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Modelling Turkish Migration to Germany

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Modelling Turkish Migration to Germany [§]

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Abstract

This study develops a time series model of Turkish migration to Germany for the period 1963-2004 using the cointegration technique. A single cointegrating relation between the migration flow variable and the relative income ratio between Germany and Turkey, the unemployment rates in Germany and Turkey, and the trade variable, that captures intensity of bilateral economic cooperation, is found. By including the trade variable in the empirical migration function we investigate whether trade and migration are complements or substitutes: a question on which the theoretical literature does not provide a definite answer. Our results support the former view.

Keywords: Migration, trade, economic development, cointegration
    JEL code: F22, C32.

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1 Introduction

Understanding international migration is of a crucial importance not only for academics but also for policy makers. Especially now, when in the wake of ongoing globalisation the travelling costs and informational barriers, that in the former time hindered mass migration from economically less developed areas of the world into the richer countries or regions represented by the Western Europe, North America, and Australia, fall continuously. Hence, now more than ever expectations of potentially large inflows of workers from the developing countries to the rich migration target countries raise fears about adverse labour market and government budget impacts therein.

Our study contributes to understanding of the migration phenomenon in the following aspects. First, 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 the 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 throughout the early seventieth, 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 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).

Second, in the wake of the recognition of Turkey as a candidate for accession at the Helsinki European Council meeting in December 1999 and in the anticipation of the start of accession negotiations between European Union and Turkey in October 2005, a number of studies (Togan, 2002; Lejour et al., 2004; Flam, 2004; Hughes, 2004; Quassier and Reppegather, 2004) have addressed the question of the migration potential, i.e., a hypothetical number of migrants from Turkey to EU if all migration restrictions were suddenly lifted. All these studies do not develop the migration functions on their own but instead take the sets of coefficient values of the migration functions estimated in the context of the EU Eastern Enlargement, that took place in May 2004. Among them the most influential studies are Boeri and Brücker et al. (2001) and Alvarez-Plata et al. (2003) where a migration function is estimated by pooling the relevant country-specific data from a number of migrant source countries into a panel. In this paper, we take a different approach to modelling the migration function for Turkey. In particular, we develop a parsimonious, stable-coefficient time-series error correction model using the bilateral data for Turkey and Germany only. To the best of our knowledge, there is only one reference (Hatton, 1995) that applies a similar modelling strategy to emigration data from UK using historical 1870-1913 data, and at the same time it has never been applied to estimation of the parameters of the migration function for Turkish nationals into Germany.

Third, in addition to the economic variables that are typically chosen as the traditional determinants

of international migration like host-home country income differential, unemployment rates in the host and the receiving countries, we add a variable that captures intensity of economic cooperation between Germany and Turkey which is approximated by share of total trade (i.e., sum of exports and imports) between these two countries in total trade of Turkey. Motivation for including this variable is brought by large literature that investigates how trade affects international labour mobility surveyed in Razin and Sadka (1997), Venables (1999), and Schiff (2000).

In particular, this literature investigates the interplay between trade and migration, i.e., whether migration and trade are complements or substitutes. One stream of literature inspired by Mundell (1957) 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 relatively abundant supply of input factors and thus have a comparative cost advantage. As a result, trade will lead to 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.

Another stream of 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 relation between migration and trade could also arise when income growth in the less developed country that have been generated by trade with 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).

Summarising, it seems that there is no consensus on the relationship between migration and trade such that in the end an answer depends on a particular model used as far as the theoretical literature is concerned. Hence, the ultimate answer must lie in the outcomes of empirical studies. This provides an additional motivation for our paper, where by adding trade volume variable to the migration function in question we will be able to shed more light on this controversial issue by investigating whether economic cooperation between Germany and Turkey had any influence on the dynamics of Turkish migration into Germany, and if it had then we will be able to assess whether trade and migration in this case have been either complements or substitutes.

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 decision to migrate as well as the motivation for choice of the explanatory variables in our study. To this end, we follow the standard microeconomic 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 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, below we will model the migration function of Turks to Germany in the following general form:

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

where M_t denotes 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. Finally, T_t is the proxy for intensity of economic cooperation between Turkey and Germany which is calculated as 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. Inclusion of this variable could be justified on the grounds that the volume of trade can serve as an indicator of the level of business linkages between these two economies as well as economic opportunities that may lower down informational and adjustment costs, level of uncertainty, and certain other prohibitive factors that are associated with migration decision. Thus, one expects that high level of business involvement between the two countries will facilitate and therefore promote international labour movement. The data have been gathered from the Federal Statistical Office in Germany, State Institute of Statistics in Turkey, and OECD.

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

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

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 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. 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).

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, long-run exclusion, 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.

