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Linda A. Toolsema
Jan-Egbert Sturm
Jakob de Haan*

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CESifo
Center for Economic Studies & Ifo Institute for Economic Research
Poschingerstr. 5, 81679 Munich, Germany
Tel.: +49 (89) 9224-1410
Fax: +49 (89) 9224-1409
e-mail: office@CESifo.de

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CONVERGENCE OF MONETARY TRANSMISSION IN EMU - NEW EVIDENCE

Abstract

This paper examines how the pass-through of monetary policy measures in 6 EMU countries has evolved over time and whether there is convergence in monetary transmission. The countries included are: Belgium, France, Germany, Italy, the Netherlands and Spain, and the sample period is 1980-2000. We conclude that major differences in pass-through exist in our sample, both in terms of initial as well as long-run responses to policy-induced interest rate changes. There is no indication for convergence of monetary policy transmission.

JEL Classification: E52, E43.

Keywords: Monetary transmission, pass-through, interest rate stickiness, EMU.

Linda A. Toolsema
University of Groningen
PO Box 800
9700 AV Groningen
The Netherlands

Jan-Egbert Sturm
University of Groningen
PO Box 800
9700 AV Groningen
The Netherlands

Jakob de Haan
University of Groningen
PO Box 800
9700 AV Groningen
The Netherlands
j.de.haan@eco.rug.nl

1. Introduction

On January 1st, 1999 Europe entered a new era with the adoption of a single currency – the euro – by 11 of the European Union's 15 member states. For the first time since the Roman Empire, a large portion of Europe again shares a common currency.[1] The launch of the euro has created the world's second largest single currency area in terms of economic size after the Unites States. The euro area accounts for some 15 per cent of global GDP (Eijffinger and De Haan, 2000).

With the start of Economic and Monetary Union (EMU), participating countries no longer have their own monetary policy. The European Central Bank (ECB) is responsible for monetary policy decisions in the euro zone. Amongst other things, the impact of monetary policy on the real economy depends on how changes in policy rates are transmitted to market interest rates. Two elements are crucial for the transmission of monetary policy decisions: the speed and the degree to which changes in the policy rate affect the cost of borrowing. A well-known study by Cottarelli and Kourelis (1994) on the pass-through of monetary policy measures concludes that the degree of stickiness of market rates in the eurozone countries is, on average, quite high and shows considerable variation, especially in the short run. Also in the long run sometimes substantial differences show up.

Although the EMU countries now share the same currency, their financial systems showed considerable differences. A number of authors have argued that this may complicate the implementation of a single monetary policy (see e.g. Dornbusch et al., 1998). Although many features of the financial structure may be endogenous to the monetary policy regime, some may adjust more slowly (or perhaps not at all). As pointed out by Mojon (2000), national segmentation in the retail banking industry may remain significant in spite of EMU as retail banking involves heavy investments in brand names, in a network of branches and in relationships with customers. Also differences in regulation may cause retail banking markets to remain segmented along national lines. Furthermore, differences in the balance sheet structure of households and firms will only gradually adjust to the new monetary regime. As a consequence,

[1] At the time of writing, three EU member states do not (yet) participate in EMU: Denmark, the United Kingdom and Sweden (Greece participates in the EMU since 2001). Still, it is expected that at some time these countries will also use the euro, as will some potential future EU member countries in Central and Eastern Europe.

the pass-through from policy-controlled interest rates to bank interest rates may remain country specific. This potential source of asymmetry in monetary transmission is particularly relevant in the euro area where bank rates are a key determinant of the cost of capital and the yield on savings.

Following the approach of Cottarelli and Kourelis (1994) this paper examines how the pass-through of monetary policy measures in the six largest EMU countries (Belgium, France, Germany, Italy, the Netherlands, and Spain) has evolved over time and whether there is convergence in monetary transmission. Of course, it can be argued that the start of EMU implies a regime shift and that, therefore, the Lucas critique applies. However, as Issing (2001, p. 290) points out: "One should realise that, first, a long and gradual process of monetary convergence has preceded the introduction of the new currency, so that many of the adjustments may already have taken place. Second, the effect of the single currency on competition in goods, labour, and financial markets follows previous structural changes such as the Single Market Initiative, so that whatever structural change will take place is part of an on-going process." We test whether this hypothesis is true for the pass-through of policy-controlled interest rates to bank rates. The countries in our sample cover most of the euro zone. Our estimation period is 1980-2000. We conclude that differences in pass-through exist in our sample, both in terms of initial as well as long-run responses to policy-induced interest rate changes. There is no indication for convergence of monetary policy transmission.

The remainder of the paper is organised as follows. Section 2 offers a brief review of the literature. Section 3 presents our model and the data, while sections 4 and 5 contain our results. The final section offers some concluding comments.

2. Review of the literature

Lowe and Rohling (1992) point out that many of the explanations advanced to explain price stickiness in goods markets are also applicable to financial markets. Following their approach, we may distinguish four theories: agency costs (Stiglitz and Weiss, 1981), adjustment costs (Cottarelli and Kourelis, 1994), switching costs (Klemperer, 1987), and risk sharing (Fried and Howitt, 1980).

Agency costs arise due to asymmetric information. Banks cannot distinguish between risky and less risky projects. Consequently, an increase in the costs of funding will not necessarily result in a proportionate increase in the loan rate of banks. When the bank increases its loan rate, the firms with the safest projects will be the first to withdraw from the markets. As a result, the mix of applicants applying for loans changes adversely (adverse selection). Furthermore, firms may decide to undertake riskier projects due to the higher interest rates (moral hazard). As the probability of default due to the higher interest rate would rise, an increase in the loan rate will not necessarily result in a proportionate increase in the bank's expected receipts. Banks may therefore prefer to set the loan rate below the market clearing rate and ration credit.

Cottarelli and Kourelis (1994) argue that the banking industry faces *adjustment costs* when interest rates change. A profit-maximising bank will only change the lending rate if the adjustment costs are lower than the costs of keeping lending rates unchanged. The cost of maintaining non-equilibrium rates is positively related to the elasticity of the demand for bank loans. The demand for bank loans is less elastic in markets that have fewer competitors, higher barriers to entry or no alternative sources of finance, including foreign capital. Finally, banks will not adjust their lending rates if they perceive that the changes in the money market rates are only temporary.

Banks are concerned with the characteristics of their clients, like risk profile. Unlike many other markets, one client is not as good as the other. To find out about the characteristics of clients is a costly activity for a bank, which is often passed on to the client in the form of a fee, which makes it costly for a buyer to switch from one bank to another (*switching costs)*. As shown by Klemperer (1987), switching costs cause the derivative of price with respect to marginal cost to be less than one (Lowe and Rohling, 1992).

