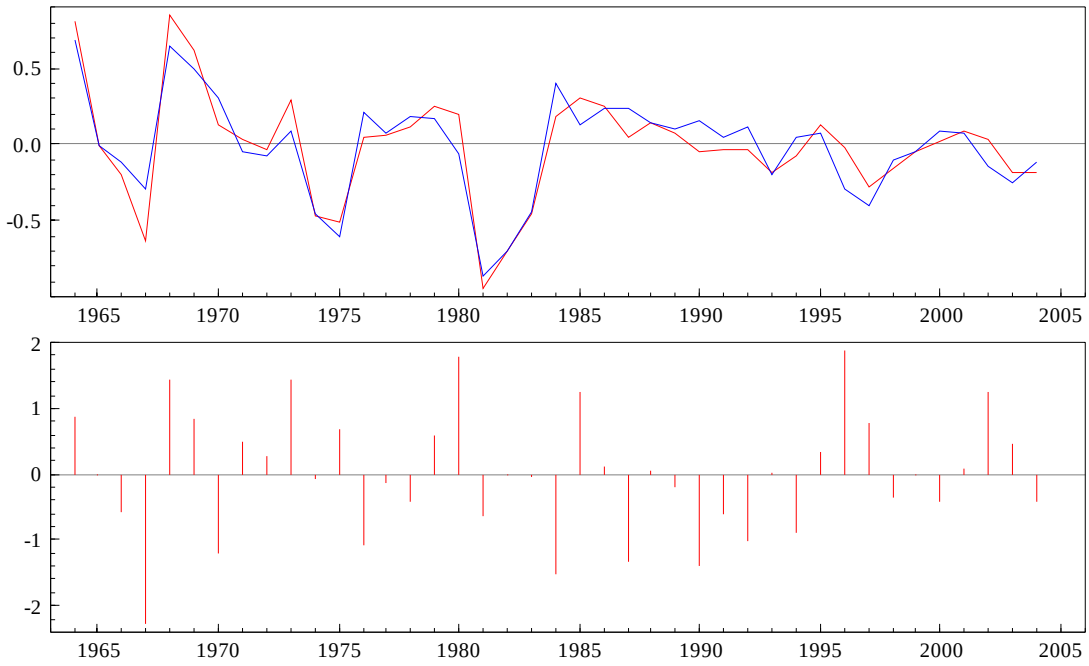

Figure 4: Actual (solid line), fitted (dashed line) and residual values for conditional model (equation (9))

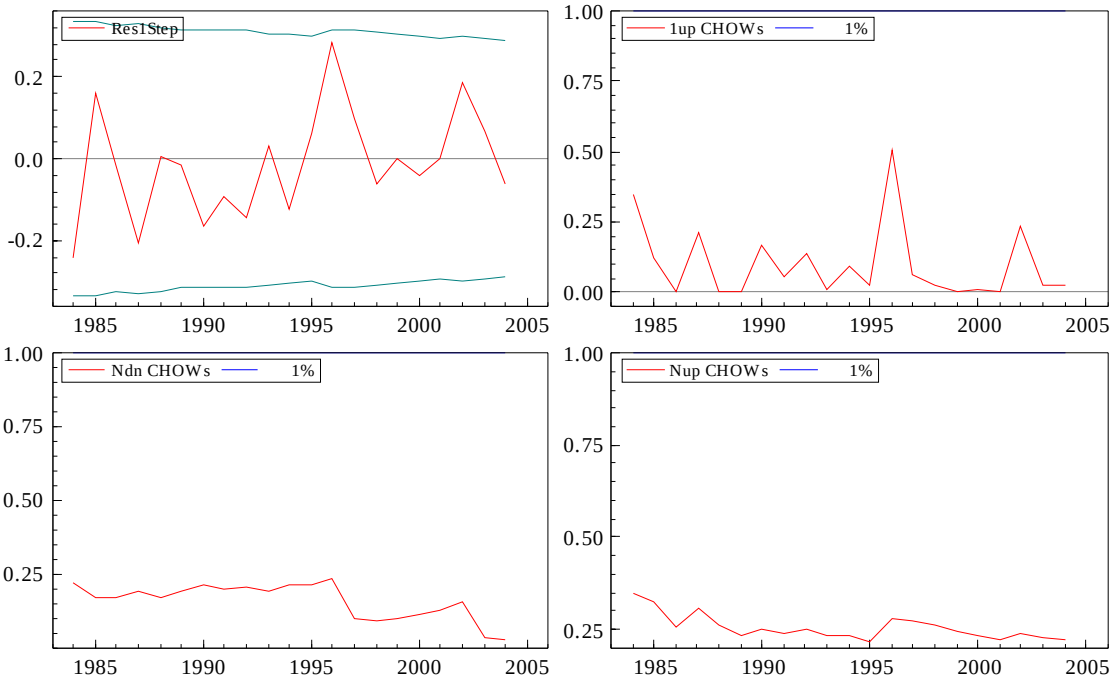

Figure 5: The recursive Chow test statistics scaled by the corresponding 1 percent critical values and the one-step residuals (Res1step) for the conditional model (equation (9))

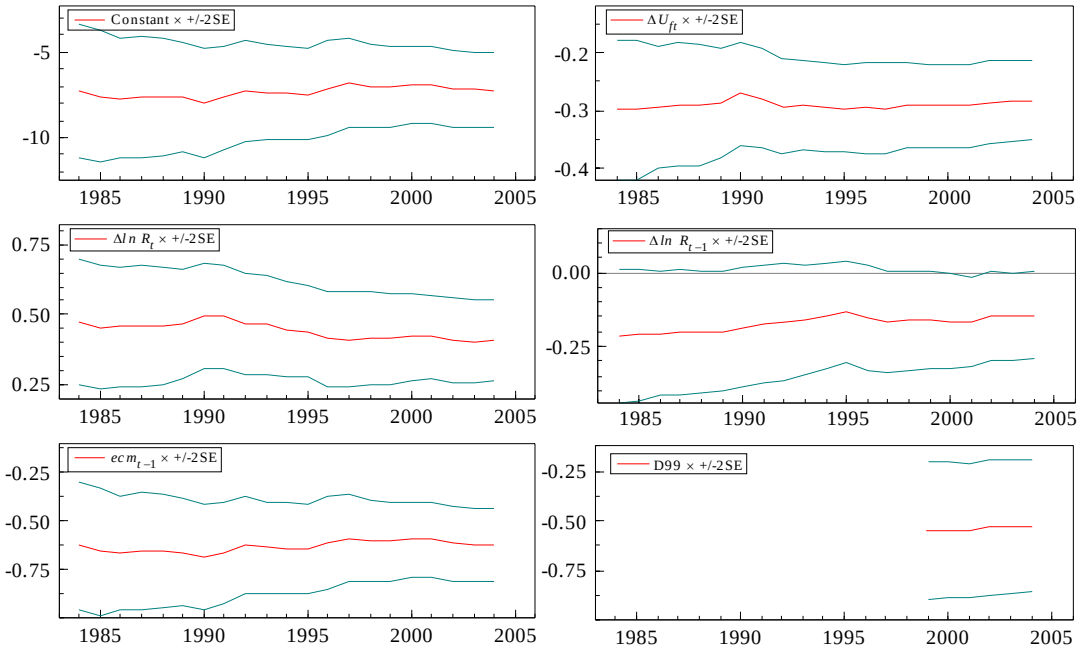

Figure 6: The recursively estimated coefficient values for the conditional model (equation (9))

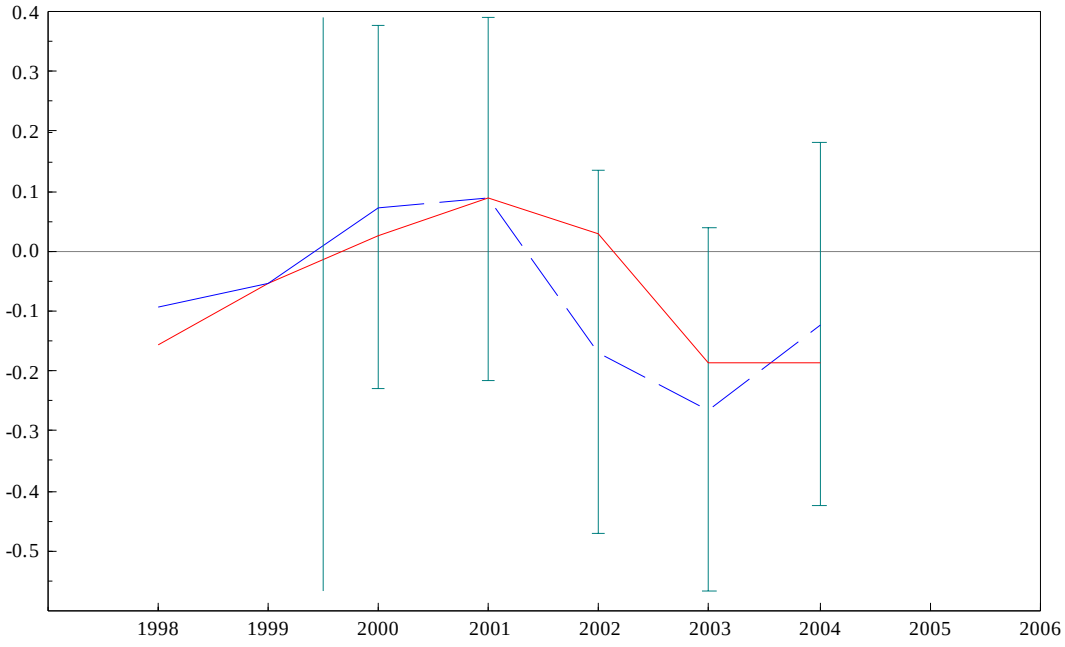

Figure 7: 1-step (ex-post) forecasts (dashed line) for conditional model (equation (9))

Migration and Trade – Complements or Substitutes? Evidence from Turkish Migration to Germany [§]

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Abstract

This study investigates whether migration and trade can be regarded as complements or substitutes using the data on Turkish migration to Germany for the period 1963-2004. Our results support the former view.

Keywords: Migration, trade, economic development, cointegration

JEL code: F22, C32.

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1 Introduction

This study intends to contribute to the ongoing debate on whether migration and trade can be considered complements or substitutes (Razin and Sadka, 1997; Venables, 1999; Schiff, 2000, among others). Knowing such a relationship can help to devise appropriate trade policies to deal with migration, but the problem is that in the theoretical literature one finds arguments that support either point of view. On the one hand, there is a stream of literature inspired by Mundell (1957) which argues that in the standard Hechscher-Ohlin model, a significant level of trade leads to the countries' specialization in production of the goods for which they have a relatively abundant supply of input factors and thus have a comparative cost advantage. As a result, trade will lead to the equalisation of factor prices and hence in a reduction of migration incentives. Thus, from this point of view, trade and migration can be regarded as substitutes. This scenario is also stressed in the development literature where it is argued that under these circumstances sustained and equitable growth in migrant sending countries is the only effective strategy to cope with the migration pressure. Hence, aid policies and other forms of economic assistance and cooperation should be geared to the objective of fostering growth in migration source countries and subsequent reduction of incentives to migrate.

On the other hand, another stream of the literature inspired by Markusen (1983) shows that, by relaxing some of the underlying assumptions of the standard Hechscher-Ohlin model, trade and migration, in fact, are complements, i.e., increase in the volume of trade is accompanied by corresponding increase in labour mobility. A positive relationship between migration and trade could also arise when income growth in the less developed country that has been generated by trade with a more economically developed partner may relax financial constraints and may allow more rather than less people to migrate, see Schiff (1994, 1995) for the corresponding analysis. In addition, it also is noteworthy to mention, that there are also theoretical models which show that the relationship between migration and trade is ambiguous, e.g., see Panagariya (1992).

In sum, it seems that there is no consensus in the theoretical literature on the relationship between migration and trade, as in the end, an answer depends on a particular model used. Hence, the ultimate answer must lie in the outcomes of empirical studies. This provides the main motivation for our paper.

We investigate the relationship between migration and trade while controlling for the influence of other factors that shape migration flows such as relative income in host and source

countries as well as prospects of employment in the respective locations (usually approximated by the foreign and domestic unemployment rates). The choice of these variables follows from the traditional micro-economic theories of migration, largely represented by Ravenstein (1889), Hicks (1932), Sjaastad (1962), Todaro (1969), and Harris and Todaro (1970).

As the case study, we look at the developments of Turkish migration to Germany for the period 1963 - 2004. Arguably, this is a very interesting topic to study given the massive migration of Turkish labourers into Germany during this period of time. As a result of the guest-worker agreements that were initialised by the German authorities in the early sixties through the early seventies, and then of family unification, refugee and asylum programmes, net migration from Turkey to Germany measured as the balance of outward and inward migration totalled 1.3 million people. This resulted in an estimated population of 2.1 million with Turkish origins in year 2004 or about 70% of about 3 million Turkish people that reside in the EU-15 countries. This effectively means that the Turkish nationals constitute by far the largest group of third country nationals in the EU-15 (about 25% of all third country nationals). Hence, it is particularly interesting to investigate whether trade has played any role – either complementary or substituting – on these rather large flows of Turkish migrants to Germany.

The rest of the paper is organised as follows: in the next section, we discuss the theoretical background of the migration model and motivate the choice of explanatory variables. In Section 3 the econometric methodology is described and the empirical results are presented. Section 4 summarizes the findings.

2 Theoretical Background and Empirical Model

In this section we briefly present the theoretical background behind the decision to migrate as well as the motivation for the choice of the explanatory variables in our study. To this end, we follow the standard micro-economic theories of migration, largely represented by the following studies: Ravenstein (1889), Hicks (1932), Sjaastad (1962), Todaro (1969), and Harris and Todaro (1970). This literature stipulates that the decision to migrate arises from expectations on utility differences in the home and the host countries, which are determined by the income differentials between these respective locations as well as by the variables that reflect labour market conditions. Thus, a migration decision of an individual is based on the pull factors of prospects abroad and the push factor of conditions at home which prospective emigrants face.

Given all these considerations, we model the migration function of Turks to Germany in the following general form below:

$$\ln(M_t) = f(\ln(Y_{ft}/Y_{ht}), U_{ft}, U_{ht}, T_t), \tag{1}$$

where M_t denotes gross inflow of Turkish migrants into Germany, expressed as the share of the home population, Y_{ft}/Y_{ht} – relative income in the host and the home countries, measured in per capita terms in purchasing power parity, U_{ft} and U_{ht} – the unemployment rates that capture prospects of employment in the respective locations. We expect that the relative income between the host and source countries Y_{ft}/Y_{ht} has positive influence on migration flows as it is the main pull factor that stimulates migration. The foreign (German) unemployment rate U_{ft} has negative influence as when the unemployment rises the prospects of employment for the potential migrants decrease and hence the willingness to migrate lessens. The effect of the domestic (Turkish) unemployment variable U_{ht} is positive as increase in local unemployment indicates that prospects of finding a job in the source country increases and hence the willingness to migrate should decrease.

Finally, T_t is the share of trade volume (sum of exports and imports) between these two countries in the total trade volume of Turkey with all its trading partners[1]. The variable T_t is central to our analysis as its statistical significance will indicate that trade and migration flows have been interrelated in our case study, and, more importantly, either a positive or negative sign of the corresponding coefficient estimate will indicate whether trade and migration have been either complements or substitutes.

3 The Econometric Approach

In our modelling of the Turkish migration to Germany, we follow the general-to-specific approach advocated in Hendry and Mizon (1993) and Hendry and Juselius (2000, 2001), inter alia. In particular, we start with an unrestricted VAR(p) model transformed into the error-correction form

$$\Delta x_t = \Pi x_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta x_{t-i} + \mu + \varepsilon_t, \varepsilon_t \sim N_k(0, \Sigma) \tag{2}$$

[1]The data have been gathered from the Federal Statistical Office in Germany, State Institute of Statistics in Turkey, and OECD.

where μ denotes a constant term. Then we proceed as follows. We test for cointegration and subsequently impose the implied reduced rank restrictions on the unrestricted VAR model. Then we test for the long-run exogeneity of the system variables. We use the results of the weak exogeneity tests in order to build a parsimonious time series model for migration that satisfactorily passes all diagnostic tests, displays constant coefficients, and possesses the ability to accurately forecast migration flow in the recent time period.

The annual data collected in the vector $x_t = (\ln M_t, \ln(Y_{ft}/Y_{ht}), U_{ft}, U_{ht}, T_t)'$ span the period from 1963 till 2004, see Figure 1.

First, we determine the lag length order of an unrestricted VAR(p) model. At this stage, we would like to get the parsimonious model given relatively small number of observations $T = 42$ compared to the number of explanatory variables $k = 5$. It seems that the VAR(1) model can adequately describe the data as the misspecification tests report no serious departures from the underlying model assumptions, see Table 1[2].

Having found the adequate unrestricted model, the next step is to proceed imposing restrictions on that model. Hence, we address the cointegration rank of the estimated system. We use the Johansen Full Information Maximum Likelihood (FIML) procedure for this purpose. Table 2 reports the results of the trace and λ-max tests. Both tests indicate the presence of one cointegrating relation in the system.