The test for the long-run exclusion (Johansen and Juselius, 1992) investigates whether any of the variables can be excluded from a cointegrating vector. This test has an asymptotic χ^2 distribution with the $r = 1$ degrees of freedom. Finally, the test for the long-run weak exogeneity investigates whether the dependent variables adjust to the equilibrium errors represented by a cointegrating relation.

Tables 3, 4, and 5 report the results of the tests for (trend-)stationarity and long-run exclusion,

performed on the matrix of the long-run coefficients, and the tests for long-run weak exogeneity, performed on the 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. The tests for the long-run exclusion rejects the null hypothesis that the $\ln M_t$, U_{ft}, and T_t can be excluded from the cointegrating vector at the 1% significance level and the variable U_{ht} – at the 10% significance level. At the same time, we cannot reject the null hypothesis that the income-ratio variable $\ln(Y_{ft}/Y_{ht})$ could be omitted from the cointegrating relationship. The likely reason for such an outcome is that the relative ratio fluctuated more or less around the same magnitude in the period of investigation, see Figure 1. We, however, have chosen to retain it, as there is strong theoretical argument for its presence in the migration function, and, arguably, its persistence has been and still is the major pulling factor behind Turkish migration to Germany. In addition, it turns out that after imposing the four long-run weak exogeneity restrictions we no longer are able to reject the null hypothesis of the long-run exclusion of the relative income variable at the 10% significance level, as shown below.

According to the univariate long-run weak exogeneity test results (see the upper panel of Table 5), we can accept the null hypothesis that all but $\ln M_t$ variables are individually are 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]. In order to check, whether this result is robust to the change in the sample size, we report the value of the recursive test statistics of the joint null hypothesis, scaled by the 1% critical value, in Figure 2. Observe, that the restriction that the four variables $U_{ft}, U_{ht}, \ln(Y_{ft}/Y_{ht}), T_t$ are weakly exogenous with respect to the long-run parameter values is accepted for all sample sizes with only one exception. 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

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

Observe that all the coefficient estimates have the expected signs and all estimates are significantly different from zero at the conventional significance levels. Relative income, unemployment in Turkey and trade contribute positively to emigration, and unemployment in Germany contributes negatively. Observe that our estimation results provide an empirical support for the theoretical literature that views migration and trade as complements, see discussion above in Section 1.

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 error correction term. After removing the variables that have turned to be insignificant, the estimated conditional model for $\ln M_t$ looks as follows

$$
\begin{aligned}
\Delta \ln M_t \quad = \quad & \underset{(0.588)}{1.806} \ \Delta \ \ln\left(\frac{Y_{ft}}{Y_{ht}}\right) \ - \ \underset{(0.038)}{0.292} \ \Delta \ U_{ft} \ - \ \underset{(0.061)}{0.459} \ ecm_{t-1} - \ \underset{(0.184)}{0.663} \ D99 - \ \underset{(0.715)}{5.205} \\[2mm]
& \widehat{\sigma} = 0.162, \ R^2 = 0.814, \ T = 42, \ F_{AR(1-2)}(2,35) = 1.157[0.855], \\[1mm]
& F_{ARCH(1)}(1,35) = 1.145[0.219], \ \chi^2_{Norm}(2) = 1.183[0.553], \\[1mm]
& F_{Hetero}(7,29) = 0.256[0.965], \ F_{Hetero-X}(10,26) = 0.301[0.974], \\[1mm]
& F_{RESET}(1,36) = 0.584[0.449]
\end{aligned}
\tag{4}
$$

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

The conditional model (4) is parsimonious but at the same time the diagnostic tests show no signs of misspecification. 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.

The conditional model has very good explanatory power as it can be assessed by looking at the actual values and the regression fitted values as well as the regression residuals (see Figure 4). The coefficient estimates are well determined and exhibit remarkable stability according to the recursive Chow stability tests, the one-step residuals as well as recursively estimated coefficients (see Figures 5 and 6). Finally, the conditional model is able to accurately forecast migrant inflow to Germany over the period 2000-2004 (see Figure 7 for the one-step ahead forecasts), and this fact is supported by the Chow parameter constancy forecast F-test statistic which takes the value of 0.214[p=0.953].

4   Conclusion

In this paper we develop a model for Turkish emigration to Germany for the period 1963-2004 using the cointegration technique. A single cointegrating vector is found among the migration flows and the following explanatory variables: the relative income ratio between Germany and Turkey, the unemployment rates in Germany and Turkey, and the trade variable calculated as the share of total trade between Germany and Turkey in total Turkish volume of trade. On the basis of the results of the cointegration analysis and imposed long-run weak exogeneity restrictions, a parsimonious single equation conditional error-correction model is developed that has good in- and out-of-sample explanatory power and possesses well-defined and stable coefficients.