Finally, *risk sharing* may explain interest rate stickiness. Fried and Howitt (1980) argue that borrowers may be more risk averse than the shareholders of a bank. As the borrower is risk averse, he prefers stable interest rate payments. The bank therefore charges a less variable interest rate than its marginal cost of funds for which it is compensated by a higher interest rate (risk premium).

A few studies have investigated the pass-through empirically in a multi-country setting. Cottarelli and Kourelis (1994) report important differences in pass-through in various countries. Table 1 shows the short-term (i.e. one-month) effect for the six countries which are focused upon in the present study. Also the outcomes of similar studies by Borio and Fritz (1995) and BIS (1994) are presented in this table.

Table 1. Short-run and long-run effect of policy rate increase of 100 basispoints on lending rate (basispoints)

	Belgium	Germany	Spain	France	Italy	Netherlands
Cottarelli and Kourelis (1994)	21 87	37 100	36 94	- -	12 83	52 82
Borio and Fritz (1995)	61 127	11 105	0 117	43 74	26 122	108 108
BIS (1994)	85	18	-	43	14	125

Note: the first row shows the short-run effect, the second presents the long-run effect. The BIS study only reports initial multipliers.

Mojon (2000) examined the pass-through in the same six EMU countries as the present paper for the period 1979-1998 for a whole range of deposit and credit rates (which can, however, not be fully compared across countries) and confirms the conclusion of heterogeneity of previous studies. Finally, Sander and Kleimeier (2001) provide evidence that the speed of adjustment and the nature of the adjustment process itself differ in the EMU countries.

Cottarelli and Kourelis (1994) have also examined whether differences in pass-through are related to diverging financial structures. They obtain a significant negative effect of five financial structure variables on the pass-through: the absence of a money market for negotiable short-term instruments, the volatility of the money market rate, constraints on international capital movements, the existence of barriers to entry and the public ownership of the banking system.

Following Cottarelli and Kourelis (1994), Mojon (2000) has estimated the impact of financial structure on the pass-through within a panel of 25 credit market rates and 17 deposit rates in the six biggest EMU countries. He finds that for both credit and deposit rates the volatility of the money market rate reduces the pass-through and that competition from direct finance increases it.

Some studies report evidence on interest rate stickiness for just one country. For instance, Lowe and Rohling (1992) find large differences in pass-through in Australia across different types of loans. They report complete pass-through of changes in banks' marginal costs of funds only for overdraft rates to business borrowers. For credit cards, personal loans, mortgages, and the standard overdraft rate, changes in the banks' marginal costs of funds have not been translated one for one. This result underlines that in analyses involving various countries one has to be very careful to use as much as possible comparable interest rates.

Cottarelli et al. (1995) conclude that differences in the degree of lending rate stickiness among Italian banks are to a large extent due to differences in concentration of the local markets in which banks operate. Other relevant factors are: the extent of securitisation of banks' liabilities, the form of the loan, bank size and the banks' ownership structure.

In the following sections we will build upon the method of Cottarelli and Kourelis (1994) to examine whether the pass-through of monetary policy measures has changed over time. In Section 5 we will employ an error-correction model for this purpose.

3. The Cottarelli-Kourelis model and the data

We have first estimated a similar model as Cottarelli and Kourelis (1994) to analyse the speed and the degree to which interest rates react to changes in policy-determined rates. The estimated model is:

$$i_t = \beta_0 + \beta_1 i_{t-1} + \beta_2 m_t + ... + \beta_{n+2} m_{t-n} + u_t \qquad (1)$$

where i_t denotes either the lending rate or the capital market rate in month t; m_t is the money market rate and u_t is an error term. As noted by Cottarelli and Kourelis (1994), this specification and the resulting steady state solution is consistent with a monopolistic competition model relating the loan rate to the money market rate (i.e. to the exogenously given marginal costs of funds). The model is, of course, a simplification as the lending (and capital market) rate is also influenced by shifts in the demand for loans, changes in the perceived riskiness of loans, and perhaps by the business cycle. However, to make our results comparable to those of Cottarelli and Kourelis (1994), we start with this simple model.

On the basis of equation (1), the following three multipliers can be calculated:[2]

- The impact multiplier: $h_0 = \beta_2$
- The interim multiplier: $h_k = \beta_1 h_{k-1} + \sum_{i=0}^{\min(k,n)} \beta_{2+i}$
- The long-term multiplier: $h_l = \frac{1}{1-\beta_1} \sum_{i=0}^{n} \beta_{2+i}$

The idea behind the model is that the money market rate is determined by monetary policy. The money market rate used refers to the three-month inter-bank rate in the various countries.[3] As the study of the BIS (1994) shows that the response of the three months money market rate to the official monetary policy rate is nearly one for one, we use this interest rate as proxy for the policy-determined interest rate (see also Sander and Kleimeier, 2001). For the observations after the start of EMU the three month euro inter-bank market rate has been used. The data for the lending rate (short-term loans to enterprises) have been provided by the ECB, except for Italy where we have used the lending rate as published in the *International Financial Statistics* (IFS) of the IMF, because the ECB data set started only in 1989.[4] We have also used the T-bill rate for Italy, because according to Cottarelli et al. (1995, p. 693), lending on the Italian inter-bank market was limited before the 1990s, and the T-bill rate was the relevant reference rate then. As proxy for the capital market rate we have employed the government bond yield as published in the IFS, except for France, for which we have used data from Datastream. The model is estimated using monthly data and the estimation period is 1980.1-2000.1.[5] The sample covers two complete interest rate cycles.

Table 2 summarises our data set and provides the correlation between (the level and the first differences of) the money market rate with the lending rate and the

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[2] See Stewart and Venieris (1978) for details.
[3] Data have kindly been provided by Jan Kakes of the Dutch central bank.
[4] This is one of the differences with the study of Mojon (2000) who employed a whole range of interest rates, which lack comparability. Furthermore, in contrast to Mojon (2000), we focus on changes in pass-through over time.
[5] For the lending rate the periods are 1983:8-1999:11 for Italy and 1984:4-2000:1 for France.

capital market rate, as well as the average and the standard deviation of the spread between the money market rate and the lending and capital market rate, respectively.

Table 2. A summary of the data

Money market rate versus …	Correlations		Spread	
	Levels	First diff.	Average	St. deviation
Lending rate				
Belgium	0.97	0.82	3.11	0.68
Germany	0.83	0.50	2.95	1.19
Spain	0.99	0.85	1.03	0.49
France	0.93	0.08	1.83	1.04
Italy	0.97	0.38	2.69	1.05
Netherlands	0.99	0.70	0.34	0.30
Capital market rate				
Belgium	0.93	0.32	0.60	1.58
Germany	0.90	0.52	0.74	1.34
Spain	0.94	0.46	-0.19	1.67
France	0.93	0.51	0.69	1.31
Italy	0.94	0.41	-0.19	1.63
Netherlands	0.86	0.57	1.14	1.39

4. Results for the Cottarelli-Kourelis model

The first step in our analysis was to examine whether the model had to be estimated in levels or first differences.[6] As the ADF tests clearly indicated that we cannot reject the hypothesis that the interest rates are I(1), the model is estimated in first differences. The second step is the selection of the number of lags to be included. We have used Akaike's Information Criterion (AIC) criterion to determine the lag structure. Table 3 presents the various multipliers for the lending rate. It clearly follows that there are substantial differences across countries with respect to both the initial effect of monetary policy and the long-term effect of policy-induced interest rate changes.