Thus we impose the cointegration rank $r = 1$ on the system (2) and proceed with testing for (trend-)stationarity and long-run weak exogeneity of the variables in our model. The test of stationarity of the variables in the model has been suggested in Johansen and Juselius (1992). This is a multivariate version of the Augmented Dickey-Fuller test with the null hypothesis of stationarity rather than non-stationarity. Since a linear combination of I(1) variables that is I(0), or I(0) variables themselves, could only belong to the cointegration space, it investigates whether any of the variables alone belong to the cointegration space. This test has an asymptotic χ^2 distribution with the $(k - r) = 4$ degrees of freedom.

Tables 3 and 4 report the results of the tests for (trend-)stationarity performed on the matrix of the long-run coefficients, and the tests for long-run weak exogeneity, performed on the

[2]The univariate as well as multivariate model diagnostic tests comprise: F_{AR} – test of no residual autocorrelation (see Godfrey (1978)); χ^2_{Norm} – test for the normally distributed residuals (see Doornik and Hansen (1994); F_{Hetero} and $F_{Hetero-X}$ – White (1980) tests for heteroscedasticity based on the original and squared regressors, and on the original, squared regressors, and their cross-products; F_{ARCH} – Engle (1982) test of no residual AutoRegressive Conditional Heteroscedasticity. The graphics, regression output, and residual diagnostic tests were calculated using GiveWin 2.2 and Pc-Give 10.2 (see Doornik and Hendry, 2001a,b).

matrix of the adjustment coefficients, respectively. According to the stationarity test, the null hypothesis that each variable is either I(0) or I(0) around a linear deterministic trend is decisively rejected. According to the univariate long-run weak exogeneity test results (see Table 4), we can accept the null hypothesis that all but $\ln M_t$ variables are individually weakly exogenous at any conventional significance level. Moreover, the joint test for the long-run weak exogeneity also conforms with this finding with the log likelihood ratio test statistic of 4.630[p=0.327]. Hence, this restriction seems to be reasonable, and in our further analysis we treat these four variables as weakly exogenous with respect to the long-run parameters.

Imposing the long-run weak exogeneity restrictions on the $\ln(Y_{ft}/Y_{ht}), U_{ft}, U_{ht}, T_t$ variables results in the following cointegrating vector with the corresponding standard errors reported in parentheses below the coefficient estimates

$$\ln M_t = \underset{(1.427)}{2.500}\ \ln\left(\frac{Y_{ft}}{Y_{ht}}\right) - \underset{(0.026)}{0.255}\ U_{ft} + \underset{(0.040)}{0.125}\ U_{ht} + \underset{(0.029)}{0.118}\ T_t + constant + ecm_t \tag{3}$$

Observe that all the coefficient estimates are statistically significant at the conventional significance levels. Moreover, the coefficient estimates of the relative income and domestic employment have expected positive signs such that the increase in income gap and in unemployment in Turkey exert stimulating influence on migration. On the other hand, the coefficient sign of the foreign unemployment is negative which implies that rise in unemployment in Germany exerts prohibitive influence on migration.

More importantly, our estimation results provide empirical support for the theoretical literature that views migration and trade as complements. The likely reason for such outcome is that during the period under investigation, the large income differential between those two countries was present which served as a dominating factor that stimulated people to migrate. Given such persistent income inequality between these two countries, developments in the total volume of trade between Germany and Turkey positively affected migration flows by generating income of the potential migrants in Turkey that could not afford to migrate before. Therefore the financial constraints as well as various adjustment and informational costs associated with decision to migrate were significantly alleviated.

Given our finding that trade and migration are complements, one may consider controlling migration through more restrictive trade policies. However, in the presence of huge income

disparity between those two countries it is unlikely that further increases in trade barriers is going to reduce the migration potential in Turkey. Instead, trade promotion and creation of incentives to invest in infrastructure, health, education, and technology sectors in Turkey with an ultimate goal of boosting productivity and wages may eventually reduce income gap between Turkey and Germany and thus relieve incentives to migrate.

As shown in Johansen (1992), the status of long-run weak exogeneity of some variables allows us to reformulate the model (2) in terms of a conditional model, where we condition on the current and past values of the weakly exogenous variables, and the lagged error correction term, ecm_{t-1}. After removing the variables that have turned out to be insignificant, the estimated conditional model for $\ln M_t$ looks as follows

$$\begin{aligned}\Delta \ln M_t \;=\; & \underset{(0.588)}{1.806}\;\Delta\;\ln\left(\tfrac{Y_{ft}}{Y_{ht}}\right) \;-\; \underset{(0.038)}{0.292}\;\Delta\,U_{ft} \;-\; \underset{(0.061)}{0.459}\;ecm_{t-1} - \underset{(0.184)}{0.663}\;D99_t - \underset{(0.715)}{5.205} \\ & \widehat{\sigma} = 0.162,\; R^2 = 0.814,\; T = 42,\; F_{AR(1-2)}(2,35) = 1.157[0.855], \\ & F_{ARCH(1)}(1,35) = 1.145[0.219],\; \chi^2_{Norm}(2) = 1.183[0.553], \\ & F_{Hetero}(7,29) = 0.256[0.965],\; F_{Hetero-X}(10,26) = 0.301[0.974], \\ & F_{RESET}(1,36) = 0.584[0.449]\end{aligned} \tag{4}$$

with the corresponding standard errors reported in parentheses below the coefficient estimates.[3]

The conditional model (4) is parsimonious, but at the same time, the diagnostic tests show no signs of misspecification. Moreover, the estimated coefficients display remarkable stability indicated by the Chow parameter constancy forecast F-test statistic which takes the value of 0.214[p=0.953]. Observe that the error-correction term is highly significant and it has the expected sign. It is noteworthy to note that the German unemployment rate and relative income also in the short-run dynamics of the conditional model have expected signs and exert dampening and promoting effects on the Turkish migrant inflow in Germany, respectively.

4 Conclusion

In this paper we conducted an empirical analysis of the question on whether migration and trade can be regarded as complements or substitutes for which the theoretical literature yields rather

[3]The impulse dummy variable $D99_t$ accounts for the sharp fall in the German unemployment rate in 1999 that was not reflected in migration flows, see Figure 1.

controversial conclusions. In our analysis, we used the time series data on Turkish migration to Germany over the period 1963-2004.

Our estimation results provide empirical support for the theoretical literature that views migration and trade as complements. The likely reason for such an outcome is the persistence of the large income differential between those two countries that still shows no signs of declining. Such a large income discrepancy served as a dominating factor that stimulated people to migrate. Given this, positive developments in the total volume of trade between Germany and Turkey positively affected migration flows by providing additional financing for potential migrants who could not migrate before. The development of trade linkages between these two countries also necessarily lowered various adjustment and informational costs associated with decision to migrate.

References

Doornik, J. A. and H. Hansen (1994). A practical test for univariate and multivariate normality. Discussion Paper, Nuffield College, Oxford.

Doornik, J. A. and D. F. Hendry (2001a). *GiveWin: An Interface to Empirical Modelling*. London: Timberlake Consultants Press.

Doornik, J. A. and D. F. Hendry (2001b). *Modelling Dynamic Systems Using PcGive*, Volume II. London: Timberlake Consultants Press.

Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of united kingdom inflation. *Econometrica 50*, 987–1007.

Godfrey, L. G. (1978). Testing for higher order serial correlation in regression equations when the regressors include lagged dependent variables. *Econometrica 46*, 1303–1313.

Harris, J. and M. Todaro (1970). Migration, unemployment, and developement: A two-sector analysis. *American Economic Review 60*, 126–142.

Hendry, D. F. and K. Juselius (2000). Explaining cointegration analysis. Part 1. *The Energy Journal 21*(1), 1–42.

Hendry, D. F. and K. Juselius (2001). Explaining cointegration analysis. Part 2. *The Energy Journal 22*(1), 75–120.

Hendry, D. F. and G. E. Mizon (1993). Evaluating econometric models by encompassing the VAR. In P. C. Phillips (Ed.), *Models, Methods and Applications of Econometrics*, Basil. Blackwell.

Hicks, J. (1932). *The Theory of Wages*. London: McMillan.

Johansen, S. (1992). Testing weak exogeneity and the order of cointegration in the UK money demand. *Journal of Policy Modelling 14*, 313–334.

Johansen, S. and K. Juselius (1992). Testing structural hypotheses in a multivariate cointegration analysis of the PPP and the UIP for the UK. *Journal of Econometrics 53*, 211–244.

Markusen, J. R. (1983). Factor movements and commodity trade as complements. *Journal of International Economics 14*, 341–356.

Mundell, R. (1957). International trade and factor mobility. *American Economic Review 47*, 321–335.

Panagariya, A. (1992). Factor mobility, trade and welfare: A north-south analysis with economies of scale. *Journal of Development Economics 39*(2), 229–245.

Ravenstein, E. (1889). The laws of migration. *Journal of the Statistic Society 59*, 214–301.

Razin, A. and E. Sadka (1997). *International Migration and International Trade*, Volume 1B, Chapter 15, pp. 851–887. Amsterdam, New York, and Oxford: Elsevier Science, North-Holland.

Schiff, M. (1994). How trade, aid, and remittances affect international migration. World Bank Policy Research Working Paper No. 1376.

Schiff, M. (1995). Trade policy and international migration in the short and the long run. *Revue d'Economie du Developpement 1*, 3–25.

Schiff, M. (2000). South-north migration and trade: A survey. *Revue d'Economie du Developpement 3*, 3–54.

Sjaastad, L. (1962). The costs and returns of human migration. *Journal of Political Economy 70*, 80–93.

Todaro, M. P. (1969). A model of labour migration and urban unemployment in less developed countries. *American Economic Review 59*(1), 139–48.

Venables, A. (1999). Trade liberalisation and factor mobility: An overview. In R. Faini, J. De Melo, and K. F. Zimmermann (Eds.), *Migration: The Controversies and the Evidence*, pp. 23–47. Cambridge: Cambridge University Press.

White, H. (1980). A heteroscedastic-consistent covariance matrix estimator and a direct test for heteroscedasticity. *Econometrica 48*, 817–838.

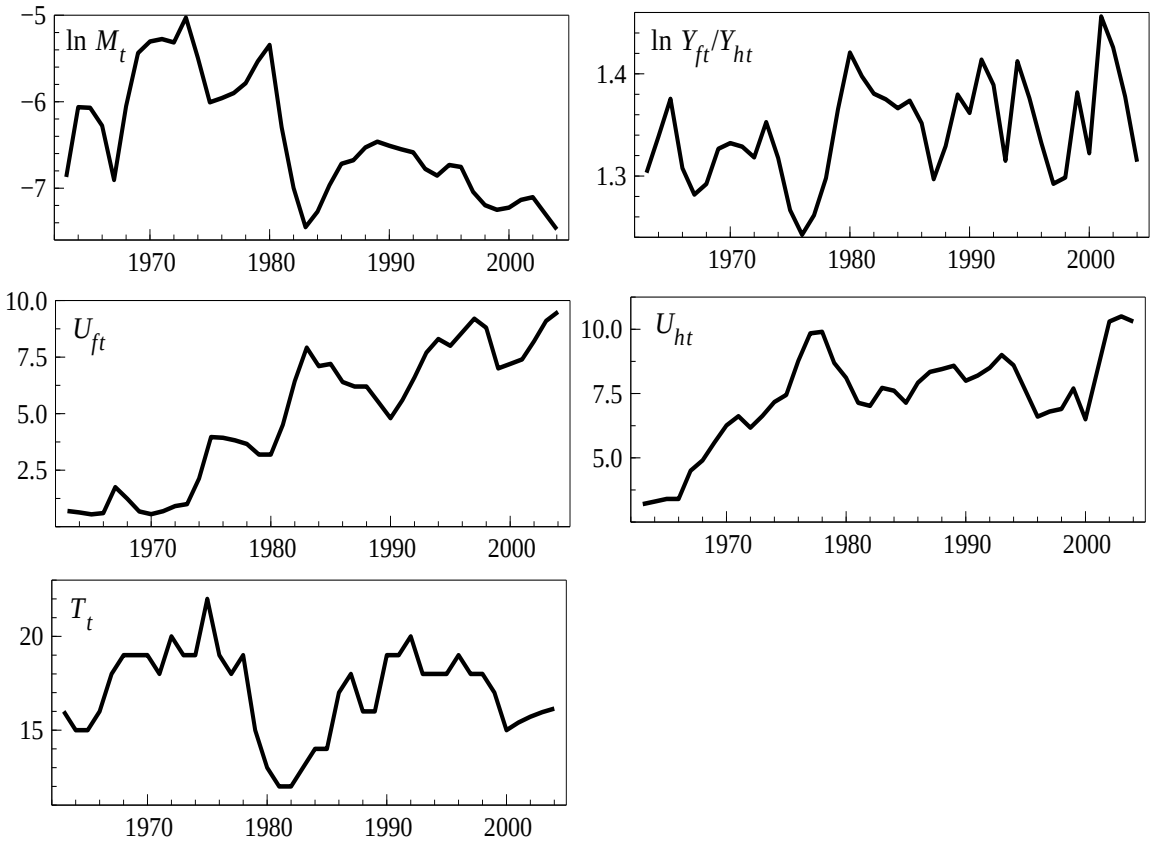

Figure 1: Data: 1963 - 2004

Table 1: VAR model: specification tests

Multivariate tests

$F_{AR(1-3)}(75,85)$	1.212	[0.195]
$\chi^2_{Norm}(10)$	18.751	[0.044]*
$F_{Hetero}(150,110)$	0.801	[0.897]
$F_{Hetero-X}(300,55)$	0.681	[0.976]

Univariate tests

	$\ln M_t$	$\ln(Y_{ft}/Y_{ht})$	U_{ft}	U_{ht}	T_t
$F_{AR(1-3)}(3,33)$	2.405	0.864	1.195	1.606	0.786
	[0.085]	[0.467]	[0.327]	[0.207]	[0.511]
$\chi^2_{DH}(2)$	3.635	4.655	0.265	4.742	0.988
	[0.163]	[0.097]	[0.876]	[0.093]	[0.610]
$F_{ARCH(1)}(1,34)$	0.0264	0.255	0.152	5.842	0.178
	[0.872]	[0.617]	[0.698]	[0.021]*	[0.676]
$F_{Hetero}(10,25)$	0.561	0.667	0.888	2.121	1.141
	[0.829]	[0.743]	[0.556]	[0.062]	[0.373]
$F_{Hetero_X}(20,15)$	0.853	0.523	0.433	1.807	1.207
	[0.636]	[0.912]	[0.959]	[0.123]	[0.363]

Notes: The corresponding p-values are reported in the squared brackets.
'*' indicates significance at the 5% level.

Table 2: VAR model: cointegration tests

rank	Trace test	[Prob]	Max test	[Prob]
0	73.51	[0.023]*	38.93	[0.009]**
1	34.58	[0.475]	22.32	[0.210]
2	12.25	[0.919]	6.08	[0.973]
3	6.17	[0.679]	5.00	[0.742]
4	1.17	[0.279]	1.17	[0.279]

Notes: The corresponding p-values are reported in the squared brackets.
'*' and '**' indicate significance at the 5% and 1% levels, respectively.

Table 3: VAR model: tests for (trend-)stationarity

$\ln M_t$	$\ln(Y_{ft}/Y_{ht})$	U_{ft}	U_{ht}	T_t	trend	$\chi^2(v)$	p-value
			Stationarity				
.	0	0	0	0		34.307	[0.000]**
0	.	0	0	0		21.269	[0.000]**
0	0	.	0	0		34.798	[0.000]**
0	0	0	.	0		32.187	[0.000]**
0	0	0	0	.		30.358	[0.000]**
			Trend-stationarity				
.	0	0	0	0	.	29.137	[0.000]**
0	.	0	0	0	.	26.409	[0.000]**
0	0	.	0	0	.	40.404	[0.000]**
0	0	0	.	0	.	40.607	[0.000]**
0	0	0	0	.	.	38.345	[0.000]**

Notes: '0' denotes the zero restriction on the coefficient of the corresponding variable, '·' denotes unrestricted coefficient in the 5×1 cointegration vector when testing for the stationarity and 6×1 cointegration vector when testing for trend-stationarity of the variables.
The number of degrees of freedom v in the χ^2 tests corresponds to the number of zero restrictions imposed.
The corresponding p-values are reported in the squared brackets.
'**' indicates significance at the 1% level.

Table 4: VAR model: tests for long-run weak exogeneity

$\ln M_t$	$\ln(Y_{ft}/Y_{ht})$	U_{ft}	U_{ht}	T_t	$\chi^2(v)$	p-value
0	.	.	.	.	9.950	[0.002]**
.	0	.	.	.	0.545	[0.460]
.	.	0	.	.	0.301	[0.583]
.	.	.	0	.	0.705	[0.401]
.	.	.	.	0	0.522	[0.470]
.	0	0	0	0	4.630	[0.327]

Notes: '0' denotes the zero restriction on the adjustment coefficient of the corresponding variable, '·' denotes unrestricted coefficient in the 5×1 vector of the adjustment coefficients.
The number of degrees of freedom v in the χ^2 tests corresponds to the number of zero restrictions imposed.
The corresponding p-values are reported in the squared brackets.
'**' indicates significance at the 1% level.