Furthermore, by including the trade variable in the empirical migration function, our study contributes to the better understanding of the relationship between trade and migration, for which the theoretical literature yields rather controversial conclusions. Our results support the view that trade and migration

are complements at least as far as the Turkish migration to Germany is concerned. This means that the business linkages between these two economies significantly facilitate mobility of Turkish nationals between Turkey and Germany by relaxing financial constraints as well as by lowering various adjustment and informational costs that are associated with the decision to migration.

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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

	$\ln M_t$	$\ln(Y_{ft}/Y_{ht})$	$\ln U_{ft}$	$\ln U_{ht}$	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]

v

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]

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.

Table 4: VAR model: tests for long-run exclusion

$\ln M_t$	$\ln(Y_{ft}/Y_{ht})$	U_{ft}	U_{ht}	T_t	$\chi^2(v)$	p-value
0	.	.	.	.	16.456	[0.000]**
.	0	.	.	.	1.287	[0.256]
.	.	0	.	.	15.463	[0.000]**
.	.	.	0	.	3.521	[0.061]
.	.	.	.	0	12.510	[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 long-run exclusion of the variables.

The number of degrees of freedom v in the χ^2 tests corresponds to the number of zero restrictions imposed.

Table 5: VAR model: tests for long-run 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.
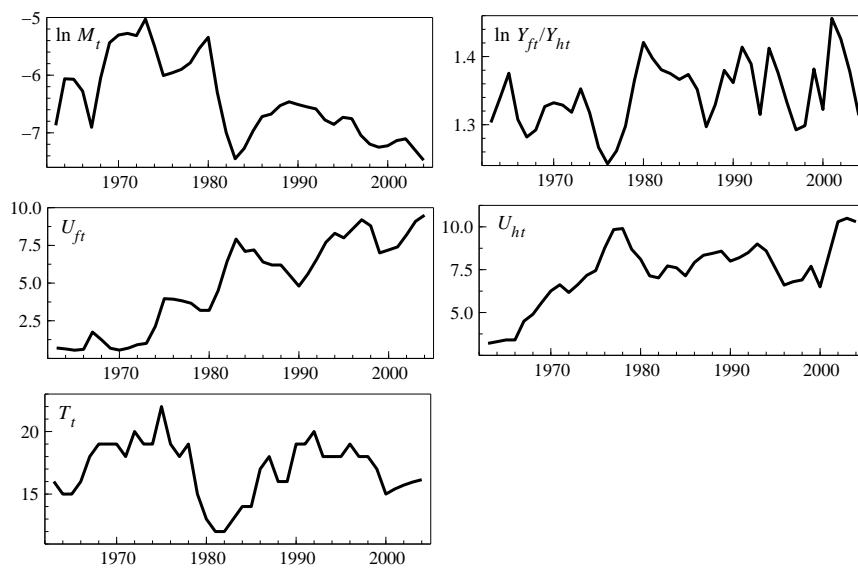
Figure 1: Data: 1963 - 2004

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

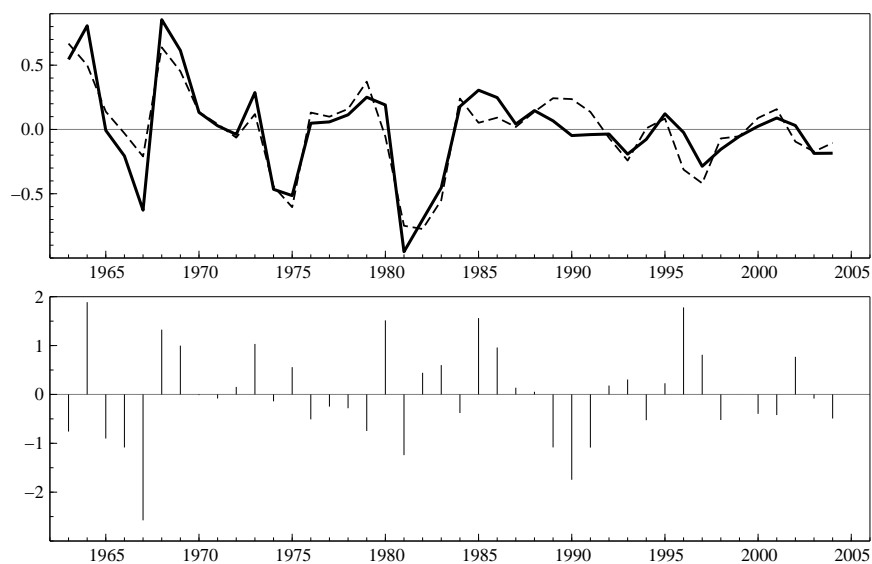Figure 3: Cointegrating relation, equation (3)