[6] Cottareli and Kourelis (1994) also report first difference estimates.

Table 3. Multipliers (lending rate)

Country	Lags	h_0*	h_3	h_6	h_{12}	h_L*
Belgium	12	0.752 (0.033)	0.755	0.923	1.039	1.018 (0.085)
Germany	8	0.330 (0.029)	0.719	0.801	0.899	0.899 (0.056)
Spain	8	0.898 (0.031)	1.033	1.117	1.135	1.135 (0.054)
France	10	0.075 (0.053)	0.526	0.664	0.618	0.618 (0.132)
Italy (interbank)	2	0.175 (0.036)	0.614	0.616	0.616	0.616 (0.061)
Italy (T-bill)	3	0.182 (0.037)	0.722	0.733	0.733	0.733 (0.079)
Netherlands	5	0.847 (0.048)	0.841	0.958	0.965	0.965 (0.056)

* Standard errors in parentheses.

Our findings differ from the results of Cottarelli and Kourelis (1994). For Belgium, the Netherlands and Spain we find substantially higher initial impact (h_0) multipliers. The short-run results for Germany and Italy are very similar in both studies, while France is not included by Cottarelli and Kourelis (1994). For the long-run multipliers we find for Germany and Italy lower values than Cottarelli and Kourelis (1994).

Table 4 shows the outcomes if we estimate the model using capital market rates instead of lending rates. The differences across countries are less pronounced than in Table 3. Still, both initial and long-run effect differ.

Table 4. Multipliers (government bond yield)

Country	Lags	h_0*	h_3	h_6	h_{12}	h_L*
Belgium	2	0.134 (0.034)	0.138	0.137	0.137	0.137 (0.054)
Germany	1	0.320 (0.042)	0.273	0.271	0.271	0.271 (0.071)
Spain	4	0.272 (0.033)	0.372	0.472	0.475	0.475 (0.078)
France	8	0.254 (0.032)	0.325	0.343	0.416	0.416 (0.107)
Italy (interbank)	5	0.314 (0.047)	0.393	0.581	0.589	0.589 (0.129)
Italy (T-bill)	7	0.319 (0.042)	0.573	0.681	0.821	0.821 (0.126)
Netherlands	1	0.423 (0.039)	0.466	0.466	0.466	0.466 (0.062)

* Standard errors in parentheses.

As explained in Section 1, the purpose of this paper is not so much to determine whether monetary transmission differs across EMU countries, but whether there is convergence of monetary transmission. For this purpose we have employed rolling regressions. The idea behind this approach is to take a fixed number of observations and to redo the regressions, every time adding one observation at the end of the sample, while dropping one at the beginning. The results should indicate whether the monetary policy transmission has been stable over time. The upper part of Figures 1-6 show the impact and long-run multipliers for the lending rate (plus and minus two standard errors)[7], using for every regression a period of 48 months and the same number of lags as reported in table 3. The lower part of the figures shows the intermediate multipliers. The dotted lines indicate the estimated multiplier values for the full sample period. Although in some countries the multipliers change somewhat over time, there is no clear trend towards convergence. The same conclusion holds for the government bond yield multipliers (not shown).[8]

[insert figures 1-6 here]

5. Error correction model

So far, we have updated and extended the analysis of Cottarelli and Kourelis (1994). The advantage of following this study is that our results are directly comparable with those of Cottareli and Kourelis (1994). However, the model of Cottarelli and Kourelis (1994) can be improved upon by using cointegration techniques. The underlying idea of cointegration is that non-stationary time series (such as interest rates) can move apart in the short run, but will be brought back to an equilibrium relation in the long run. If variables are cointegrated, their relationship can be modelled by using an Error Correction Model (ECM).[9] In this section we report our results for this alternative approach, while following as closely as possible the method followed in the previous section.[10]

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[7] For the impact multiplier, the variance is straightforward and (omitting hats) given by $\mathrm{var}(h_0) = \mathrm{var}(\beta_2)$. For the long-term multiplier, we have (asymptotically) $\mathrm{var}(h_l) = g\Sigma g'$ where g denotes the gradient of the long-term multiplier (i.e. the vector of derivatives of $h_l = h_l(\beta)$), and Σ is the variance-covariance matrix of β. The gradient is given by

$$g = \begin{bmatrix} 0 & \frac{1}{(1-\beta_1)^2}\sum_{i=0}^{n}\beta_{2+i} & \frac{1}{1-\beta_1} & \cdots & \frac{1}{1-\beta_1} \end{bmatrix}$$

(assuming $\beta_1 \neq 1$, which seems to be the case in our estimation).

[8] Results available on request.

[9] See also Kleimeier and Sander (2000), Mojon (2000) and Sander and Kleimeier (2001).

[10] For this purpose we have to use a somewhat different model than Cottarelli and Kourelis as in the RHS of eq. (1) we need a term $\beta^* i_{t-1}$, $\beta^* \neq 0$. In the model of Cottarelli and Kourelis (1994),

A general formulation of an ECM is:

$$\begin{aligned}\Delta i_t &= c + \sum_{j=1}^{j\max}\alpha_j \Delta i_{t-j} + \sum_{k=0}^{k\max}\beta_k \Delta m_{t-k} + \lambda e_t + u_t \\ &= \tilde{c} + \sum_{j=1}^{j\max}\alpha_j \Delta i_{t-j} + \sum_{k=0}^{k\max}\beta_k \Delta m_{t-k} + \lambda(i_{t-1} - \hat{\delta} m_{t-1}) + u_t\end{aligned} \quad (2)$$

where e_t denote the residuals of the long-run (cointegration) equation; $\hat{\delta}$ is the estimated long-run parameter. The idea is first to test for cointegration and then to estimate this model and apply rolling regressions to examine whether there is evidence for convergence of monetary transmission in our sample of EMU countries.