Trade, Aid, Remittances and Migration

By

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Abstract

We investigated whether migration is interrelated with trade, aid and remittances so that any policies that consider trade, aid and remittances also affect the decision to migrate. We developed and estimated an empirical model of Turkish migration to Germany and tested the model for the 1969-2004, using the cointegration technique. A single cointegrating vector is found among the gross migration inflows and the following explanatory variables: the relative income ratio between Germany and Turkey, the unemployment rates in Germany and Turkey, aid, the trade intensity variable and the ratio of manufacturing exports with Germany to total exports with Germany and remittances as a ratio of Turkish GDP. The results of this study show that migration, trade, aid and remittances are interrelated, however, migration will be better managed when the dynamic gains from trade and aid are considered. Hence, the broad-based and rapid economic development with increase in income is the only effective means of reducing migration pressures in a labour-surplus country. This is mainly because the income differential is the most significant factor in determining migration flows.

Keywords: Trade; Aid; Remittances; Migration; Cointegration

JEL Classification: C22; F16; F22; F24; F35

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1. Introduction

In the traditional trade models, both trade and international factor mobility are driven by differences in factor proportions between countries. Countries with a high ratio of capital to labor will export capital-intensive goods, import labor-intensive goods, invest in abroad and will be attractive for migration. Trade in goods in these models will reduce the incentive for factor movements and will lead the exact equalization of factor prices across countries. Thus, international trade narrows the wage gap and reduces the incentives to migrate. The feared resumption of massive labor flows from Turkey with the recognition of Turkey as a candidate for accession at the Helsinki European Council in December 1999 and the start of accession negotiations between European Union and Turkey in October 2005, brings back the question that whether the trade policy can be effective in reducing migration pressure from Turkey. Thus, can we have an optimal combination of trade, aid, remittance and migration policies in order to avoid massive labor inflows from Turkey with the accession? This proposition might be attractive for the receiving countries because the movements of goods and services between countries through trade is more welcomed than the movements of people due to the additional fiscal burdens that migrants put on others and these external costs can create social tension. Thus, by exporting labor-intensive goods Turkey in effect export labor embodied in its export and hence there will be no need for migration in this approach. More importantly, if trade substantially reduce unemployment and contribute to the economic growth as well as economic efficiency then it can really help reduce the pressures for migration. Thus, trade is not only exchange of goods but promotes competition and investment in education and infrastructure, creates an opportunity to exploit economies of scale, transfer of knowledge and technology. Therefore, the dynamic rather than static effect of trade can be more effective in reducing the income differential that is the main driving force of migration.

Although rich countries protect most strongly the sectors that produce competing labor-intensive goods, Turkish trade with Germany has been in favour of Turkey. Turkey took two major trade liberalizing policies: in the early 1980s and the Customs Union

Agreement in 1996. The export-led growth strategy was accompanied by gradual import liberalization, more flexible exchange rate regime and more effective export incentive programmes. These reforms not only rapidly expanded total volume of exports but also the export decomposition changed in favour of manufacturing goods that Turkey has a comparative advantage. Furthermore, following trade liberalization investment, employment and output in manufacturing sector increased, although the real wage growth in manufacturing sector has been very modest, TSI (2005). Hence, the share of manufacturing exports in total exports in which Turkey has a comparative advantage may have an important deterrent factor in determination of migration flows.

Development aid that speeds up economic development and human capital formation also helps to keep the population at home. Investment in human capital results in higher productivity that is translated into increasing returns to scale effect and labor productivity increases countinously. Remittances, likewise if are used for productive investment at home can create employment and contribute to economic growth. However, economic growth and increase in income are likely to increase migration pressure in the short-run by making migration accessible to unskilled migrants with low incomes and low access to credit markets. Thus, labor mobility tends to interact closely with trade, aid, and capital flows in many ways direct and indirect. These inter-linkages have special importance in relation to current and anticipated inflows of Turkish migrants to Germany. Therefore, revised policies based on the study of these linkages can make migration more manageable and promote efficiency in the region. This is especially important if we consider migration not only economic but also social phenomenon.

To our knowledge, this is the only empirical study that incorporates trade, aid and remittances in a migration model in order to consider the extent to which trade, aid and remittance policies can be effective in managing migration inflows.

The paper structured as follows. Section 2 gives background information on how trade, aid, remittances and migration are interrelated. Section 3 considers the empirical model. Section 4 provides the econometrics results. Section 5 concludes.

2. Background

Trade liberalization aims not only access to foreign markets to sell goods but also to speed up economic growth. However, international trade agreements have been unsuccessful in promoting growth in poor countries such as NAFTA. Stiglitz (2006) argues that NAFTA did not bring benefits to Mexico, but lowered wages and increased unemployment. This was because trade agreements have been asymmetric, and this put developing countries at a disadvantage. In addition, a lack of infrastructure in developing countries prevents them to bring their goods to markets. Likewise, imperfect capital markets prevent them to get the necessary finance for new export opportunities. Trade liberalization when done fairly, when accompanied by the right measures and the right policies help development. In this process, aid certainly has an important role to increase trade by providing the infrastructure. NAFTA had the aim that it would help close the gap in income between Mexico and the United States and thus reduce the pressure of illegal migration. However, NAFTA did not result in a rapid growth in Mexico's economy. This was because trade liberalization was so fast that private sector could not create jobs immediately, and further high interest rates prevented them create new jobs. It needs to be added that, in so far as increased imports to migrant sending countries may drive out local firms from the market, thus eliminating jobs directly or indirectly linked to them, liberalized trade may contribute to increase pressures for migration during the transition. However, any such job losses in the short-run should be outweighed by additional employment created in the labour-intensive export sector, combining economies of scale, easier and less expensive supply of imports as production inputs and a more efficient allocation of resources throughout the economy in the long-run.

In traditional model factor price equalization holds so that wages of skilled workers, of unskilled workers and the return to capital will be the same in everywhere. Trade liberalization leads toward the equalization of factor prices. Free trade is a substitute for people having to move. Furthermore, if labor moves from a labor abundant country where productivity and wages are low to one where labor is scare where wages are high,

then output will increase and economy will grow. However, economic growth in the labor abundant country will depend on how fast they acquire the knowledge and technology that the advanced countries have. Thus, wages will only rise if productivity increase and this will depend on the investment on technology and education.

Turkey has a comparative advantage in production of agricultural and textile goods (that are labor-intensive goods) and reduction in tariffs and restrictions of these products with the European countries may reduce migration in the long-run. However, in the short-run the effect may be positive. The exports of manufacturing goods to Germany certainly helped Turkey's transition from the agriculture dominated economy. Over the years following trade liberalization employment, exports and output of manufacturing sector have increased.

However, even if all tariff and trade barriers are reduced to zero the wage differences between Turkey and Germany will not equalize. This is not only related to the transportation costs, but the economic structure of Turkey. The wage differences will persist unless there are capital flows to Turkey that will make workers more productive and the gap in knowledge between the West and Turkey is eliminated. It will take longer time than the period under investigation in this study to eliminate the knowledge gap and the capital shortage in Turkey. However, in this study we show that the increase of exports of goods that Turkey has a comparative advantage can reduce migration pressure in the long-run. Therefore, fair trade regime has an important role to play. However, the most important impacts of trade liberalization would be its help to alleviate poverty through job creation, promoting competition, improvements in education and in health and technological learning.

Aid[1] or official development assistance (ODA) is not only the transfer of funds that combines loans and grants but also the provision of technical assistance or capacity building. It should be emphasized that a loan is called aid if only it carries a subsidy element. However, aid will only help if they introduce ideas and improve practices that

[1] Aid in this paper refers to the official development assistance (ODA).

increase the overall size of the resources available for growth and poverty reduction. Therefore, aid is most welcomed when it is accompanied with ideas, policies and capacity building. Only then aid can contribute to the long-run economic growth and eliminate wage differences between Turkey and the west. However, the share of "short impact" aid to Turkey such as budget and balance of payments support, infrastructure investments is higher than the share of aid for productive sectors such as agriculture and industry, see Uygur (1992) and OECD (2007). In the 1960s and 1970s, aid was used to finance investments in the manufacturing sector, but in the 1980s and 1990s, aid was used to greater extent to finance the interest bills, principal repayments and trade deficits as well as investment in energy and infrastructure. Thus, a relative neglect of industrial investments can make aid detrimental to long-run economic growth and employment creation. Needless to mention Turkish economic and social policies and governance as well as the institutions affect project qualities.

Aid and trade are viewed as substitute for one another and trade is the favoured of the two. The role of trade in economic growth and poverty alleviation might be more effective than aid, given the structure, type and the magnitude of aid. Exports growth can certainly generate incomes for the poor, as many unskilled would-be migrants as in the Turkish case are unable to finance their migration cost out of their low-wage income. The increase of migration with trade liberalization in the short-run has been called a *migration hump,* see Martin and Taylor (1996). This means that the same economic policy that reduces migration in the long-run can increase it in the short-run, making free trade policy a dilemma as the best way to reduce migration.

3. An empirical model

We model Turkish migration to Germany as follows:

$$\ln M_t = \alpha_0 + \alpha_1 \ln(Y_{ft} / Y_{ht}) + \alpha_2 U_{ft} + \alpha_3 U_{ht} + \alpha_4 \ln\left(\frac{A_t}{GNI_t}\right) + \alpha_4 \ln T_t$$
$$+ \alpha_5 \ln\left(\frac{MXG_t}{TXG_t}\right) + \alpha_6 \ln\left(\frac{R_t}{Y_{ht}}\right) + \varepsilon_t \qquad (1)$$

In (1), $\ln M_t$ denotes the log of the gross inflow of Turkish migrants to Germany, expressed as a share of the home population. Brücker and Schröder (2006) argue that migration stocks, rather than the (net) migration rate, should be used in migration estimation, since an equilibrium relationship between migration stocks and the explanatory variables arises in the long run, while the net flows tend to zero. However, in this study we use the gross migration rate (as is done, for example, in Borjas (1987, 1999), Hatton (1995), Clark et al. (2002), Pedersen et al. (2006), Péridy (2006), and Mayda (2007)), not the stock of Turkish migrants. We test several hypotheses such that trade and aid flows reduce incentive to migrate and remittances trigger additional migration. Typically, migrants of different cohorts exhibit different remittance behaviour. For example, migrants tend to pay the debt that they incurred in financing their migration during the first year or so following their migration, and over time, upon bringing their families to Germany, they remit less than more recent migrants. This implies different remittance behavior for the cohorts that sum up to the stock of Turkish migrants. Therefore, we use as the dependent variable the gross migration rate rather than stocks or net inflows. In addition, as explained below, we incorporate the share of manufacturing exports to Germany in total exports to Germany and the trade intensity as independent variables, which require us to work with flows rather than with the stock of migrants. Notably, the initial data analysis did not provide evidence of any significant relationship between the stocks and the explanatory variables, especially not between the stocks and workers' remittances, the export and the trade intensity variable.

The $\ln(Y_{ft} / Y_{ht})$ is the log of the income in the host country divided by the income in the home country, measured as per capita GDP in purchasing power parity terms. This variable captures the pecuniary incentive to migrate that arises from the income differential.

U_{ft} is the unemployment rate in Germany. The German migration policies have become more restrictive during periods of high unemployment in Germany (Mayda and Patel (2004)).

The U_{ht} term is the unemployment rate in Turkey. It represents a simple push factor. The unemployment rate enters the empirical model individually rather than as a difference term, in line with (for example) Borjas (1987, 1999), Hatton (1995), Clark et al. (2002), Pedersen et al. (2006), Péridy (2006), and Mayda (2007).

$\ln\left(\frac{A_t}{GNI_t}\right)$ is the overseas development aid to GNI ratio. The hypothesis is that aid will encourage economic development and will reduce incentive to migrate.

$\ln T_t$ is a proxy for the intensity of economic cooperation between Turkey and Germany, calculated as the log of the share of the trade volume (sum of exports and imports) between the two countries in the total trade volume of Turkey with all its trading partners. The volume of trade between two economies could measure a variety of links between the economies. The higher the volume, the more intensive the links. The bilateral links co-shape the migration "infrastructure" or environment. It stands to reason that an increase in the total volume of trade between Germany and Turkey can alleviate the financial and informational constraints associated with migration from Turkey to Germany, and thereby lower the cost of migration, particularly for low-skill workers with low incomes and with limited access to credit markets. Trade can serve as an indicator of the level of business linkages between economies, which in turn lower informational costs and reduce uncertainty, thereby impinging on the migration "climate." In addition, trade could impact on migration in more subtle ways. When the volume of trade between Turkey and Germany is high, Turkey will be less likely to allow appreciation of its currency - exporters could suffer greatly if it did - and is more likely to tilt in the direction of depreciation of its currency. For a given stock of Turkish migrants in

Germany, a depreciation of the Turkish currency could prompt migrants to increase their remittances.

$\ln\left(\frac{MXG_t}{TXG_t}\right)$ is the share of Turkish manufacturing exports with Germany in total Turkish exports with Germany. This variable captures the effects of the expansion of manufacturing exports that Turkey has a comparative advantage on decision to migrate. In other words, with this variable we test whether trade and migration are substitutes or complements.

Finally, $\ln\left(\frac{R_t}{Y_{ht}}\right)$ is the log of the ratio between workers' remittances and Turkish GDP.

The data on workers' remittances were obtained from the balance sheets of the Bundesbank, while the data on the per capita GDP of Germany and of Turkey were obtained from the OECD. Data on Turkish unemployment, population, and trade were gathered from the Turkish Institute of Statistics. Data on Turkish migration and on German unemployment were obtained from the Federal Statistical Office in Germany. Data on aid is obtained from the World Development Indicators, World Bank.

4. The general to specific approach and econometrics results

Modelling based on the general-to-specific modeling approach that aims to build empirical models that economically sensible and statistically satisfactory, Hendry (1995), Campos and Ericsson (1999) and Hoover and Perez (1999). Although we have thirty-six years of annual data, as shown in Akkoyunlu (1999) and Campos and Ericsson (1999), the sample size is only one of several factors which determine how much information is in the sample. Even our data sample is small, the data movements so large that are crucial for the information of data. Therefore, over-parameterisation should not be a concern.

Therefore, we start with a general model which is probably over-parameterised with two lags for the gross inflows of Turkish migrants to Germany, expressed as the share of the home population, $\ln M_t$ and a broad set of explanatory variables (income differential (the ratio of German GDP to Turkish GDP in PPPs, $\ln\left(\frac{Y_{ft}}{Y_{ht}}\right)$), the German unemployment rate, U_{ft}, the Turkish unemployment rate, U_{ht}, aid (aid to GNI ratio, $\ln\left(\frac{A_t}{GNI_t}\right)$), trade intensity (the share of total trade with Germany in total Turkish trade, $\ln T_t$), the share of Turkish manufacturing exports with Germany in total Turkish exports with Germany, $\ln\left(\frac{MXG_t}{TXG_t}\right)$, and Turkish remittances from Germany, expressed as a ratio to Turkish GDP, $\ln\left(\frac{R_t}{Y_{ht}}\right)$).[2] Thus, we allow for everything[3] at the outset that might be significant and then investigate whether and how this initial general model can be reduced without significant loss of information about the parameters of interests. Economic theory information helps specify the vector of parameters of interest; however, the parameters of interest might come from a data-instigated model. However, theory consistency is essential, so that there is no evaluation conflict between the model and the theory interpretation. Hence, I aim to conclude with a parsimonious model which has orthogonal regressors as well as satisfying the necessary conditions for both congruence and encompassing.

However, the general-to-specific modelling *still* suffers from allegations that it mines the data pejoratively. These allegations are, as in Campos and Ericsson (1999):

I. *Repeated Testing:* Regressors are selected in an attempt to maximise *t*-ratios. Thus simply conducting multiple tests will induce significant outcomes by chance.

[2] All the variables apart from the unemployment rates are expressed in logs.

[3] Social networks are considered to be and found in many studies to be an important determinant of migration as they can provide information prior to migration, and financial assistance and support until the migrants get used to the new environment. However, in this study we found the stock of Turkish migrants that represents social networks to be insignificant in the short- as well as in the long-run.

II. ***Data Interdependence:*** Non-constant coefficient might result due to an omitted regressor that is correlated with the included one, and this correlation changes over time due to regime changes that generate the system.

III. ***Corroboration:*** The regressors are chosen according to a criterion such as having sensible coefficient estimates. However, there might still be important omitted variables.

IV. ***Over-parameterization:*** If the model is over-fitted, it uses up many degrees of freedom.

However, this paper, during the building process of the empirical model, shows that these allegations can be refuted easily.

The annual data covers the period from 1969-2004 (see Figure 1, for the basic properties of the data).

Our first step is to obtain parsimonious unrestricted model, which is quite challenge given the relatively small number of observations (T=36) compared to the number of explanatory variables (k=7). The results of the unrestricted general model are given in Table 1. Table 1 shows that the unrestricted model can adequately describe the data, since the misspecification tests show no serious departures from the underlying model assumptions.