Figure 4: Actual (solid line), fitted (dashed line), and residual values for the conditional model (4)
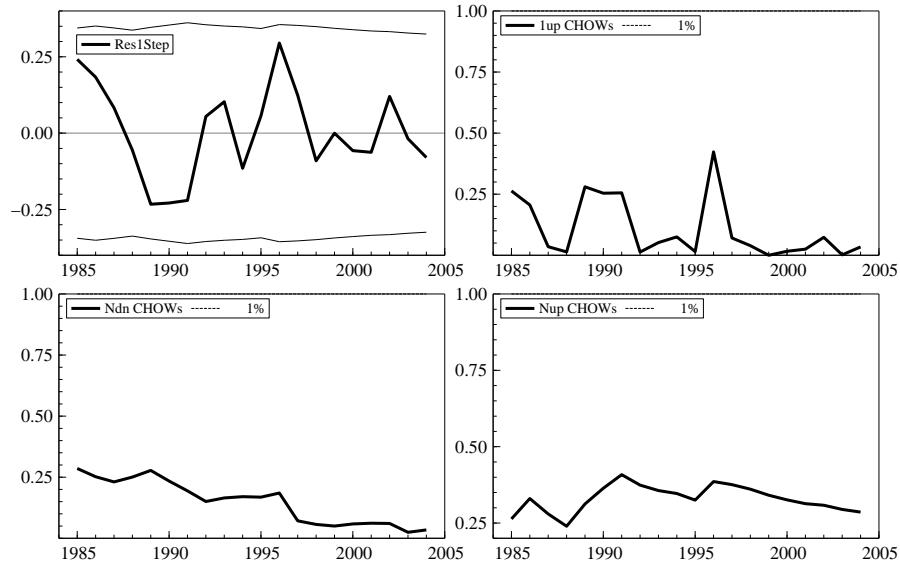
Figure 5: The recursive Chow test statistics scaled by the corresponding 1% critical values and the one-step residuals (Res1step) for the conditional model (4)
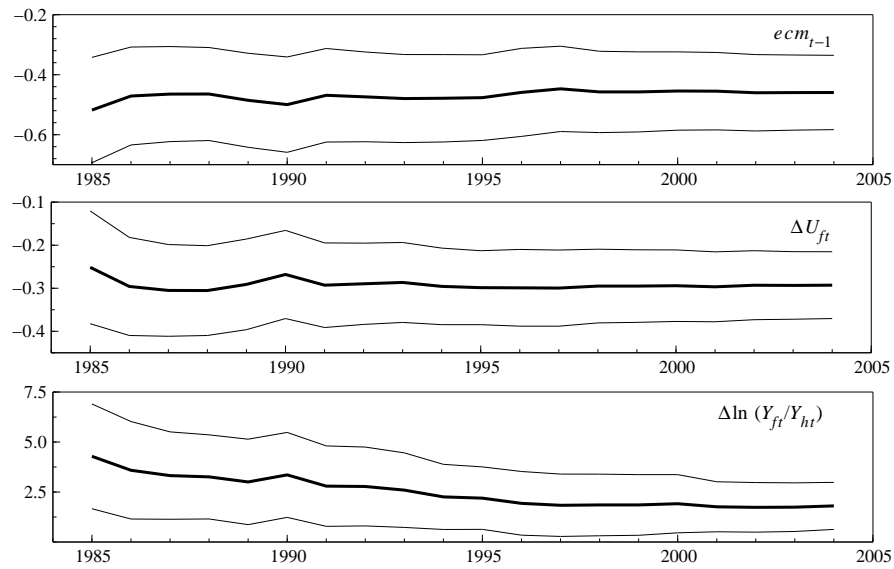

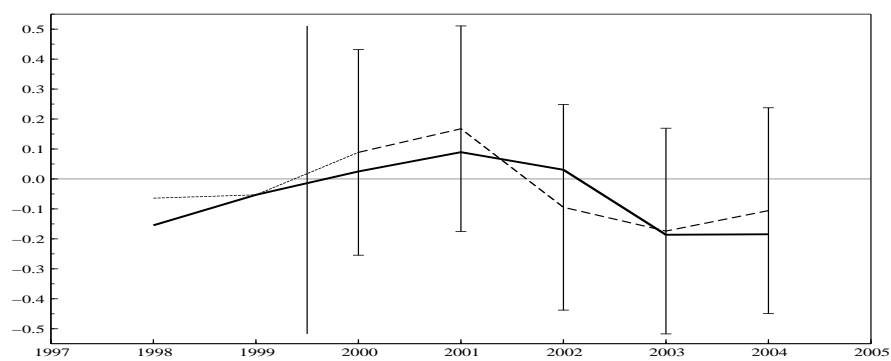Figure 6: The recursively estimated coefficient values for the conditional model (4)

Figure 7: 1-step (ex post) forecasts (dashed line) for the conditional model (4)