As pointed out, we first have to test whether the interest rates are cointegrated. It turned out that for all samples as used in the rolling regressions the variables are clearly cointegrated. Consequently, we could employ the ECM as described in equation (2). In order to make the results in this section as comparable as possible with the results in the previous section - and thus with Cottarelli and Kourelis (1994) - we have decided to report the rolling regression results for j max = 1 (and $k\max = 12$).[11] As in the previous section, the optimal lag structure for Δm_t is determined using AIC for the full estimation period.[12] We focus on the following parameters:

- β_0: which is comparable with h_0 in the previous section (B0 in figures 7-12);
- $\hat{\delta}$: indicates the long-run equilibrium relationship between both interest rates, which is comparable with h_l (denoted by DH in figures 7-12);
- λ: shows the adjustment speed (denoted by LB in figures 7-12).

The rolling regressions of the ECM have been done with 60 and 84 months. We only report the results for the 7 year period (the results for the 5 year period are very similar and are available on request). The lower part of figures 7 to 12 present the outcomes of the cointegration test.

$\beta^* \equiv 0$. In other words, Δi_t does not react to a difference from the equilibrium value in the previous period so that an ECM-model is not possible.

[11] We have also done the rolling regressions using $j\max = k\max = 6$. The conclusions are not sensitive to this alternative specification (results available on request).

[12] The following lags were used: BE 1; DE 9; ES 3; FR 11; IT 3; NL 3.

[insert figures 7-12 here]

Also figures 7-12 do not provide support for convergence of monetary transmission. There are substantial differences across the EMU countries in terms of all the parameters of the ECM. There is no clear sign that over time these differences have become less. Those countries that have below (above) EMU average values for the parameters of the ECM do not consistently show a downward (upward) trend. Again, the same basic conclusion was found when rolling regressions were used for the model with the government bond yield (results available on request).

6. Concluding comments

In this paper we have examined how the pass-through of monetary policy measures in 6 EMU countries has evolved over time and whether there is convergence in monetary transmission. The countries included are: Belgium, France, Germany, Italy, the Netherlands and Spain and the sample period is 1980-2000. We conclude that major differences in pass-through exist in our sample, both for the initial and the long-run responses to policy-induced interest rate changes. There is no indication for convergence of monetary policy transmission. Given the convergence in other areas that has occurred during this period, this is quite a remarkable finding. Our results also suggest that it is unlikely that convergence in monetary transmission will take place in the near future, as there are no indications that since the start of EMU convergence has started. Our results imply that ECB policy decisions affect interest rates in the countries in the euro area differently, thereby complicating the implementation of a single monetary policy.

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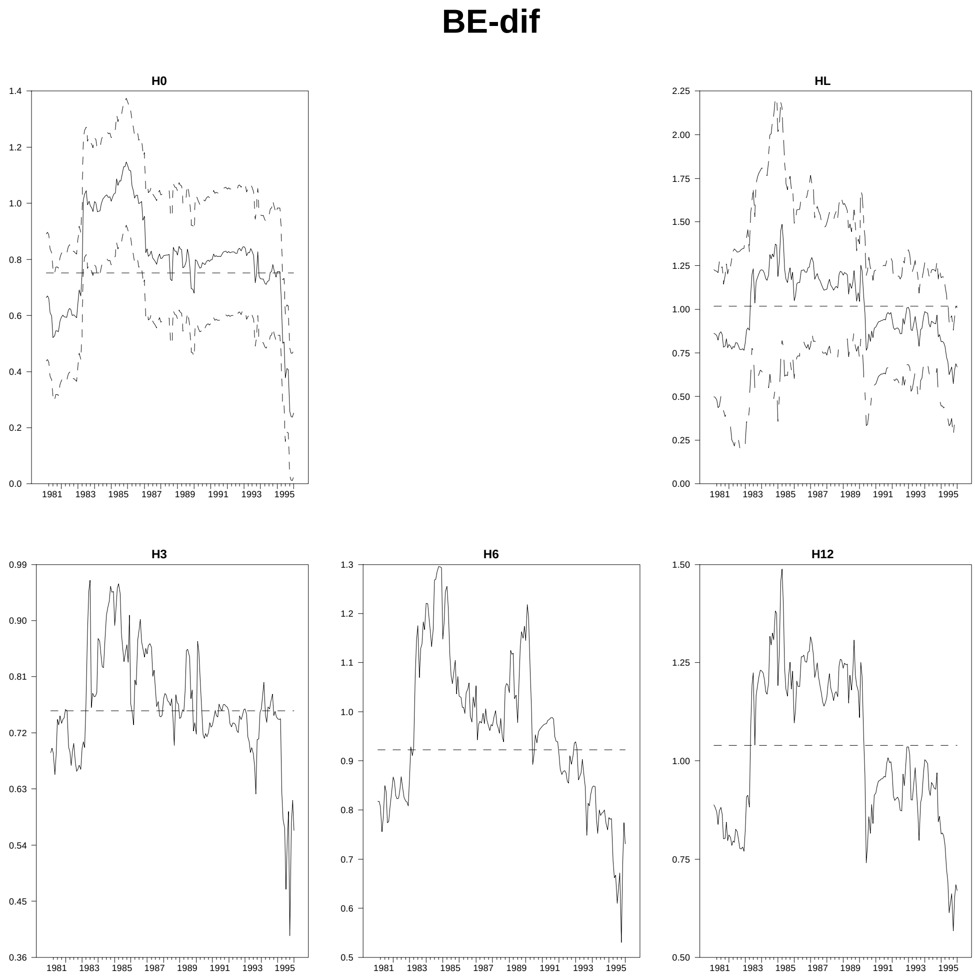
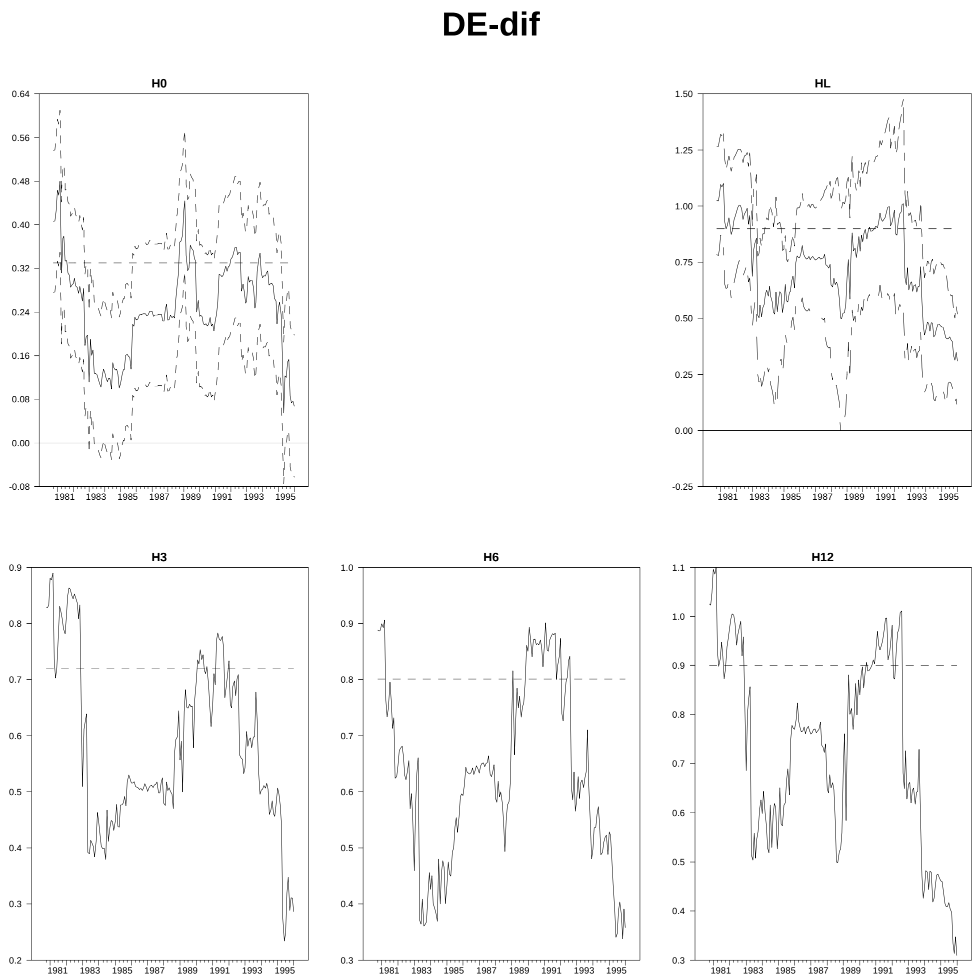
Figure 1: Multipliers in the Cottareli-Kourelis model: Belgium