The next step is to find the cointegrating relationship between variables. The solved long run equation, as well as the error correction mechanism (ECM) is given below. The test on the significance of the lag length suggests that the model should have two lags.

$$\ln M_t = -18.927 + 4.858 \ln\left(\frac{Y_{ft}}{Y_{ht}}\right) - 0.034\, U_{ft} + 0.229\, U_{ht}$$
$$\text{(SE)} \quad (3.004) \quad (1.852) \quad (0.042) \quad (0.044)$$
$$- 0.055 \ln\left(\frac{A_t}{GNI_t}\right) + 2.327 \ln T_t - 0.679 \ln\left(\frac{MXG_t}{TXG_t}\right) \qquad (2)$$
$$\text{(SE)} \quad (0.053) \quad (0.362) \quad (0.195)$$
$$+ 0.743 \ln\left(\frac{R_t}{Y_{ht}}\right)$$
$$\text{(SE)} \quad (0.119)$$

$$\text{ECM} = \ln M_t + 18.927 - 4.858 * \ln\left(\frac{Y_{ft}}{Y_{ht}}\right) + 0.034 * U_{ft} - 0.229 * U_{ht}$$
$$+ 0.055 * \ln\left(\frac{A_t}{GNI_t}\right) - 2.327 * \ln T_t + 0.679 * \ln\left(\frac{MXG_t}{TXG_t}\right) \qquad (3)$$
$$- 0.743 \ln\left(\frac{R_t}{Y_{ht}}\right)$$

WALD test $\chi^2(7) = 1210.27$ [0.00] **

Tests on the significance of each lag

Lag	
1	F(8,10) = 10.13 [0.00] **
2	F(8,10) = 9.88 [0.00] **

Tests on the significance of all lags up to 2

Lag	
1- 2	F(16,10) = 9.88 [0.00] **
2- 2	F(8,10) = 13.89 [0.00] **

It is immediately clear that this set cointegrates.[4] The solved long run equation represents the cointegrating vector that enters in the conditional model as the error correction term.

[4] The graphics, regression output and residual diagnostic tests were all calculated using GiveWin 2.2, Pc-Give 10.2 and Pc-Gets 1.2, see Doornik and Hendry (2001a,b,c).

In the long run equation, relative income, the unemployment rate in Turkey, the trade intensity, and workers' remittances contribute positively to migration from Turkey, while unemployment in Germany, aid and the share of manufacturing exports to Germany in total exports to Germany contribute negatively to migration from Turkey to Germany. The unemployment rate in Germany and aid are not significant in the long-run equation, but we keep unemployment rate in Germany for further analysis as there is a strong theoretical argument for its presence in the migration equation. We also keep aid for the further analysis as aid might be more significant in the short-run compared to the long-run due its structure, type and magnitude. In the long-run, income differential and trade intensity are the most significant variables in explaining migration flows from Turkey to Germany. Thus, a 10 percent increase in income differential increases the gross migration inflows by 48.58 percentage points, a very significant effect. Likewise, a 10 percent increase in trade intensity increases the gross migration inflows by 23.27 percentage points, a large effect. In addition, the sign on the share of manufacturing exports with Germany to total exports with Germany suggests that trade and migration are substitutes in the long-run. It is together with remittances are the important determinants of migration inflows in the long-run, after the income differential and the trade intensity.

There are a few steps in the reduction of the final (conditional) model from the above general specification and these reductions are done automatically with Pc-Gets[5] (the corresponding standard errors and *t*-ratios reported in parentheses below the coefficient estimates).

$$\Delta \ln M_t = \underset{\substack{(0.019)(0.082) \\ [2.23]\ [2.51]}}{0.043 + 0.206\ \Delta \ln M_{t-1}} + \underset{\substack{(0.486) \\ [3.98]}}{1.936\ \Delta \ln\left(\frac{Y_{ft}}{Y_{ht}}\right)} - \underset{\substack{(0.026) \\ [-3.53]}}{0.093\ \Delta U_{ft}}$$

$$- \underset{\substack{(0.031) \\ [-3.00]}}{0.093\ \Delta U_{ft-1}} - \underset{\substack{(0.017) \\ [-2.37]}}{0.039\ \Delta \ln\left(\frac{A_t}{GNI_t}\right)_{-1}} + \underset{\substack{(0.128) \\ [3.99]}}{0.510\ \Delta \ln\left(\frac{MXG_t}{TXG_t}\right)_{-1}} \qquad (4)$$

[5] The corresponding standard errors reported in parentheses below the coefficient estimates.

$$+\ 0.126\ \ \Delta\Delta U_{ht}\ \ +\ 0.333\ \ \Delta\Delta \ln\left(\frac{R_t}{Y_{ht}}\right)\ \ -\ 0.733\ \ ecm_{t-1}$$

(0.025) (0.068) (0.069)
[4.96] [4.86] [-10.60]

R^2 = 0.919 F(9,24) = 30.36 [0.00] $\hat{\sigma}$ = 0.094 DW = 1.96
RSS = 0.2109 for 10 variables and 34 observations
F_{ar} (2,22) = 3.389 [0.05] F_{arch} (1,22) = 1.214 [0.28]
χ^2_{nd} (2)= 0.37 [0.83] F_{hetero} (18,5) = 0.33 [0.96]
F_{reset} (1,23) = 1.75 [0.20] T = 34 (1971-2004)

The conditional model (equation (4)) is parsiomonious. The diagnostic tests are satisfactory, hence, the conditional model satisfies the *design criteria.* The data generating process (DGP) as a model satisfies the design criteria suggesting that the general-to-specific modelling is successful in creating a model that mimics the properties of DGP. The error-correction term is highly significant and has the expected sign. Figure 2 shows the actual and fitted values of the final model. The graphs show how well the final model explains the data and the residuals uncorrelated and normally distributed.

Income differential is the most important determinant of migration flows in the short-run also: a 10 percent increase in the change in income differential will increase the change in migration inflows almost by 20 percent. This suggests that until the income gap is reduced, the pressure to migrate will remain. However, the high unemployment rate at home, sustains less strong pressure to migrate. The availability of jobs in Germany strongly matters in the short-run. The share of manufacturing exports with Germany in total exports to Germany increases migration flows in the short-run that can be interpreted with the migration hump. Thus, increase in income due to exports might make some unskilled with low income workers to afford the cost of migration. In addition, the displacement and disruptions that accompany development temporarily can also increase migration.

Aid policy only effective in reducing migration flows in the short-run, but this effect is small. Hence, financial assistance is not a durable long-run solution to reduce migration pressure. However, if aid are conditional on good policies and has a higher share of technical assistance and training that would transfer expertise and know-how and increase in investment in productive sectors and hence help human capital development, and accelerate job creation and economic growth so that income differences between Turkey and Germany is reduced, only then aid policies can have a long-lasting effect.

Remittances are found to significantly explain migration in the short-run as well as in the long-run. The results support the hypothesis that remittances fuel migration. It is normally hypothesized that remittances by providing capital in the home countries, promote investment and help create jobs and reduce the incentive to emigrate. However, in this study we found that remittances to an economy are the harbinger of migration from the economy. Liquidity constraints, signalling, portfolio revision, and other considerations raise the possibility that an economy that receives more remittances will generate more migration, Akkoyunlu *et al.* (2007). The results show that both push and pull factors matter in determining Turkish migration inflows to Germany.

Figures 3, 4 and 5 plot the recursive estimates for the coefficients on the constant term, $\Delta \ln M_{t-1}$, $\Delta \ln\left(\frac{Y_{ft}}{Y_{ht}}\right)$, ΔU_{ft}, ΔU_{ft-1}, $\Delta \ln\left(\frac{A_t}{GNI_t}\right)_{-1}$, $\Delta \ln\left(\frac{MXG_t}{TXG_t}\right)_{-1}$, $\Delta\Delta U_{ht}$, $\Delta\Delta \ln\left(\frac{R_t}{Y_{ht}}\right)$, and ecm_{t-1}; their respective *t*-ratios; and the recursive residual sum of squares, one-step residuals, one-step Chow statistics, and break–point Chow statistics, respectively. Constant coefficients in Figure 3 in the presence of the large variations in the marginal process such as unemployment rates imply super exogenous variables that counter the second sense of data mining. Further, the recursive *t*-ratios in Figure 4, increase in absolute value as the sample size increases countering the first sense of data mining. Hence, the nominal critical levels of test statistics are not affected. Even with thirty-four observations and ten variables in the final model *t*-ratios are greater than three in magnitude suggesting that over-parameterisation is not a concern given information

content in the data and refuting the fourth sense of data mining. Figure 5 shows that the recursive residual sum of squares increase over time and the recursive estimate of standard error $\hat{\sigma}_t$ declines over time rather than increase, hence countering the first sense of data mining.

5. Conclusions

We investigated whether migration is interrelated with trade, aid and remittances so that any policies that consider trade, aid and remittances also affect the decision to migrate. We developed and estimated an empirical model of Turkish migration to Germany and tested the model for the 1969-2004, using the cointegration technique. A single cointegrating vector is found among the gross migration inflows and the following explanatory variables: the relative income ratio between Germany and Turkey, the unemployment rates in Germany and Turkey, aid, the trade intensity variable and the ratio of manufacturing exports with Germany to total exports with Germany and remittances as a ratio of Turkish GDP. Based on the results of the cointegration analysis, a parsimonious single equation conditional error-correction model is developed. That is both congruent and parsimoniously encompasses the general model. The residuals are also innovations against the available information. The results further support the view that a constructive data mining *qua* general-to-specific modelling approach is productive as it has a high probability of locating the DGP.

The results show that migration is interrelated with trade, aid and remittances. However, the best way to manage economic migration is to generate rapid economic growth with productive employment opportunities and therefore to raise incomes in the country of origin.

Until the income differential converges to zero the migration pressure will persists, and it would go on until relative wages in Turkey rises sufficiently. Trade policy that would

bring jobs to Turkey has a role to play in the long-run, but in the short-run will increase migration. In addition, aid is significant only in the short-run for reducing migration inflows. This might be associated with its small magnitude and its high volatility. Levels of development assistance indeed are small and declining compared with other financial flows such as remittances. Development aid takes the form of financial assistance and technical cooperation. The first concerns provision of finance in the form of grants and credits, the latter is the availability of professional exports to developing countries. The majority of foreign assistance to Turkey takes the form of grants and credits. Most of these loans are used for investments in the physical infrastructure such as energy, communications, transport and community services rather than in productive sectors such as education, agriculture and industry. However, aid that contributes to poverty alleviation through employment creation, human capital formation and income generation can only dampen the pressures to migrate.

For given unemployment differentials, a high level of unemployment in Germany reduces migration so that employment opportunities matters greatly in the destination for migration. However, employment opportunities at home also have a role in the short- as well as in the long-run. Hence, creating more employment opportunities and better conditions of work will also reduce migration pressure.

The results are consistent with Akkoyunlu *et al.* (2007) that remittances are harbinger of migration from Turkey so that liquidity constraints, signaling, portfolio revision and other considerations raises the possibility that an economy that receives more remittances would generate more migration.

Fair trade policy help reduce the incentives for migration, but it is certainly not enough to eliminate these incentives. Furthermore, the aid should be available only if the right policies are adhered to so that any structural aid from the European Commission during the accession period should have a strict conditionality element. Aid in magnitude has also been very small, and an increase its magnitude will have a significant impact.

The results show that the choice is not trade *or* aid for reducing migration pressure, but aid *and* trade. Trade and aid jointly have a role to play especially in the short run, when trade increases migration, aid reduces migration pressure. Thus, the right combination of trade and aid policies can help manage the labor inflows in the short-run. Germany should remain open to Turkish manufacturing goods that are mainly labor-intensive. Furthermore, aid should be used to increase the capacity of Turkey (manufacturing industry) to produce goods for exports.

The results of this study show that migration, trade, aid and remittances are related, however, migration will be better managed when the dynamic gains from trade and aid are considered. Hence, the broad-based and rapid economic development with increase in income is the only effective means of reducing migration pressures in a labour-surplus country. If the Turkish economy grows at a rate fast enough so as to cause a fall in unemployment, real wages are likely to increase. Wages and incomes will also rise to the extent that economic growth entails an upgrading of skills, knowledge and technology. Thus, economic development can affect migration by making the 'push' factors less powerful in the home country, while reducing the relative attractiveness of the potential host country. However, even rapid economic growth in Turkey will not enable them to catch up with Germany for many decades. This makes the research on Turkish migration to Germany an important topic in the coming years.

References

Akkoyunlu, S. (1999). *Turkish Consumption and Saving*. DPhil Thesis. University of Oxford.

Borjas, G. (1987). Self selection and the earnings of immigrants. *American Economic Review* 77: 531-553.

Borjas, G. (1999). The Economic analysis of immigration. In: *Handbook of Labour Economics*, chapter 28, pages 1697-1760. In O. Ashenfelter and D. Card eds. North-Holland Elsevier Science: Amsterdam.

Brücker, H. and P. J. H. Schröder (2006). International migration with heteregeneous agents: Theory and evidence. IZA Discussion Paper 2049.

Campos, J. and Ericsson N. R. (1999). Constructive Data Mining: Modelling of Consumers' Expenditure in Venezuela. *Econometrics Journal* 5: 226-240.

Clark, X., T. J. Hatton, and J. G. Williamson (2002). Explaining US immigration, 1971-1998. Centre for Economic Policy Research Discussion Paper 453.

Doornik, J. A. and H. Hansen (1994). An omnibus test for univariate and multivariate normality. Nuffield College Discussion Paper W4&91.

Doornik, J. A. and D. F. Hendry (2001a). *GiveWin: An Interface to Empirical Modelling*. Timberlake Consultants Press: London.

Doornik, J. A. and D. F. Hendry (2001b). *Modelling Dynamic Systems Using PcGive*, Volume II. Timberlake Consultants Press: London.

Doornik, J. A. and D. F. Hendry (2001c). *Automatic Econometrics Model Selection Using PcGets*. Timberlake Consultants Press: London.

Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. *Econometrica* 50: 987-1007.

R. F. Engle, R. F., D. F. Hendry and J.-F. Richard (1983). Exogeneity. *Econometrica* 51: 277-304.

Godfrey, L. G. (1978). Testing for higher order serial correlation in regression equations when the regressors include lagged dependent variables. *Econometrica* 46: 1303-1313.

Hatton, T. J. (1995). A model of UK migration, 1870-1913. *Review of Economics and Statistics* 77: 407-415.

Hendry, D. F. (1995). *Dynamic Econometrics: Advanced Texts in Econometrics*. Oxford University Press: Oxford

Hoover, K. D., and Perez, S. J. (1999). Data Mining Reconsidered: Encompassing and the General-to-Specific Approach to Specification Search. *Econometric Journal* 2: 167-191.

Mayda, A. M. (2007). International migration: a panel data analysis of the determinants of bilateral flows. CREAM Discussion Paper 07/07.

Martin, P. and J. E. Taylor (1996). "The Anatomy of a Migration Hump". In *Development Strategy, Employment and Migration: Insights from Models*. J. E. Taylor ed, pp: 43-62. OECD: Paris.

Mayda, A. M. and K. Patel (2004). OECD countries migration policies changes. Appendix to International migration: A panel anaysis of economic and non-economic determinants. http//www.georgetown.edu/faculty/amm23/.

OECD (2007). *The DAC Journal*. OECD: Paris.

Pedersen, P. J., M. Pytlikova, and N. Smith (2006). Migration into OECD countries 1990-2000. In: *Immigration and the transformation of Europe*. C. A. Parsons and T. M. Smeeding eds. Cambridge University Press: New York.

Péridy, N. (2006). Welfare magnets, border effects or policy regulations: What determinants drive migration flows into the EU. University of Nantes, mimeo.

Ramsey, J. B. (1969). Tests for specification errors in classical linear least squares regression analysis. *Journal of the Royal Statistical Society*, B, 31:350-371.

Stiglitz, J. E. (2006). *Making globalisation work*. Norton: New York.

TSI (2005). *Statistical Indicators (1923-2004).* Ankara.

Uygur, E. (1992), International migration for employment. Foreign aid as a means to reduce emigration: the case of Turkey. *World employment programme research working paper*, MIG WP 64.

White, H. (1980). A heteroscedastic-consistent covariance matrix estimator and a direct test for heteroscedasticity. *Econometrica* 48: 817-838.