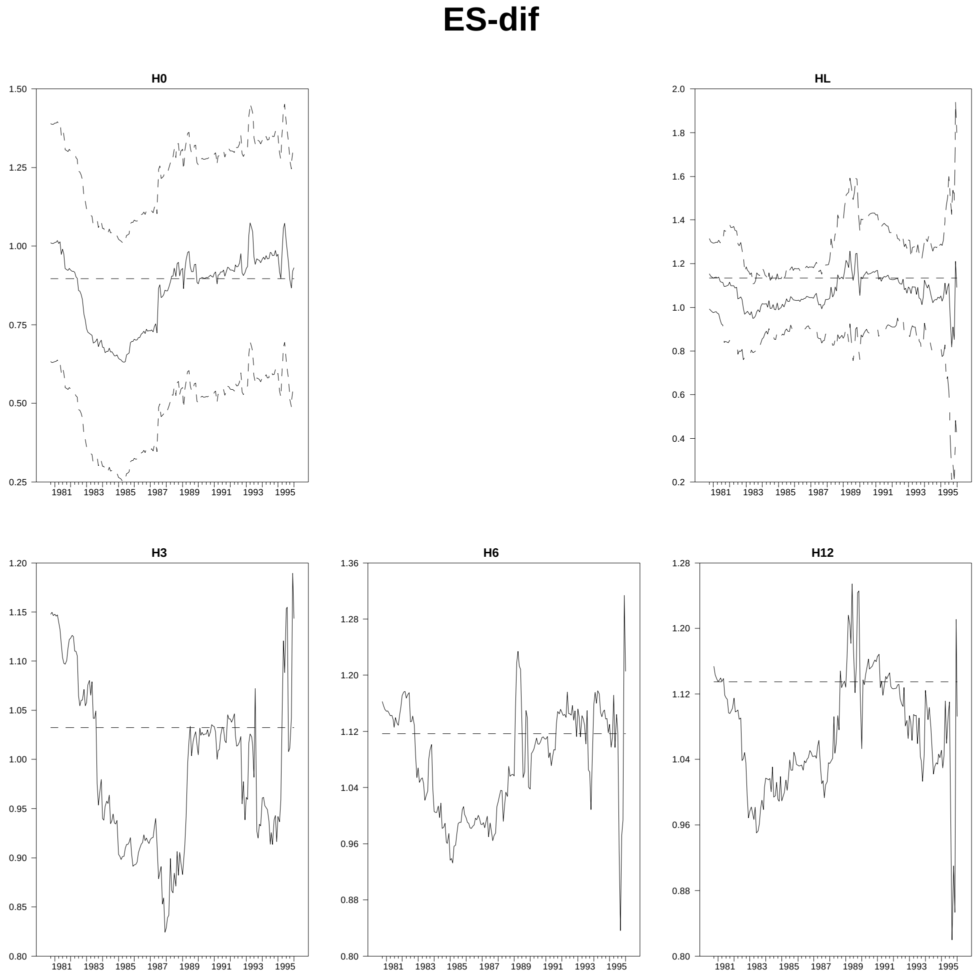
The horizontal dotted lines show the estimated values for the full sample period.

Figure 2: Multipliers in the Cottareli-Kourelis model: Germany



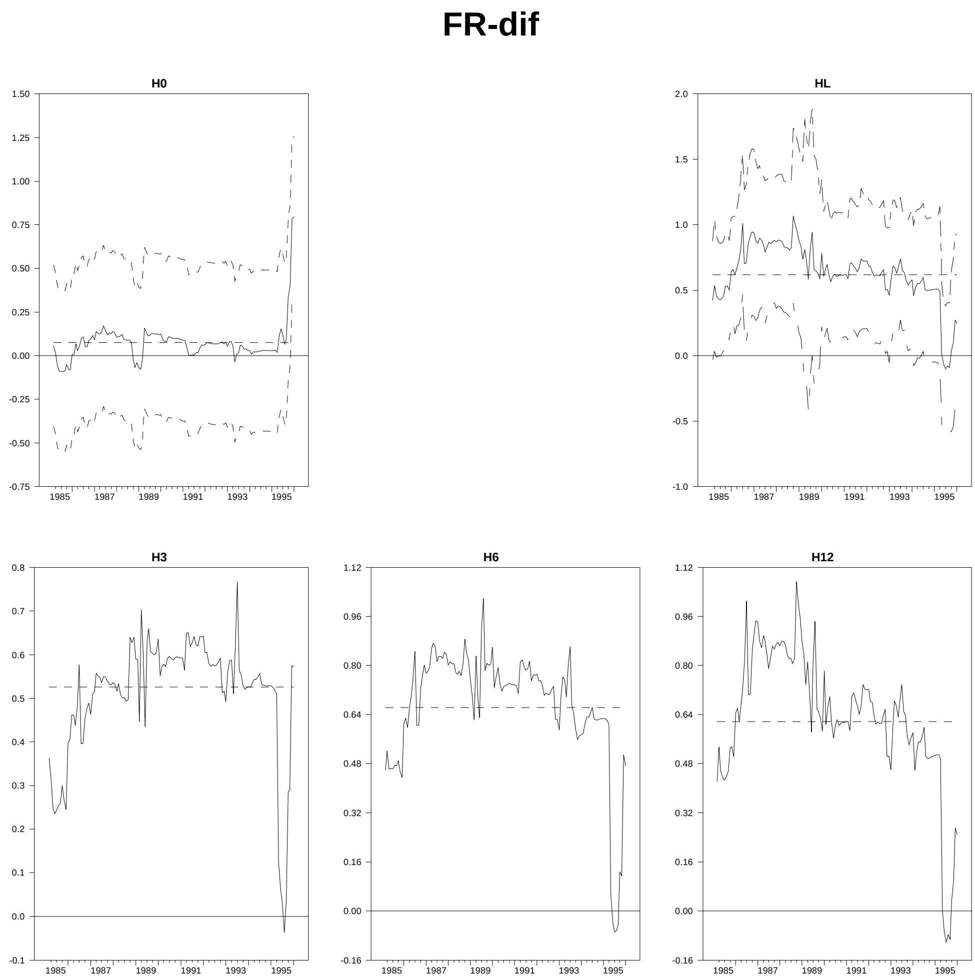
The horizontal dotted lines show the estimated values for the full sample period.

Figure 3: Multipliers in the Cottareli-Kourelis model: Spain



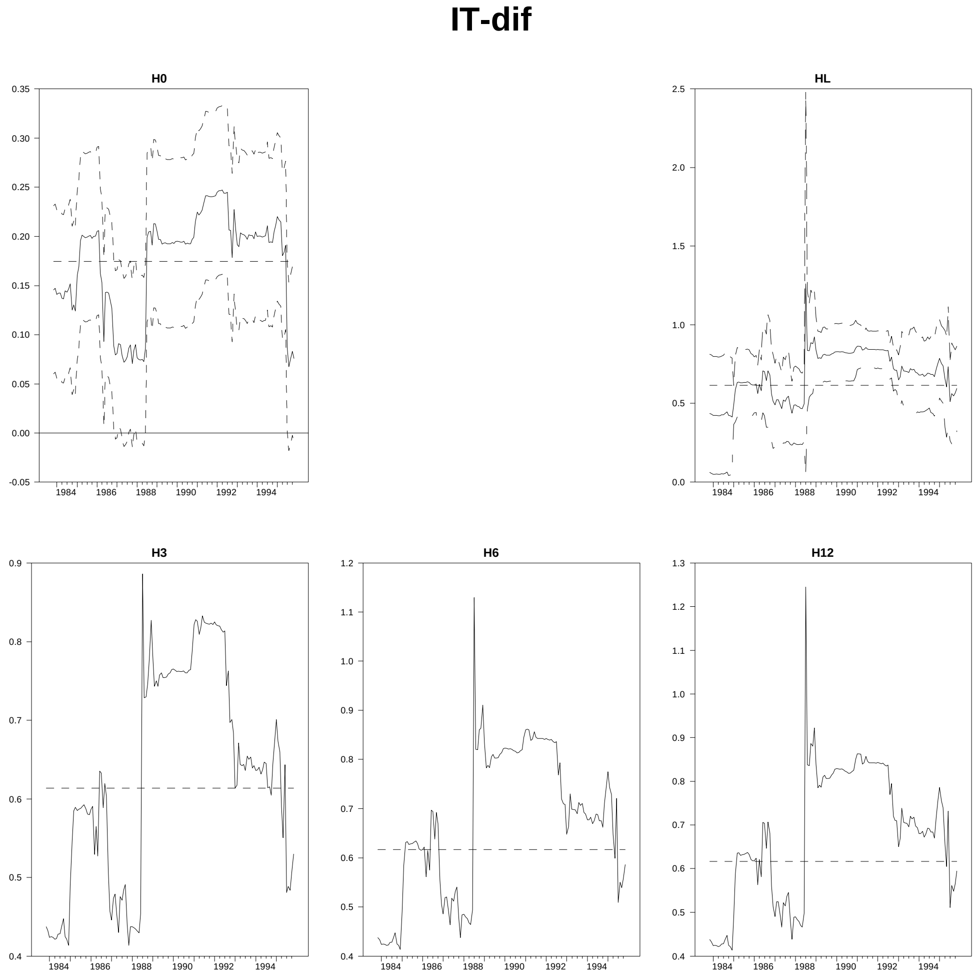
The horizontal dotted lines show the estimated values for the full sample period.

Figure 4: Multipliers in the Cottareli-Kourelis model: France



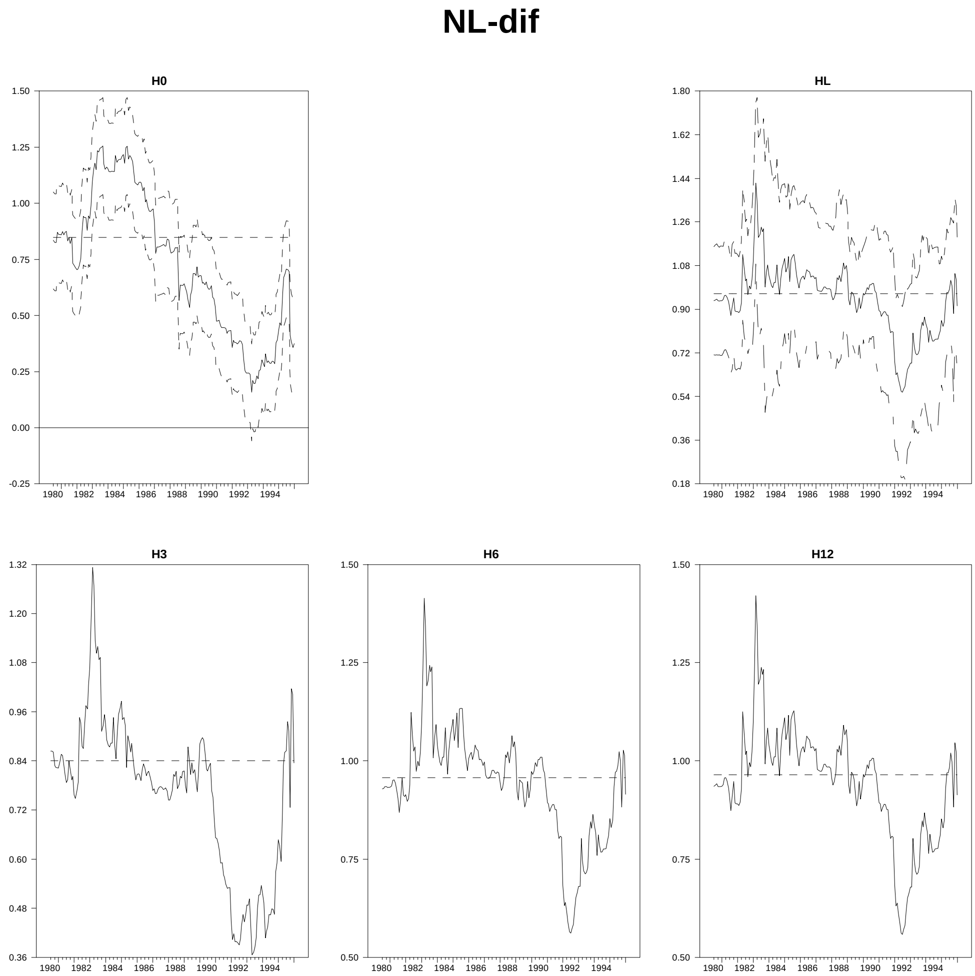
The horizontal dotted lines show the estimated values for the full sample period.