Table 1: Least squares estimates of the unrestricted gross inflows of Turkish migrants to Germany, $\ln M_t$ **(Equation 1):**

Lag j	0		1		2	
Variables		[t]		[t]		[t]
Constant	-17.903					
	(2.528)	[7.08]				
$\ln M_{t-j}$	_____		0.283		-0.229	
			(0.137)	[2.07]	(0.139)	[-1.64]
$\ln\left(\frac{Y_f}{Y_h}\right)_{t-j}$	2.098		2.609		-0.112	
	(0.728)	[2.88]	(0.759)	[3.44]	(0.842)	[-0.13]
U_{ft-j}	-0.075		-0.075		0.119	
	(0.041)	[-1.80]	(0.051)	[-1.48]	(0.058)	[2.05]
U_{ht-j}	0.236		-0.142		0.124	
	(0.050)	[4.68]	(0.047)	[-3.05]	(0.037)	[3.36]
$\ln\left(\frac{A}{GNI}\right)_{t-j}$	-0.015		-0.097		0.059	
	(0.024)	[-0.610]	(0.030)	[-3.17]	(0.028)	[2.14]

$\ln T_{t-j}$	0.014	1.525	0.663
	(0.201) [0.069]	(0.256) [5.90]	(0.297) [2.23]
$\ln\left(\frac{MXG}{TXG}\right)_{t-j}$	0.730	-1.005	-0.367
	(0.373) [1.96]	(0.372) [-2.70]	(0.199) [-1.85]
$\ln\left(\frac{R}{Y_h}\right)_{t-j}$	0.215	-0.151	0.639
	(0.116) [1.85]	(0.137) [-1.10]	(0.122) [5.26]

R^2 = 0.996 F(23,10) = 113.4 [0.00]** $\hat{\sigma}$ = 0.079 DW = 2.98
RSS = 0.0626 for 24 variables and 34 observations
F_{ar} (1,19) = 6.48 [0.03] F_{arch} (1,8) = 0.75 [0.59]
χ^2_{nd} (2) = 4.46 [0.11] F_{reset} (1, 9) = 0.16 [0.71] T = 34 (1971-2004)

R^2 is the squared multiple correlation, $\hat{\sigma}$ is the residual standard deviation. The diagnostic tests are the form $F_j(k, T-1)$ which denotes an approximate *F*-test against the alternative hypothesis *j* for: k^{th}-order serial correlation F_{ar}, Goldfrey (1978), k^{th}-order autoregressive conditional heteroscedasticity F_{arch}, Engle (1982), heteroscedasticity F_{hetero}, White (1980), the functional form RESET test F_{reset}, Ramsey (1969) and a chi-square test for normality χ^2_{nd} (2), Doornik and Hansen (1994).

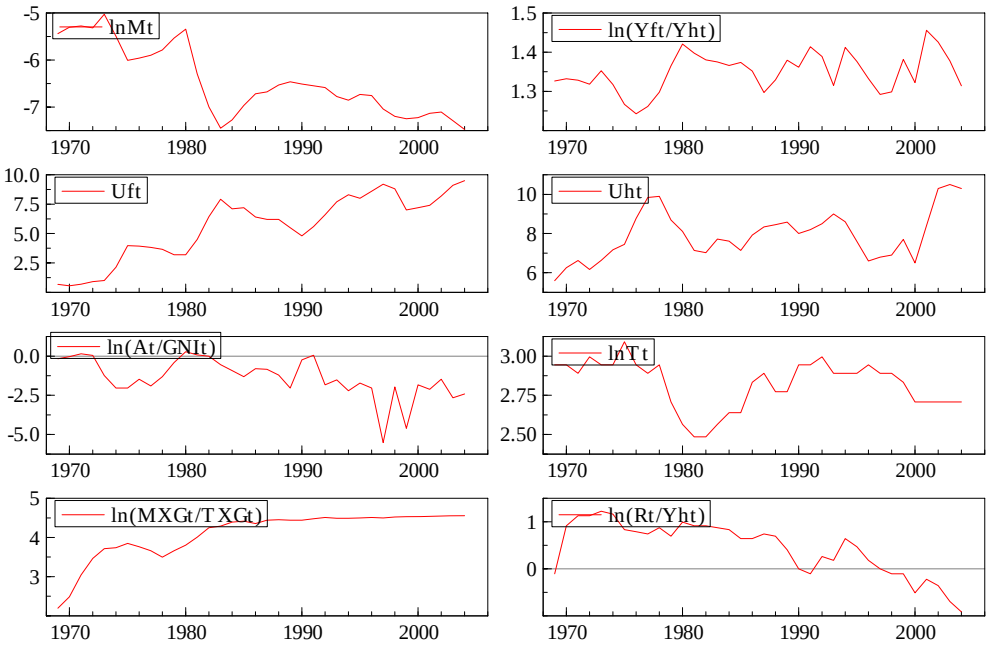

Figure 1: The basic properties of data: 1969-2004

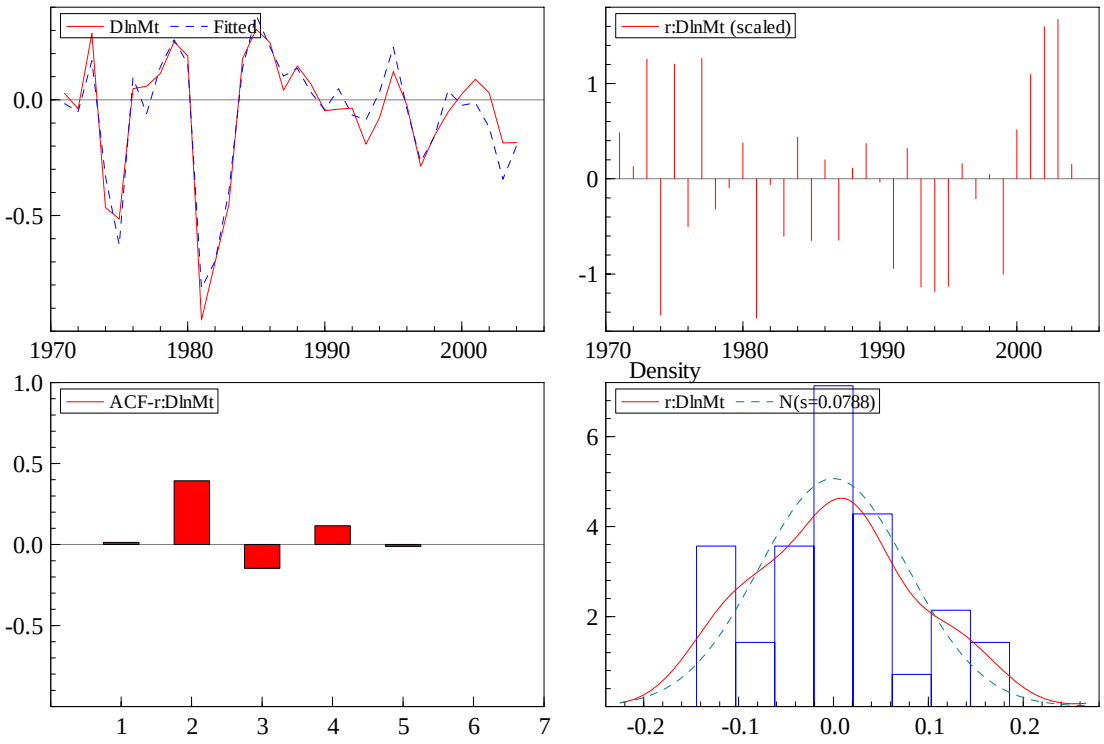

Figure 2: Actual and fitted values of migration model from Equation (4), residuals, the histogram and estimated density of the residuals and their correlogram.

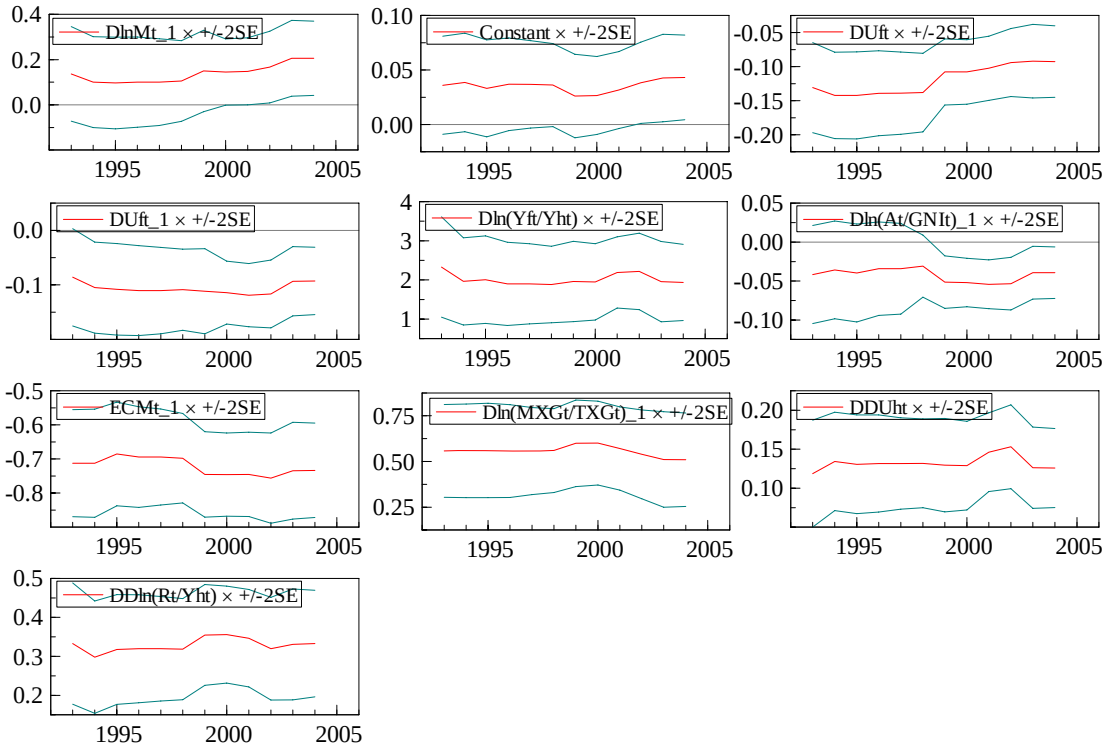

Figure 3: Recursive coefficients of consumption model (Equation 4) with ± SE.

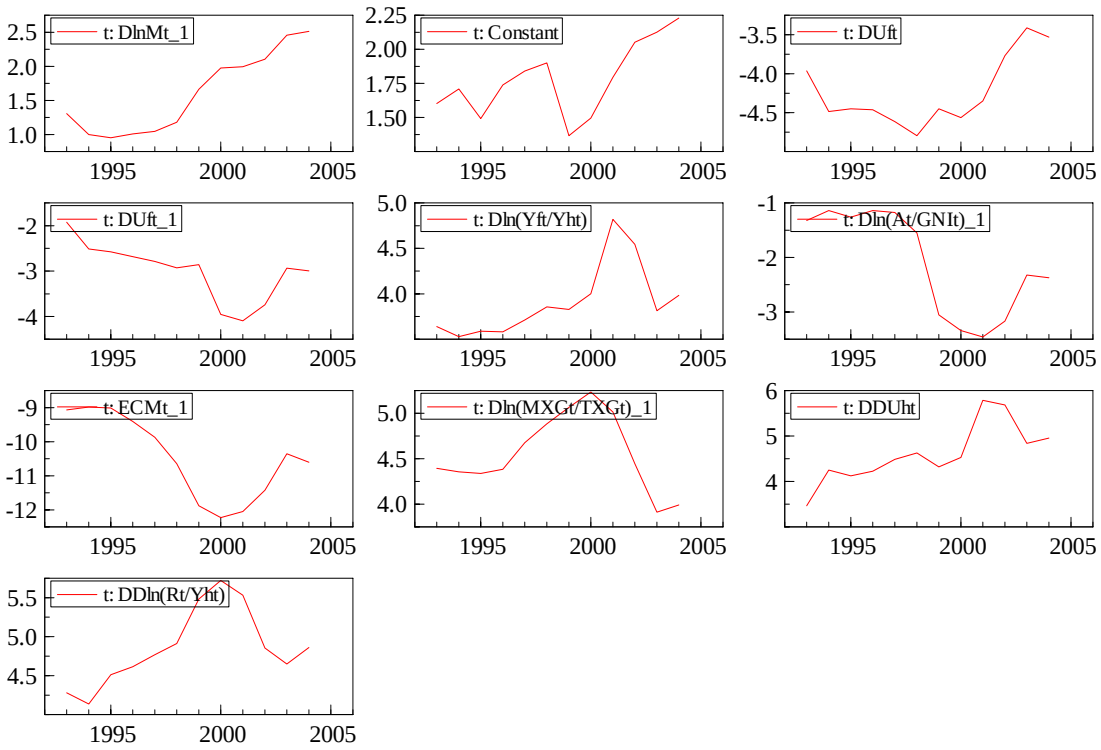

Figure 4: The recursive *t*-ratios.

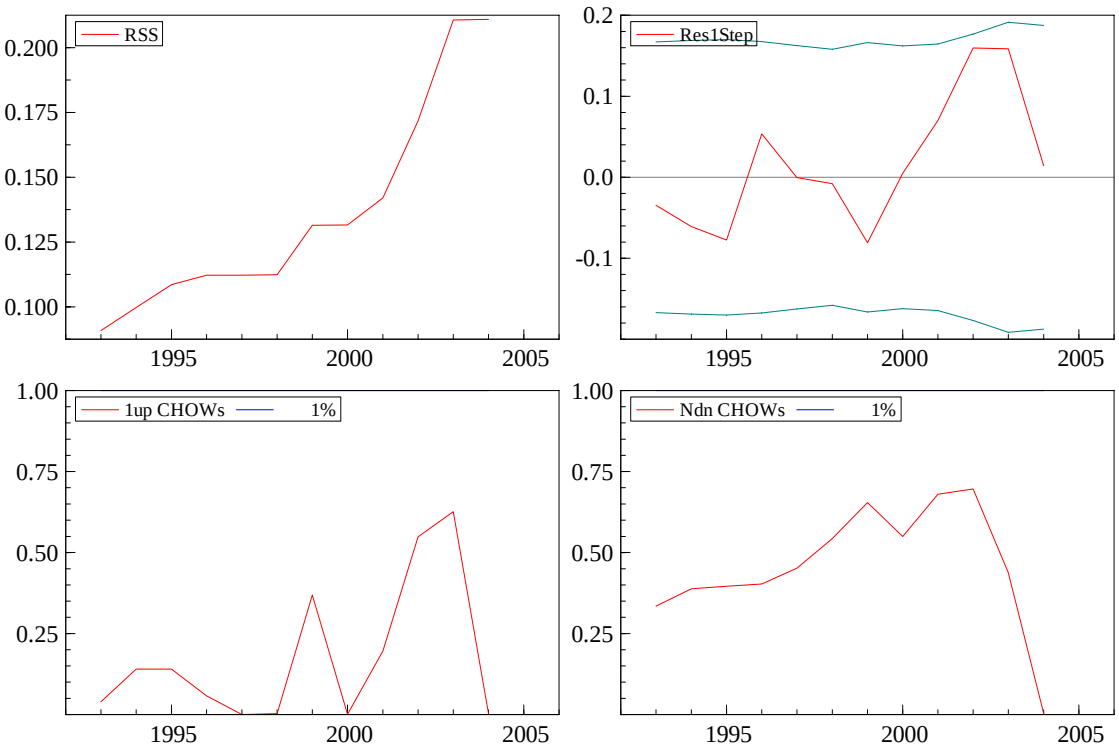

Figure 5: The residual sum of squares (RSS), one-step residuals and $0 \pm 2\hat{\sigma}_t$, one-step Chow statistics and breakpoint Chow statistics.

Self-Employment of Immigrants in the UK, the U.S. and Germany*

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Abstract

Using several large micro data sets this paper studies self-employment decision in the U.S., the UK and in Germany, focusing in particular on differences between native-born persons and immigrants. In a reduced-form framework we decompose differences in self-employment rates into age and skill effects and an unexplained (cultural) component. As a methodical innovation we employ a novel non-parametric decomposition technique in addition to standard parametric techniques. In a more structural set-up we let self-employed be determined by pull, push, and cultural components. To this end separate earnings functions for self-employed workers and employees are estimated, also taking into account endogenous sorting into self-employment or salaried-employment (which are found to be significant). The paper also compares self-employment of first and second generation immigrants and, using the German data, also employment decisions of naturalised immigrants and of *Aussiedler*.

Keywords: International Migration; Self-employment; Self-selection; Non-parametric decomposition.

JEL Classification: C13; C14; E24; F22

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1 Introduction

Self-employment is a route out of underprivileged social circumstances which can be particularly attractive for social groups, such as migrants, who have to deal with resentments and poorer matches on the market for salaried-employed labour, i.e. employees. Moreover, in most Western countries migrants face higher unemployment rates and for unemployed migrants or migrants running the risk of becoming unemployed self-employment offers an obvious alternative to salaried employment (see, e.g. Constant and Zimmermann 2004). Self-employment thus also offers a way to integrate into the economy of the host country even if it should be relatively difficult for immigrants to find jobs. The present paper describes the evolution of self-employment rates in the United States, the United Kingdom and Germany and depicts differences in self-employment rates of native-borns and immigrants. We describe how much of these differences are due to a standard set of factors affecting employment and incomes and measure the importance of push and pull components. Here push components are factors that induce individuals to start their own business because they find it difficult to integrate into the job market, while pull components are factors that lure people away from salaried- and into self-employment.

There are strong arguments why immigrants are expected to be more often self-employed than native-born workers. Due to the fact that immigrants have taken the risk of moving abroad, one would expect that they are a strongly selected group of motivated and risk-loving workers. Both of these attitudes should prove to be advantageous for self-employed work. Other circumstances of immigrants are also expected to lead to higher self-employment rates of immigrants. Often immigrants have larger families than natives and therefore have to some extent access to cheap labour helping out in small businesses. Similarly, in ethnic enclaves immigrants can be stronger integrated into the neighbourhood which can ease the recruitment of trusted personnel (Borjas 1986, Lazear 1995). There, natives have the comparative advantage to know the local product markets and the demand for certain 'exotic' niche products which they can then serve (Light 1984). Religious believes can further entrepreneurial activity and thus lead to higher self-employment rates of immigrants (Light 1984, Rafiq 1975). On the other hand are those obstacles to a successful integration into the market for em-

ployees, such as language deficiencies and lack of education or training, also harmful for a successful operation of the own business.