Figure 5: Multipliers in the Cottareli-Kourelis model: Italy



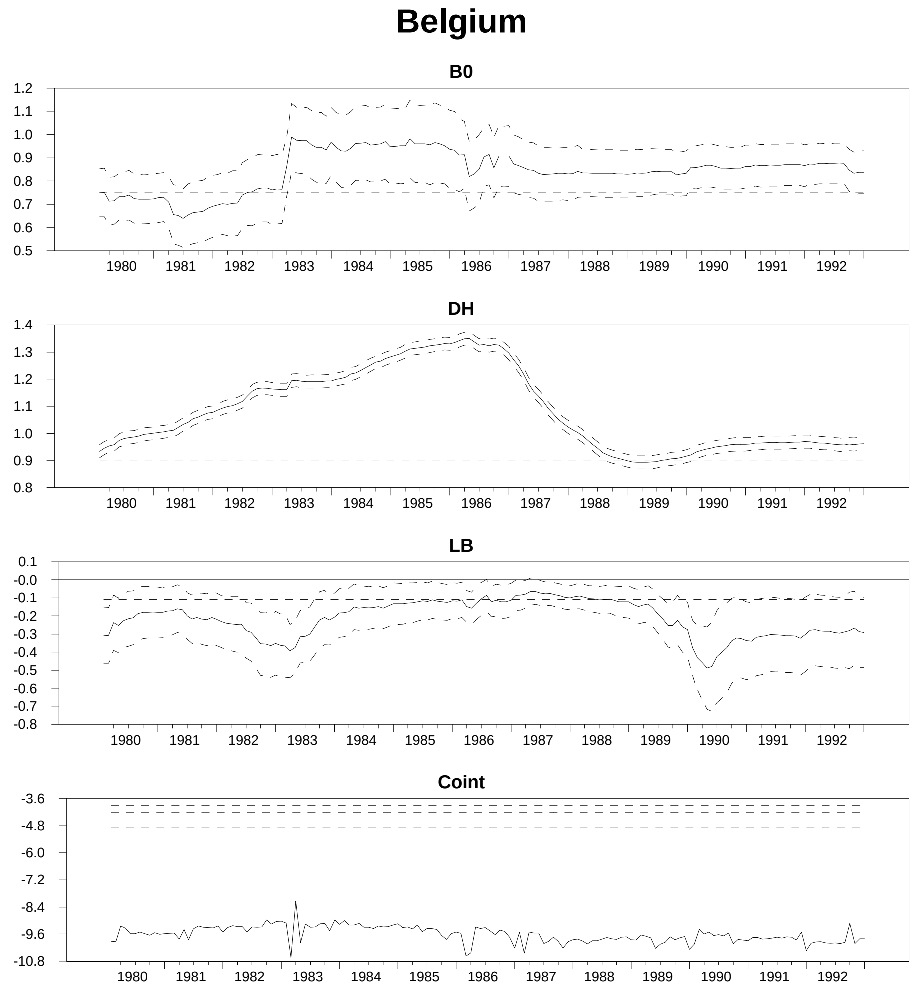
The horizontal dotted lines show the estimated values for the full sample period.

Figure 6: Multipliers in the Cottareli-Kourelis model: Netherlands



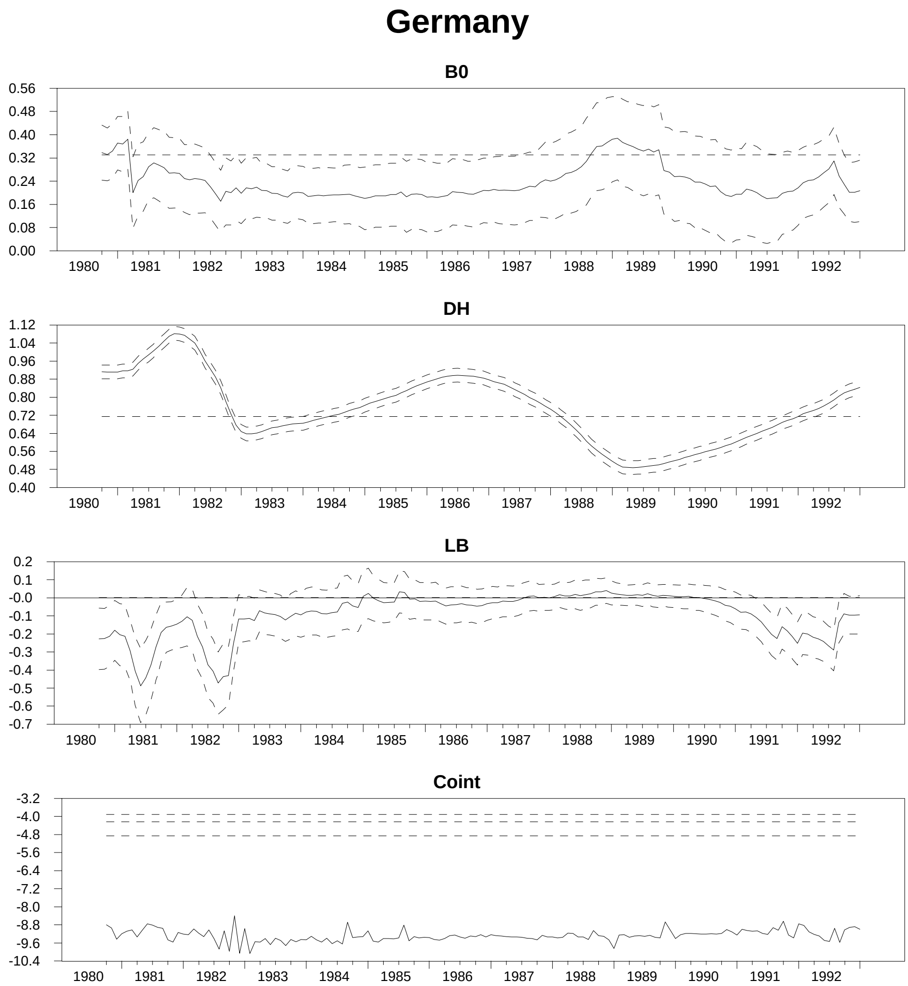
The horizontal dotted lines show the estimated values for the full sample period.