As theory is somewhat inconclusive about whether immigrants should be more or less likely to be self-employed than natives, the present paper is mainly descriptive. Table 1 reports self-employment rates of native and immigrant men in the U.S., the UK and (West-)Germany in 1995 and 2005 (we describe our data and classification of immigrants in some detail below). We find that the overall differences in self-employment rates of natives and immigrants are relatively small. In the U.S. and in Germany immigrants in total are slightly less often self-employed than natives, while in the UK it is the opposite. Moreover, there is no clear trend that this gap is closing or widening. However, when taking a closer look at the main immigrant groups there are dramatic difference between these three countries. The by far dominant immigrant group in the U.S. comes from Mexico and in 2005 only 7 percent of Mexican men were self-employed, while around 13 percent of native men were. The picture in Germany is comparable. There the main immigrant group comes from Turkey and only 8 percent of Turkish men were self-employed which contrasts strongly with a self-employment rate of 15 percent of native men. As noted, in the UK immigrants are more often self-employed than natives and this mainly stems from the high self-employment rates of the dominant immigrant group in the UK which is from the Indian sub-continent (India, Pakistan, Bangladesh). In the UK around 16 percent of native-born men were self-employed in 2005, while 21 percent of immigrants from the Indian sub-continent were.

Table 1 also reports self-employment rates in the host country of the main immigrant groups in the three countries under scrutiny, as reported by the International Labour Office (ILO). In all three cases self employment rates in the sending countries are much higher than those in the host countries. For example in 2005 around 32 percent of men in Mexico were self-employed, 52 percent in Pakistan (data for India is unavailable from ILO), and 38 percent in Turkey. As one could expect from the strong agricultural sector in all these three countries, self-employment rates there are much higher than in the industrialised receiving countries. The table shows, however, that even when excluding the agricultural sector self-employment rates are still considerably higher than that of men of the same ethnic group in their host country (for further discussion of the association between self-employment

Table 1: Self-employment rates in a cross-section of countries

	U.S.		UK		Germany	
	1995	2005	1995	2005	1995	2005
Natives	.14	.13	.18	.16	.12	.15
Immigrants	.12	.11	.22	.19	.09	.14
(percent of population)	*11.3*	*18.3*	*7.7*	*12.2*	*11.0*	*12.1*
main immigrant group						
country/region of origin	Mexico		Indian Sub-Continent		Turkey	
	.06	.07	.25	.21	.05	.08
(percent of immigrant population)	*34.2*	*35.9*	*21.3*	*21.2*	*30.7*	*26.0*
for comparison: self-employment rate in country of origin						
all industries	.36	.32	.57*	.52*	.47	.38
excl. agriculture	.28	.26	.39*	.37*	.29	.27

Note: Men aged 25-54. Self-employment rates refer to full-time employed males only. Weights used as provided in these census data. See section 2 for a detailed description of the data used to compute figures for host countries. Data for sending countries are from the website `http://laborsta.ilo.org` of the International Labour Office (ILO). Notice ILO figures are based on a slightly different selection of the sample; it includes also men below 25 and above 54 and does not exclude men working part-time. Unpaid (or contributing) family workers are excluded. $*$ Data for India are unavailable. Data therefore refer to Pakistan only.

rates of immigrants in host and sending country see also Yuengert 1995, Light 1984, Fairlie and Meyer 1996).

The present study attempts to shed some light on the reasons that underlie the observed differences in aggregate self-employment rates of natives and immigrants. We follow two different routes. First, we model self-employment decisions in a very reduced form where the self-employment decision is simply modelled as a function of age, skill and a cultural component. Our interest will be in the counterfactual self-employment rate, had immigrants had the same age and skill distribution as natives. We estimate these counterfactual self-employment rates employing both a parametric and, as a methodical innovation, a non-parametric estimation procedure.

We find that self- and salaried-employed workers (employees) have a comparable skill structure but self-employed workers are significantly older than employees. Since immigrants are much younger than natives, differences in education and, in particular, in age are found to explain a considerable ex-

tent of the differences in aggregate self-employment rates. Moreover, results of the parametric and non-parametric estimations sometimes differ considerably. Using these differences as a very rough specification tests, the evidence presented in this paper casts some doubts on the standard (parametric) model employed in this literature (see, among many others, Constant and Schachmurove 2003, Constant, Schachmurove and Zimmermann 2005, Borjas and Bronars 1989, Clark and Drinkwater 1998).

Second, in a structural set-up we model self-employment decisions to be driven by pull, push and cultural components (see also Clark and Drinkwater 2000). Pull components are factors that provide incentives for individuals to become self-employed. In this study the main pull component will be the expected income difference in both types of employment. Both natives and immigrants are expected to choose this job that yields higher incomes (Rees and Shah 1986, Borjas and Bronars 1989, Bernhardt 1994, Lofstrom 2002). Thus, the pull component induces an incentives for immigrants to turn more often to self-employment than natives if the income *difference* between the income when self-employed and the earnings when salaried-employed is higher for immigrants than for natives. This is in particular the case if immigrants are disadvantaged as employees but not so much when working on their own account (Light 1972, Light 1979, Sowell 1981, Moore 1983); for instance, because their skills are not highly rewarded as employee but as self-employed workers or because language problems pose a big problem for finding the right job as employee, while this may be relatively unimportant if setting up the own business (see also Lofstrom 2002, Borjas 1986).

Push components capture that self- or salaried employment opportunities might be limited. For instance, if unemployment rates are high finding or switching jobs is difficult which then makes the option of starting the own business more attractive. Finally, immigrants groups also have some common cultural idiosyncrasies. Immigrants may belong to specific religious groups that favour entrepreneurship or may have migrated from countries with strong traditions of self-employment. Quite generally, immigrants can be expected to be strongly self-selected and, since they have taken the risk of migration, are probably more willing to bear entrepreneurial risks. On the other hand, exactly because of their selectivity there can also be a breach of tradition favouring, as argued, self-employment which would then dampen

positive self-selectivity effects into self-employment. All these factors are subsumed under the term "cultural components".

We find that in Germany (the U.S. and the UK data do not contain information of incomes of the self-employed) between 6 and 30 percent of the explained variation in the data is explained by the cultural component when comparing natives and immigrants. Then in fact push and pull components are equally strong and have a stronger explanatory effect than cultural components. If however we compare natives with several different immigrant groups the relative explanatory power of push and pull components declines considerably and then between 60 and 90 percent of the explained variation in the data is due to cultural components.

The paper is structured as follows. The next section describes the data sets and the sample used in the analysis. Section 3 uses a very reduced-form model to compute counterfactual self-employment rates for immigrants. There we also introduce a novel non-parametric method to compute counterfactual distributions and compare these results with standard parametric set-ups. Section 4 estimates a structural model of self-employment, decomposing differences in self-employment rates of natives and immigrants into push, pull, and cultural components. Section 5 summarises the main findings and concludes.

2 Data Description and Sample

The data used in our analysis comes from the large labour force surveys (LFS) in the United States, the United Kingdom and Germany. These are respectively the CPS, the British and Northern Ireland Labour Force Survey and the Mikrozensus. These surveys are particularly suited to study economic outcomes of immigrants, such as self-employment, due to the large sample size. This allows the researcher to employ less strong parametric assumption when decomposing the variation in the data, even when analysing smaller immigrant populations. Moreover, data on the type of economic activity of the respondent are fairly well standardised which allows for a cross-country comparison as the present paper pursuits. All three survey cover a wide range of aspect of the labour market.

Identification of immigrants in the three labour force surveys used in this study differs considerably. While in Germany the discussion about

immigrants largely centres around the ethnic origin of the migrants, in the UK and the U.S. people born in the host country are considered to be natives —which may has to do with the fact that they automatically become citizens of the host country if they are born there, in contrast to the regulations in Germany—and therefore information about the country of origin (*alias*, country of birth) is used to identify immigrants. The UK LFS has asked households about their country of origin from its beginning in 1973. In the U.S. question on the country of origin were only included in the survey in 1994. The Mikrozensus does not contain information about the country of origin but instead reports citizenship. We use the available scientific-use files of the Mikrozensus 1989-2004 as well as the recent Mikrozensus 2005 data file. In particular the Mikrozensus 2005 is very well suited to our research project as it contains detailed information about the migration background of each person (though still not the country of birth).[1] Subsequently, we will use this additional information in the Mikrozensus 2005 to take a closer look at the performance of second-generation and naturalised immigrants in Germany. Below we will be more specific about our strategy to identify second-generation immigrants in the U.S. and Germany (the UK LFS does not allow their identification).

A peculiar feature of immigration to Germany is the large inflow of ethnic Germans who migrated to Germany mainly from Poland and the former USSR (so-called *Aussiedler* and, since 1990, *Spätaussiedler*). Even though the government collects data about their total inflow, Aussiedler basically vanish from most data sources (surveys as well as administrative data sets) as they have German citizenship. The recently published Mikrozensus 2005 allows to identify Aussiedler reasonable well. Up to 1999 Aussiedler were officially naturalised and the Mikrozensus 2005 contains information about the year of immigration, information about naturalisation and the citizenship prior to naturalisation can also be used. This identification strategy is of course not without pitfalls. First, many Aussiedler have always considered themselves as native Germans and will therefore not report their official naturalisation. Second, the (modest) inflow of Spätaussiedler after 1999 remains invisible in our data.

[1]The Mikrozensus of other years than 2005 only contains the citizenship of each respondent. Answering other questions like "year of immigration" or "born in Germany" were either optional or only asked to people with only a foreign citizenship (as with the former question) or were not asked at all (as with the latter question).

One drawback of all three surveys is that they only provide limited information regarding a person's labour earnings. Notwithstanding the quite general problem to distinguish capital and labour incomes of the self-employed, neither the CPS-ORG data nor the UK LFS contain *any* information at all about income of the self-employed. In contrast, the German Mikrozensus reports the net income of both salaried- and self-employed workers. Using the provided information about the number of hours usually worked per week, this actually allows to compute an hourly measure for net income. The main problem with the income variable in the Mikrozensus, however, is that incomes are reported net of taxes and benefits. On the one hand, this may actually increase the accurateness of the reported earnings of the self-employed as these worker often have ample opportunity to avoid taxes and after all people are pulled into self-employment because of higher net incomes, not of incomes before taxes. On the other hand, earnings profiles of net and gross incomes cannot be compared which would make it difficult to compare, say, age-earnings profiles from the Mikrozensus with those obtained from other data sources. More importantly, one needs to be very careful when comparing incomes of married and unmarried workers (which poses a problem if the spouse does not work at all or has a significantly different income) and of incomes of persons with children as married workers and people with children receive a beneficial tax treatment.

Our focus in this paper is on males aged between 25 and 54.[2] We only study men because, independent of their cultural background, men participate in the labour market at very high rates and the attention of this paper is on what people do when participating, not on whether participating at all. The age requirement is to ascertain that people are out of education and not yet in retirement or early-retirement schemes. Finally, our analysis of differences in self-employment rates and differing incomes of salaried- and self-employed workers only uses observation of workers who report to work full time. With respect to the German data, only observation from West Germany (including Berlin) are kept to avoid confounding the results by the various adjustment processes in East Germany. Due to the extremely low numbers of immigrants in East Germany, the consequences for this omission

[2]When computing the density of the age-skill distribution of the base group (natives), we actually use all men aged 20-60 in order to obtain more precise estimates at the boundaries of the age interval 25-54.

seem well justified.

Timing and patterns of immigration into the U.S., the UK and Germany are very different and, correspondingly, the composition of the immigrant population is quite different ([Dustmann, Glitz and Vogel 2007)for details see. Table 2 reports the composition of the immigrant population in the three countries. By far the largest immigrant group in the U.S. are the Mexicans (36 percent of all immigrants in 2005) and in Germany the Turks (29 percent). In the UK the largest fairly homogeneous immigrant group comes from the Indian sub-continent (21 percent). Notice that there is also a remarkably large share of immigrants from Africa which we however do not consider as the main sending region of immigrants to the UK because these immigrants come from many different and apparently very diverse set of countries and thus can be expected to form a very heterogeneous group of people.

2.1 Individual Characteristics

Table 3 compares some key characteristics such as education and age of natives and immigrants as well as of salaried- and self-employed workers in the U.S., the UK and Germany. The table provides insight into several regularities regarding self-employment. First, there is no clear indication that self-employed workers are in general higher educated than are employees. In the UK, actually, the percentage of self-employed men with higher education is ten points lower than that of salaried employed. Differences in the skill distribution hence cannot be expected to contribute much to an understanding of differences in self-employment rates. Second, again with the exception of the UK, immigrants are in general less educated than natives. Third, the age structure of self-employed men is significantly different from that of the salaried-employed. Figure 1 plots the age structure of both salaried and self-employed men which clearly shows that the self-employed are much older than the salaried-employed. The percentage of self-employed men in the upper half of the age interval $(25, 54)$ is 66 in the U.S., 58 in the UK and 63 in Germany, to be compared with the percentage of salaried-employed men above 40 which is 51 in the U.S., 48 in the UK and 53 in Germany. Since, fourth, immigrants in all three countries are significantly younger than natives, these differences in age structures can contribute to explaining the observed differences in self-employment rates. How much

Table 2: Immigrant composition in a cross-section of countries

U.S.	1995	2005	UK	1995	2005	Germany	1995	2005
Mexico	34.2	35.9	Africa	21.0	21.6	Turkey	30.7	26.0
Indian sub-continent	3.3	5.9	Indian sub-continent	21.1	21.2	ex-Yugoslavia	15.8	12.0
China/Taiwan	3.6	4.3	Ireland	11.4	4.5	Italy	11.3	11.4
Philippines	3.5	3.1	Germany	4.3	4.3	Greece	6.3	5.2
other OECD	16.0	10.2	other OECD	20.7	24.0	other OECD	19.8	21.9
other non-OECD	39.4	40.6	other non-OECD	21.5	24.4	other non-OECD	16.2	23.5

Men aged 25-54 participating in the labour market (i.e., for instance, excluding asylum seekers and refugees). Weights used as provided in the data. For the U.S. and the UK the listed set of countries or geographic regions are countries or regions of origin. For Germany they refer to a persons citizenship. Countries sorted by percentage in 2005.

Table 3: Individual characteristics of natives and immigrants as well as of salarried- and self-employed workers, year 2005

	Education			Age		
	low	medium	high	mean	≥ 40 (in %)	#
U.S.						
Natives	6.5	51.5	42.0	40.2	.55	64,950
Immigrants	31.8	34.6	33.6	38.2	.44	11,181
Mexico	61.6	32.4	6.0	36.3	.34	3,746
Salaried-employed	10.2	48.4	41.4	39.6	.51	63,240
Self-employed	7.9	50.6	41.5	42.4	.66	10,118
UK						
Natives	9.4	58.4	32.2	39.6	.51	27,070
Immigrants	14.0	54.4	31.7	37.9	.41	3,944
Indian sub-continent	25.0	48.8	26.3	38.2	.43	861
Salaried-employed	8.6	57.0	34.4	39.1	.48	24,364
Self-employed	12.9	61.9	25.3	41.2	.58	5,264
Germany						
Natives	13.3	67.2	19.5	40.5	.55	69,633
Immigrants	46.2	39.9	14.0	37.7	.40	7,089
Turkey	63.6	33.0	3.4	36.2	.34	2,033
Salaried-employed	14.5	66.4	19.1	40.1	.53	59,152
Self-employed	12.2	61.7	26.1	41.9	.63	9,960

Men aged 25-54 participating in the labour market. Unweighted descriptive statistics. In the U.S. low education means less than completed High School, medium refers to completed High School and possibly some years of College, while high education implies a College degree. In the UK data low education is identical no qualication, medium education means A-levels and less, high education comprises higher education and university degree. In the German data people without completed apprenticeship or university education are said to have low education, with a completed apprenticeship to have medium education, and if completed university to have high education. Sums of natives and immigrants is greater than some of salaried- and self-employed workers because for some observations self-employment status is unknown.

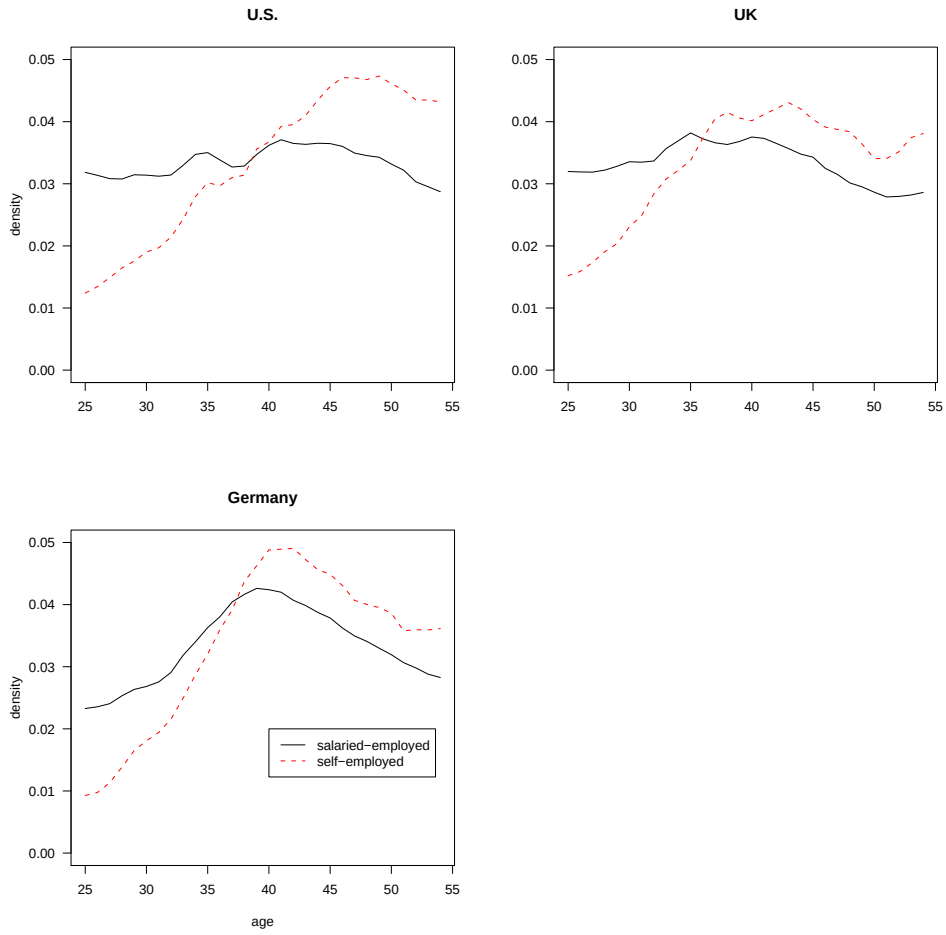

Figure 1: Age distribution of salaried- and self-employed men in 2005. Curves smoothed by moving averages over the two closest age groups.

these differences in the skill and, most notably, the age structure in fact do explain the differences in self-employment rates is studied in the next section.

3 Decomposing the Differences in Self-Employment Rates: parametrically and non-parametrically

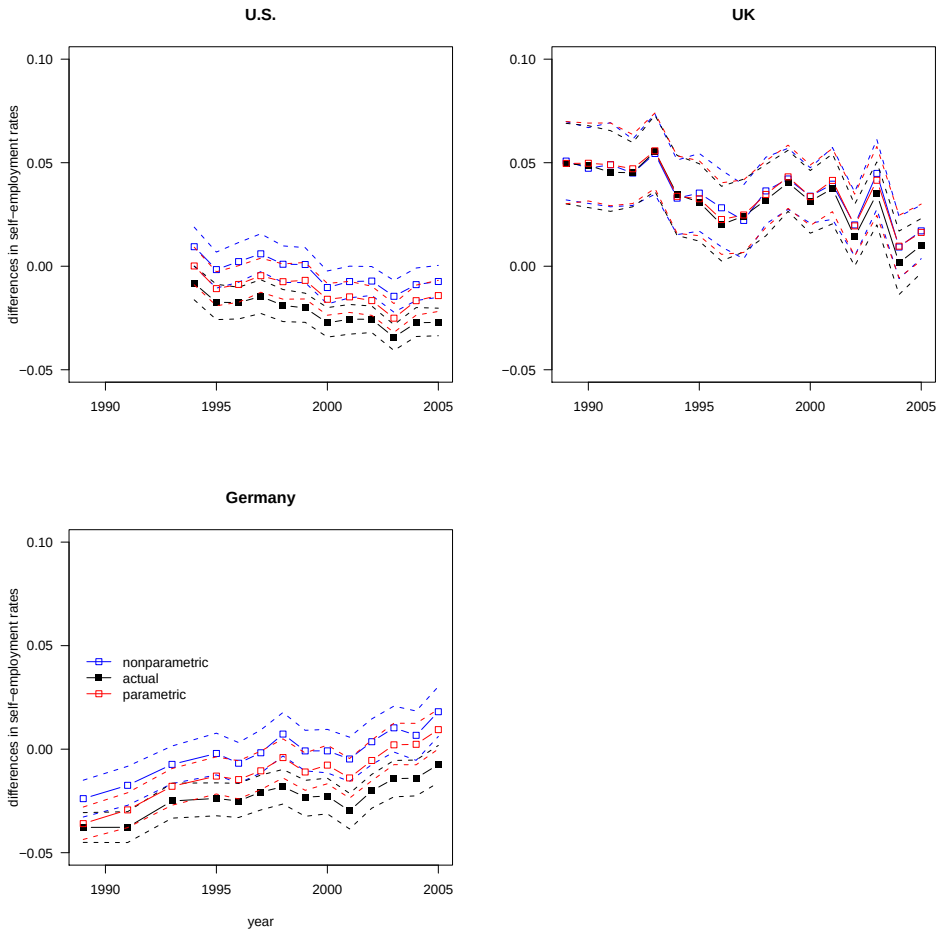

Figure 2: Differences in self-employment rates of immigrants and natives in the U.S., the UK, and Germany.

The solid black line in Figure 2 shows the differences in self-employment rates of immigrants and natives between 1989 and 2005 in the U.S., the

UK and Germany (in the U.S. between 1994 and 2005). Black dotted lines indicate (pointwise) 95% confidence bands, obtained by taking 400 bootstraps. Probably, the most noteworthy aspect of these graphs is that self-employment rates of immigrants in the U.S. and Germany are smaller, while in the UK they are larger than those of natives. In the U.S. there is a slight trend toward increasing differences in self-employment rates while in the UK and in Germany self-employment rates of immigrants become increasingly similar to those of natives. For instance, in the most recent years differences in self-employment rates are not any more statistically significantly different from zero.

3.1 Decomposition methods

We next perform two different types of decompositions to analyse how much of these differences, if anything, can be explained by differences in the skill and age structure of immigrants and natives. The questions we try to answer here is how large would have been the difference in self-employment rates, had the immigrants had the same skill and age structure as natives. The first decomposition is parametric in that for each year we estimate a standard probit model

$$\mathrm{P}\left[\text{self-employed}_i\right] = \Phi\left(\text{single index}_i\right)$$

where $\Phi(\cdot)$ denotes the Gaussian distribution function. The single index is specified as follows:

$$\text{single index}_i = \text{Foreign}_i + Polyn(\text{age}_i, 4) + \text{Education}_i \tag{1}$$

where $Foreign_i$ and $Education_i$ are set of dummy variables indicating immigrant status and education of person i. To take care of age effects we allow for a polynomial in age of order 4. We then use the estimated probit model to predict the self-employment rates of immigrants and natives in each of the 30×3 age-education cells. Finally, we use a non-parametric estimate of the age and education distribution of natives (see the detailed description below) to answer the question what would have been the self-employment rate difference, had the immigrants had the same age and education distribution as natives.[3] This estimation procedure was executed separately for

[3]Equivalently, one can predict the probability for each person in the data and then reweight immigrants such that after averaging over all 30×3 cells the adjusted average skill

each year. The solid red line in Figure 2 depicts the estimated difference and the red dashed line the bootstrapped confidence bands.

Our second decomposition method is completely non-parametric. Observing the large number of observations in our sample (see Table 3), in fact allows us to follow a different route to estimate the self-employment rates of natives and immigrants for each of the 30×3 age-education cells, thus avoiding the problem that the probit model used in the previous decomposition may be misspecified (i.e., misspecification of either the linear specification, the link function, or the functional form of equation 1). Again, separately for each year we estimate first the density of age and education levels of the natives. That is, for each year we estimate non-parametrically the probability to become self-employed,

$$\mathrm{P}\left[\text{self-employed}_i\right] = f\left(\text{age}_i, \text{Education}_i, \text{Foreign}_i\right)$$

where no assumptions are made about the functional form of $f(\cdot)$. More specifically, separately for each year and each immigrant group we apply a local-constant smoother to the self-employment status (1 if self-employed, 0 if salaried-employed) to regress self-employment status on age and education. This gives us for each immigrant group and each age and education cell an estimate of the respective self-employment rate.

Due to the rapidly increasing variance of such estimates when the sample size decreases, which happens when analysing small immigrant populations, we use a kernel estimator for mixed data types to limit the curse-of-dimensionality problem. In our setting one of the regressors is a continuous variable (age) while the other is discrete (education levels). The idea behind a kernel estimation with mixed types is not only to use observations in nearby age cells but also observations in other education cells. In fact, since education is an ordered variable (low<medium<high) a suitable kernel (for instance, the Wang and van Ryzin kernel) uses also observations of persons with, say, medium education to estimate the self-employment rate of persons of, say, low education (which are, of course, given a lower weight). Since education is an ordered discrete variable, observations of persons with higher education are given however considerably lower weights than observations of medium-skilled individuals, simply because higher education can be said

distribution is identical with that of natives. This procedure however has no computational or statistical advantages.

to be farther away, and hence less informative, from low education than medium education is (for a detailed discussions of these non-parametric kernel methods see Li and Racine 2007). Bandwidths are selected using least squares cross-validation.[4]

To compute differences in self-employment rates of immigrant group we need to aggregate over all age-education cells. We therefore estimate the density of the age and education distribution of the natives using a standard non-parametric estimator and, due to the large sample size, the standard plug-in value for the bandwidth. Thus, each age-education cell is weighted with the share of natives of this particular age and education.

Finally, our non-parametric decomposition method using kernel estimation of mixed data is comparable to the semi-parametric decompositions introduced by DiNardo, Fortin and Lemieux (1996) in that they use probit scores to weight observations by their likelihood to be part of a certain group, while here we use a suitable kernel to lift the curse of dimensionality.

3.2 Results

Natives vs Immigrants As it turns out, at least in the UK the predictive power of the first, parametric decomposition to explain the observed differences in self-employment rates is extremely limited. In the UK the self-employed are less likely to have higher education but immigrants in total are about as well educated as natives. This should male the predicted difference actually larger than what is observed in the data. However, the age distribution of immigrants works in the other direction, as immigrants are younger than natives but the likelihood to be self-employed increases with age. In Germany and the U.S., however, the probit model does explain to a significant extent the observed differences in self-employment rates. In Germany, for instance, one could not even reject any more the hypothesis that both groups actually have equal self-employment rates once we condition of age and education effects in the described way.

[4]The computation of the bandwidth is extremely computationally expensive. On a fairly recent PC it takes almost three weeks to compute the bandwidth for a sample of size 70,000. We therefore estimate bandwidths, though separately for each data set, only for the year 2000 and then apply these bandwidths for all years. In light of the fairly constant sample size across years this procedure seems innocuous. Bandwidth selection and non-parametric regression was done using the "np"-package for the R programming environment (Hayfield and Racine 2007).

The solid blue lines show the results of the non-parametric decompositions. Probably for the same reasons put forth earlier, also the non-parametric decomposition of age and education effects does not explain the higher self-employment rates of immigrants in the UK. In both Germany and the U.S., however, the computed counterfactual self-employment rate differences are significantly lower than the previous standard probit decomposition would suggest. In fact, as it turns out, according to the non-parametric decomposition the hypothesis that self-employment rates of natives and immigrants are identical could not be rejected at the 5-percent level in Germany at least since the mid-1990s. In Germany and the U.S. at least the non-parametric decomposition of this section shows quite strongly this hypothesis' feet of clay.

Detailed immigrant groups We next turn to the decomposition of differences in self-employment rates between natives and the largest groups of immigrants, which are Mexicans in the U.S., immigrants from the Indian sub-continent in the UK, and Turks in Germany. Figure 3 illustrates observed and counterfactual differences in self-employment rates for the Mexicans in the U.S., the Turkish in Germany and the people from the Indian sub-continent in the UK. In the U.S. Mexicans are found to have much lower self-employment rates than U.S.-born persons. Although this difference decreased slightly over the years 1994-2005, in 2005 the self-employment rate of Mexicans was still around 6 percent below that of natives. Conditioning on age and skill effects we see that differences in observables such as age and education account for less than 2 percentage point of this difference (around one quarter of the observed differences) and thus leave most of the observed difference unexplained.

In the UK the strongest immigrant groups is from the Indian sub-continent. Due to the small sample size estimated self-employment rates vary quite a bit from year to year but it is clear from figure 3 that immigrants from the Indian sub-continent are significantly more often self-employed than native-born British men. Moreover, since they have a relatively similar skill and age structure as natives, it comes as no surprise that correcting observed self-employment rates for differences in the age and skill structure hardly matters.

In Germany, by contrast, the situation of the largest immigrant group,

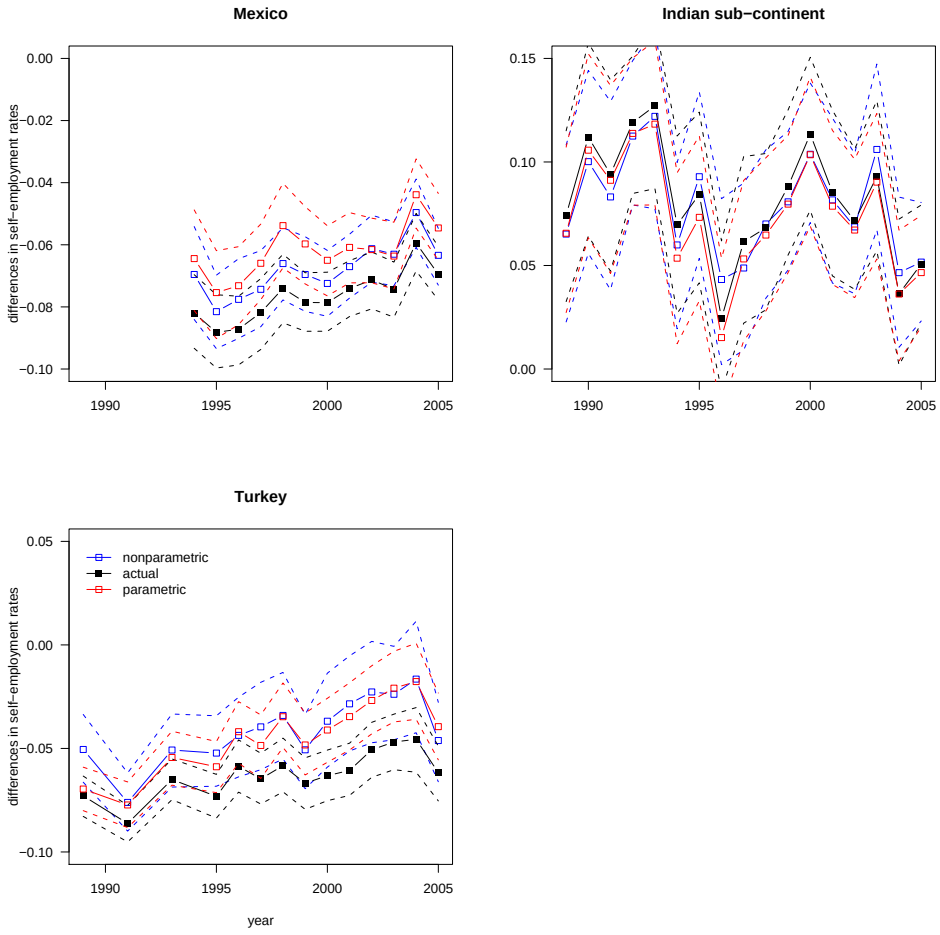

Figure 3: Differences in self-employment rates of the main group of immigrants and natives. Notice the differences in scale.

the Turkish, is comparable to that of the Mexicans in the U.S. Self-employment rates of Turkish men in Germany are between 5 and 8 percentage points lower than that of German men. Since Turkish immigrants in Germany are relatively young correcting self-employment rates for skill and age effects has a sizeable effect. In fact, for both the parametric and the non-parametric decomposition age and skill effects are found to explain roughly half of the observed differences.

Comparing these findings in self-employment rate differences with the observed self-employment rates in the respective sending countries (see table 1), it remains puzzling why these three immigrant groups perform so differ-

ently in the host countries. In all three sending countries self-employment rates are much higher than in the host countries, both in the strong agricultural sector but also in manufacturing and service sectors. However, only immigrants from the Indian sub-continent also have relatively high self-employment rates in the receiving country, while self-employment rates of Mexicans and Turks are actually below that of natives, even after correcting for age and skill effects.

4 The Impact of Push and Pull Components

The analysis in this section is complementary to that of section 3. In the previous section difference in self-employment rates of natives and immigrants were explained in a very reduced form only by differences in the age and education structure. The present section presents and estimates a more structural model that is, first, richer in regressors and, second, more explicit in how age and education actually enter the decision making process of individuals facing the two options of working on their own account or as an employee. As data about income or earnings of self-employed workers are not contained in the American CPS-ORG or the British LFS, this section focuses exclusively on Germany. Moreover, we only use data from the latest Mikrozensus 2005 because for previous years only the scientific-use files of the Mikrozensus were available to us and these do not contain detailed regional information which in our estimations, however, plays an important role as exclusion restriction.

Quite generally, three different components of explanatory factors can be distinguished: push and pull components and cultural factors. The goal of this section is to decompose the observed differences in self-employment rates into these three components and to identify the impact (analysis-of-variance) of each. To this end we estimate a probit model

$$\mathrm{P}\left[\text{self-employed}_i\right] = \Phi\left(\text{pull component}_i + \text{push component}_i + \text{cultural factors}_i\right) \tag{2}$$

Pull components are those factors that induce individuals to set up their own business. Conditional on personal characteristics such as risk aversion, entrepreneurial spirit or on factors such as financial endowment and given the fact that persons actually have the option to start working in either self-

employment or in salaried-employment, the pull components should be the key determinant of the self-employment status. Our main pull component is the income difference individuals face when making the decision to become self- or salaried-employed. Push components in contrast are factors that capture the limited availability of one type of work. If salaried-employment, for instance, is difficult to find, which may be proxied by a high unemployment rate, self-employment becomes increasingly attractive. On the other hand, enclaves can make it easier to start one's own business if an individual is well integrated in his local community where customers are loyal and tend to buy at shops where the own foreign language is spoken and the shopkeeper has a similar family background. Finally, cultural factors should capture unexplained economy wide differences between immigrants groups. These could be due for instance to religious denomination, a culture that rewards entrepreneurship and the like. Notice however that some push and pull components cannot be identified and their impact will therefore fall under the cultural components. These could be, for instance, economy wide differences in the unemployment rates of natives and immigrants. In principle these differences should enter the push component but due to the lack of identification, they enter the (cumulative) cultural factors.

4.1 Sample

The sample in this section consists of all self- and salaried employed men in the Mikrozensus 2005 who are between 25 and 54 years old and are working full-time. Importantly, with the exception of the computation of regional unemployment rates we only use observations of men who report that their main source of income is employment (in contrast to benefits, pensions, capital income, support by other family members etc.). When computing hourly incomes we divide the monthly income by 4.35 times the hours usually worked per week.[5] Immigrants groups in this section are distinguished again by their citizenship where all men with a German passport are considered to be German, irrespective of whether or not they have been naturalised. Notwithstanding the different tax treatment of married and single men in Germany, we keep both types of men since otherwise native

[5]There is a very small number of individuals (less than half a percent) reporting to work less than 20 or more than 80 hours per week. We drop the former as they appear unreliable and recode the latter to 80 for convenience.

and immigrant men might not be comparable any more, say, because certain types of Germans (young, well-educated) remain unmarried.

4.2 Descriptive statistics

The main pull argument for becoming self-employed is the income gap between self- and the salaried-employment. In turn, the local unemployment rate is considered to be the main push component. Other push and pull components are added subsequently below. Columns (2) and (4) of table 4 report some key characteristics of the monthly net income and, respectively, the hourly net income distribution of salaried- and self-employed men in the sample. These characteristics are the mean and the 90th and 10th percentile of the income distribution. Columns (3) and (5) report the corresponding sample sizes. Table 4 shows some remarkable differences in incomes of natives and immigrants and of self- and salaried employed men in Germany. Immigrants have on average an about 16 percent lower net income than native Germans. Particularly, low is the income of Turks in Germany (25 percent lower), while the net income of immigrants from the other two guest worker countries, Italy and Greece, have net incomes of about the average immigrant. Incomes of self-employed men which can be found in the lower panel of table 4 are considerably higher than those of salaried-employed men. Moreover, German self-employment men earn on average around 36 percent more than German men in salaried employment. Notice however that this percentage decreases to only 7 percent once we condition on the hours usually worked per week. Thus, the self-employment mainly earn so much because they work more hours, though also their hourly income still remains higher than that of salaried-employed men. Net incomes of self-employed immigrants, finally, are again significantly below those of Germans. Depending on whether we consider monthly or hourly incomes, immigrants' incomes are between 26 and 29 percent lower than those of Germans. Noteworthy, incomes of self-employed Turks and Italians are of a very similar magnitude. Due to the small sample size, we dispense with a discussion of the earnings of self-employed Greek immigrants.

Income In the decomposition of pull, push and cultural components the main pull component is the income difference between self- and salaried-employed work. Of course, only one of these incomes is observed directly,

Table 4: Income distribution of natives and immigrants in Germany in 2005

	net monthly income		net hourly income	
	observed	#	observed	#
Employees				
Natives	2,897	44,629	16.4	44,450
	(1,400;4,750)		(8.2;25.2)	
Immigrants	2,426	3,829	13.9	3,815
	(1,200;3,800)		(6.9;21.8)	
Turks	2,177	1,137	12.8	1,134
	(1,400;3,050)		(7.4;18.4)	
Italians	2,355	447	13.6	444
	(1,200;3,400)		(6.9;20.0)	
Greeks	2,451	198	14.5	197
	(1,400;3,800)		(7.1;22.4)	
Self-employed				
Natives	3,933	6,241	17.6	44,450
	(1,400;6,750)		(5.9;33.0)	
Immigrants	2,805	576	12.9	572
	(1,000;5,250)		(4.9;24.1)	
Turks	2,586	102	11.9	102
	(1,200;4,250)		(5.4;19.5)	
Italians	2,654	101	11.3	100
	(1,200;4,750)		(4.3;19.8)	
Greeks	3,408	41	15.3	41
	(1,600;6,750)		(5.8;31.0)	

Note: Average net income of self- and salaried employed men aged 25-54 working full-time whose main income source is employment. Numbers in brackets are the 10th and 90th percentile of the respective income distribution. Prices in year 2005 Euros.

the other hence has to be imputed. We therefore estimate a standard Mincer model

$$\begin{aligned}\text{income}_i = &\, Polyn\left(\text{age}_i, 4\right) + \text{Education}_i + \text{Foreign}_i + Polyn(\text{Tenure}_i, 2) \\ &+ \text{Married}_i + \text{Children}_i + \varepsilon_i \end{aligned} \tag{3}$$

separately for self- and salaried-employed men and then use this model to predict the missing income data. In specification (3) Married_i is unity if person i is married and zero otherwise. Children_i denotes the number of children of person i below 18 in their household. Both variables are included to account for different tax treatment of married individuals and of persons

with children. Assuming that the error term ε_i is uncorrelated with the covariates, model (3) can be estimated via OLS.

However, if the error term contains an unobserved individual fixed effect then, first, estimated coefficients were biased if this fixed effects is correlated with the covariates an, second, predicted income of person i would omit the individual fixed effect. To account for this possible deficiency we also estimate a standard (though far from impeccable) Heckman selection model where the probit model on the first stage contains all the covariates of specification (3) plus the local unemployment rate as an exclusion restriction. The underlying assumption behind this specification is that the probability to become self-employed is the greater, the higher the local unemployment rate, while the local unemployment rate does not directly affect wages. Tightness of the labour market as measured by the unemployment rate can be understood mainly as tightness of the market for salaried-employed workers because an unemployed worker always has the opportunity to start his own business (conditional, of course, on his personal traits such as skill, attitude, reliability among others), while it might be impossible to find a job as a salaried-employed worker. Finally, to justify that local unemployment does not affect incomes, notice the high union coverage rates of around 60 percent affecting salaried-employed workers in Germany, preventing wages to deviate strongly among local labour markets. Moreover, incomes of the self-employed are obviously only very indirectly influenced by local unemployment rates.

Unemployment Overall there are 205 different labour market regions in West Germany, designed by the Statistisches Bundesamt to reflect geographic mobility of workers as reported by commuters in previous surveys. For each of these labour market regions we compute the unemployment rate (according to ILO) of men aged 25-54. The number of observations available in Mikrozensus 2005 to compute the regional unemployment rate ranges between 58 (Wesermarsch) and $4,082$ (Berlin) with an average of 374 observations per region. The unemployment rate varies between 0.02 (Bad Reichenhall) and 0.21 (Berlin) with a weighted average of 0.09. Thus there is sufficient regional variation in unemployment rates possibly affecting the selection into self-employment which then also allows for identification of the coefficients in the Heckman selection model. However, although the number

Table 5: Analysis of variance of structural probit model: Distribution of explained deviance (in %)

	net monthly income		net hourly income	
	(1) OLS	(2) Heckman	(3) OLS	(4) Heckman
Germans vs immigrants				
pull component	33	41	50	40
push component	60	53	25	30
cultural factors	7	6	25	30
Germans vs detailed immigrant groups				
pull component	13	17	7	6
push component	26	25	4	5
cultural factors	61	58	89	89

of observation appear sufficiently large to be fairly robust against sampling error, even this large data set does not allow to compute regional unemployment rates separately for each immigrant group. The unemployment rate of German men in our 2005 sample is found to be 0.08 (69,633), while it is 0.19 (7089) for all immigrants, 0.22 (2,033) for Turks, 0.14 (826) for Italians, and 0.14 (352) for Greeks, where numbers in brackets refer to the size of the sample used to compute these rates. Our implicit assumption thus is that either only the overall local unemployment rate matters in the selection process or that differences in unemployment rates between natives and immigrants are fairly constant.

4.3 Results

Given the observed income in either self- or salaried-employment we can use the predicted income in the other type of employment (counterfactual) to estimate the income difference individuals faced. This will be our pull component in the estimation of the structural probit model (2). The push component in this baseline model is the regional unemployment rate. Cultural factors are subsumed under a set of dummies indicating the immigrant group.

We are interested in, firstly, how much of the observed differences this

structural model explains and, secondly, how much the different components contribute. Table 5 reproduces the differences in self-employment rates between natives and immigrants in the upper panel and between natives and Turks, Italians, and Greeks in the lower panel. If the underlying statistical process is well described by the model, these differences should be reproduced when averaging over predicted probit scores.

Next, as in section 3 we re-weight immigrants or immigrant groups so that their distribution of covariates mimics that of natives. Similar to the procedure in section 3 we estimate the non-parametrically the density of push and pull components of natives and immigrants and then re-weight individual's predicted probit scores accordingly.

The importance of pull, push and cultural components can be gauged by analysis of the deviance of model (2). The procedure is similar to a standard analysis of variance, only that the fit of a binary model should rather be measured by the reduction in deviance than by the reduction in squared difference from the mean (see, e.g., Efron 1978, McCullagh and Nelder 1989). The analysis of deviance in the upper panel of table 5 shows that push and pull components explain the most of the reduction in deviance when there is only one dummy in the model to identify immigrants.[6] For instance, if standard OLS is used to impute counterfactual monthly net incomes from salaried- or self-employment to compute individual income differences, 33 percent of the reduction in deviance of model (2) is due to the pull component, i.e., income differences. 60 percent of the reduction of deviance is however due to the push component, i.e., the regional unemployment rate, and only 7 percent to cultural factors, i.e., the immigrant indicator.

The picture however looks remarkably different once we distinguish different immigrants groups and introduce six different dummy variables to distinguish detailed groups of immigrants from different sending countries or regions. Comparing the results of this model with that of the previously discussed results, in this more detailed model only 13 percent of the reduction in deviance is explained by the pull component, while 26 percent by the push component and 61 percent by the cultural component. Thus, in particular the push component remains to be important, while the pull

[6] In general, the analysis of deviance is sensible to the way the various components are added unless the components are strictly orthogonal. As it turns out, however, in our particular case the results are very robust to changing the order in which components are added to the model.

component appears dispensable.

Once we use differences in the incomes per hour instead of incomes per month, the effect on the importance of the pull component (income difference) as explanatory factor is ambiguous, depending on whether we compare German men with all immigrants combined or with detailed groups of immigrants. Comparing Germans with the aggregate group of immigrants the pull factor explains relatively more if hourly incomes are used. However, the percentage of the decrease in deviance that is due to the pull component drops to about half its value once we compare Germans with a set of different immigrant groups. The general picture though regarding the importance of cultural factors remains unchanged whether we use differences in hourly or in monthly incomes as pull factor.

5 Conclusions

Self-employment rates differ across migrants and natives as well as across countries. Parametric and non-parametric estimations show that for the UK observed differences for the self-employment rates between immigrants and natives can not be explained by age and education. However, for the U.S. and Germany the probit as well as non-parametric model explains the observed differences for the self-employment rates between immigrants and natives by age and education. Therefore, for both Germany and the U.S. we could not reject the hypothesis that both groups actually have equal self-employment rates once we condition on age and education.

We repeat the exercise for the largest groups of immigrants, Mexicans in the U.S., immigrants from the Indian sub-continent in the UK, and Turks in Germany. We find for all three immigrant groups, the observed differences for the self-employment rates between immigrants and natives can not be explained by age and education.

We then try to decompose the observed differences in self-employment rates into three components: pull, push and cultural components and to identify the impact of each. The pull component in our model is the income difference individuals face when making decision to become self- or salaried employed. Push component is proxied by the local unemployment rates in Germany. Cultural factors capture unexplained economy wide differences between immigrant groups. Cultural factors subsumed under a set

of dummies indicating the immigrant group. Separate earnings equation is estimated for self-employed and salaried-employed to compute income difference between self- and salaried-employed work, by taking into account endogenous sorting into the sectors.

The importance of pull, push and cultural components are gauged by analysis of the deviance model. The analysis of deviance shows that push and pull components explain the most of the reduction in deviance when there is only one dummy in the model to identify immigrants. However, once we distinguish different immigrant groups, the cultural component becomes the most important explanatory factor and the push component remains important, but the pull component appears dispensable. This result shows that self-employment decision is influenced by ethnic-specific attributes as well as sectoral earnings differential. However, the detailed cultural factors that influence the decision to become self-employed are not explored in this paper. These individual cultural factors are suggested by the theory, but are not available by the data. However, still there are unanswered interesting questions with respect to interaction between ethnicity and self-employment that deserve attention for the future research. In addition to this, our results suggest that immigrants can not be treated as a single homogeneous group that any policy regarding to self-employment should take into account this variation.

References

Bernhardt, I.: 1994, Competitive advantage in self-employment and paid work, *Canadian Journal of Economics* **27**(2), 273–89.

Borjas, G.: 1986, The self-employment experience of immigrants, *Journal of Human Resources* **21**(4), 487–506.

Borjas, G. and Bronars, S.: 1989, Consumer discrimination and self-employment, *Journal of Political Economy* **97**(3), 581–605.

Clark, K. and Drinkwater, S.: 1998, Ethnicity and self-employment in britain, *Oxford Bulletin of Economics and Statistics* **60**(3), 383–407.

Clark, K. and Drinkwater, S.: 2000, Pushed out or pull in? self-employment among ethnic minorities in england and wales, *Labour Economics* **7**(4), 603–28.

Constant, A. and Schachmurove, Y.: 2003, Entrepreneurial ventures and wage differentials between germans and immigrants, *IZA Discussion Paper* **879**.

Constant, A., Schachmurove, Y. and Zimmermann, K. L.: 2005, Role of turkish immigrants in entrepreneuriel activities in germany, *PIER Working Paper* **05-029**.

Constant, A. and Zimmermann, K. L.: 2004, Self-employment dynamics across the business cycle: Migrants versus natives, *IZA Discussion Paper* **1386**.

DiNardo, J., Fortin, N. M. and Lemieux, T.: 1996, Labor market institutions and the distribution of wages, 1973-1992: A semiparametric approach, *Econometrica* **64**(5), 1001–44.

Dustmann, C., Glitz, A. and Vogel, T.: 2007, Employment, wage structure and the economic cycle: Differences between immigrants and natives in Germany and the UK, *Anglo-German Foundation Report* .

Efron, B.: 1978, Regression and ANOVA with zero-one data: Measures of residual variation, *Journal of the American Statistical Association* **73**, 113–21.

Fairlie, R. W. and Meyer, B. D.: 1996, Ethnic and racial self-employment differences and possible explanations, *The Journal of Human Resources* **31**(4), 757–793.

Hayfield, T. and Racine, J. S.: 2007, *np: Nonparametric kernel smoothing methods for mixed datatypes*. R package version 0.13-1.

Lazear, E. P.: 1995, Corporate culture and the diffusion of values, *in* H. Siebert (ed.), *Trends in Business Organization: Do Participation and Cooperation Increase Competitiveness?*, Mohr, Tübingen.

Li, Q. and Racine, J. S.: 2007, *Nonparametric Econometrics: Theory and Practice*, Princeton University Press, New Jersey.

Light, I.: 1972, *Ethnic Enterprise in America*, University of California Press, Berkeley.

Light, I.: 1979, Disadvantage minorities in self-employment, *International Journal of Comparative Sociology* **20**(1-2), 31–45.

Light, I.: 1984, Immigrant and ethnic enterprise in north america, *Ethnic and Racial Studies* **7**(2), 195–216.

Lofstrom, M.: 2002, Labour market assimilation and the self-employment decision of immigrant entrepreneurs, *Journal of Population Economics* **15**(1), 83–114.

McCullagh, P. and Nelder, J. A.: 1989, *Generalized Linear Models*, Monographs on Statistics and Applied Probability 37, 2nd edn, Chapman & Hall, London.

Moore, R. L.: 1983, Employer discrimination: Evidence from self-employed workers, *The Review of Economics and Statistics* **65**(3), 496–501.

Rafiq, R. N.: 1975, Self-employed americans in 1973, *Monthly Labour Review* **98**(1), 49–54.

Rees, H. and Shah, A.: 1986, An empirical analysis of self-employment in the uk, *Journal of Applied Econometrics* **1**(1), 95–108.

Sowell, T.: 1981, *Markets and Minorities*, New York, Basic Books.

Yuengert, A. M.: 1995, Testing hypothesis of immigrant self-employment, *Journal of Human Resources* **30**(1), 194–204.