Figure 7: Parameters of the ECM model



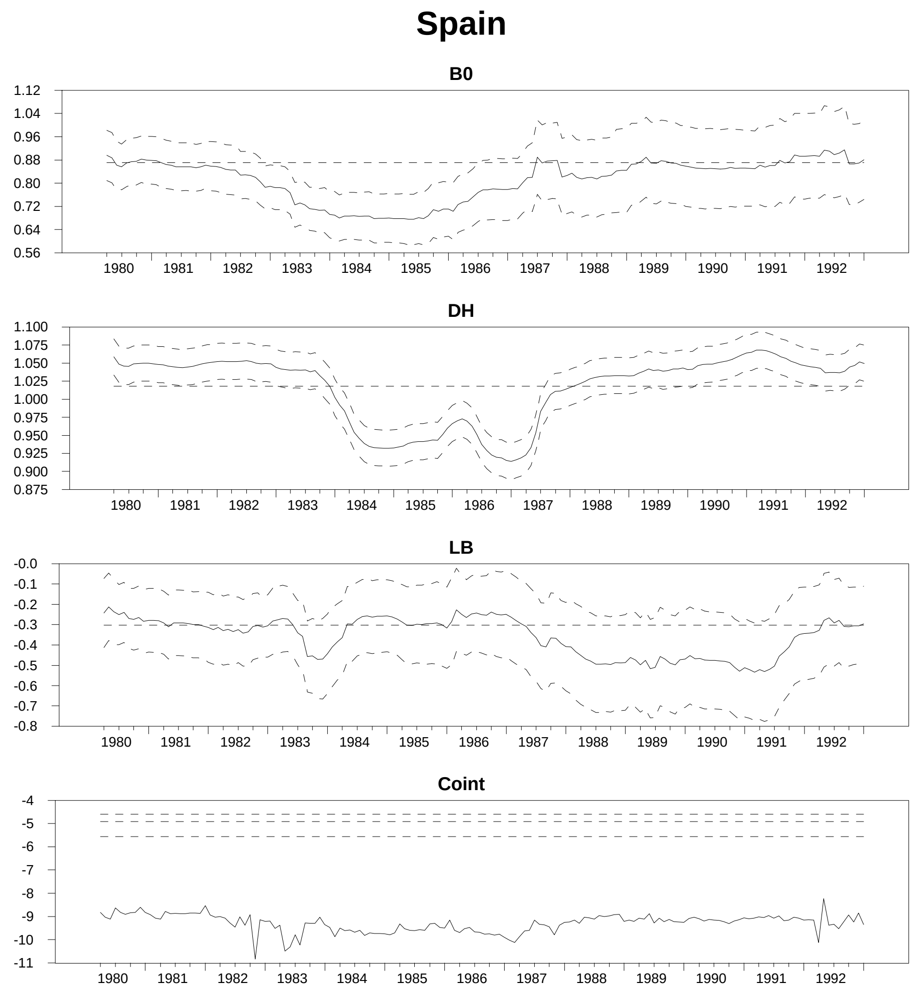
The horizontal dotted lines in the upper three figures show the estimated values for the full sample period. The lower graph - labelled "Coint" - shows the results of Engle-Granger cointegratoin tests. The three upper dotted lines in that graph depict the 1, 5, and 10 percent "exact" critical values from the response surface regression in MacKinnon (1991).

Figure 8: Parameters of the ECM model



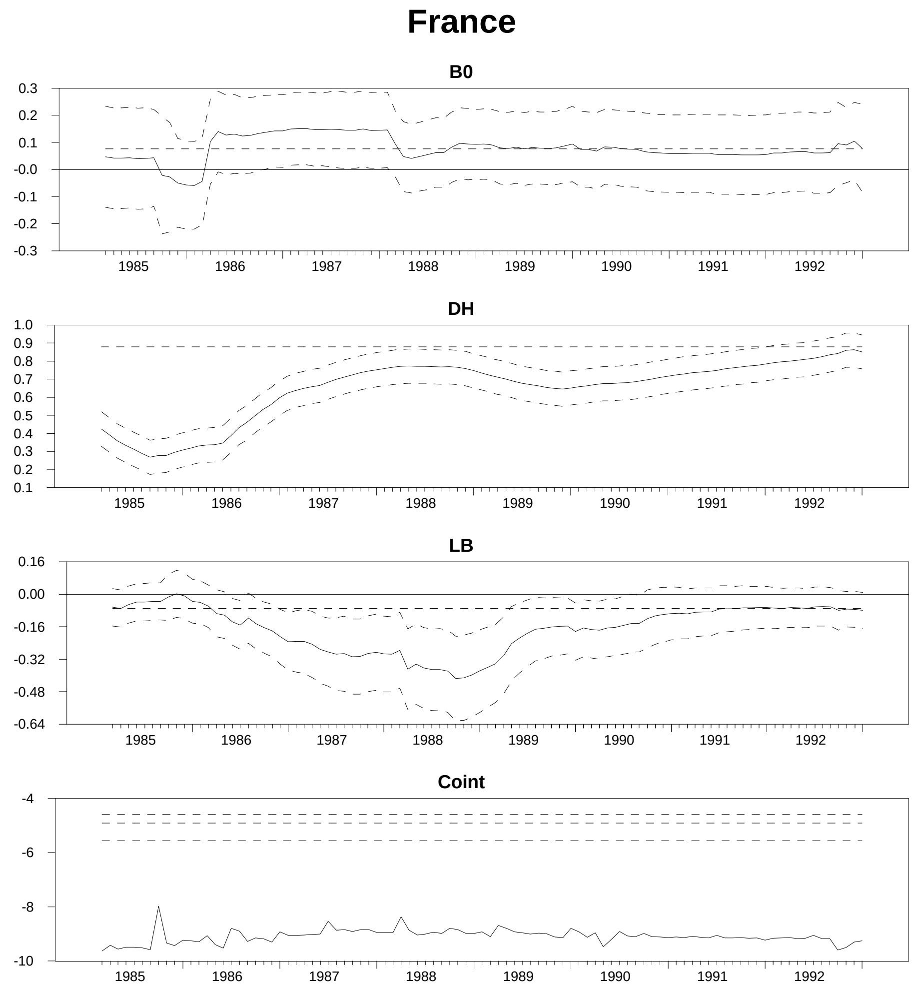
The horizontal dotted lines in the upper three figures show the estimated values for the full sample period. The lower graph - labelled "Coint" - shows the results of Engle-Granger cointegratoin tests. The three upper dotted lines in that graph depict the 1, 5, and 10 percent "exact" critical values from the response surface regression in MacKinnon (1991).

Figure 9: Parameters of the ECM model



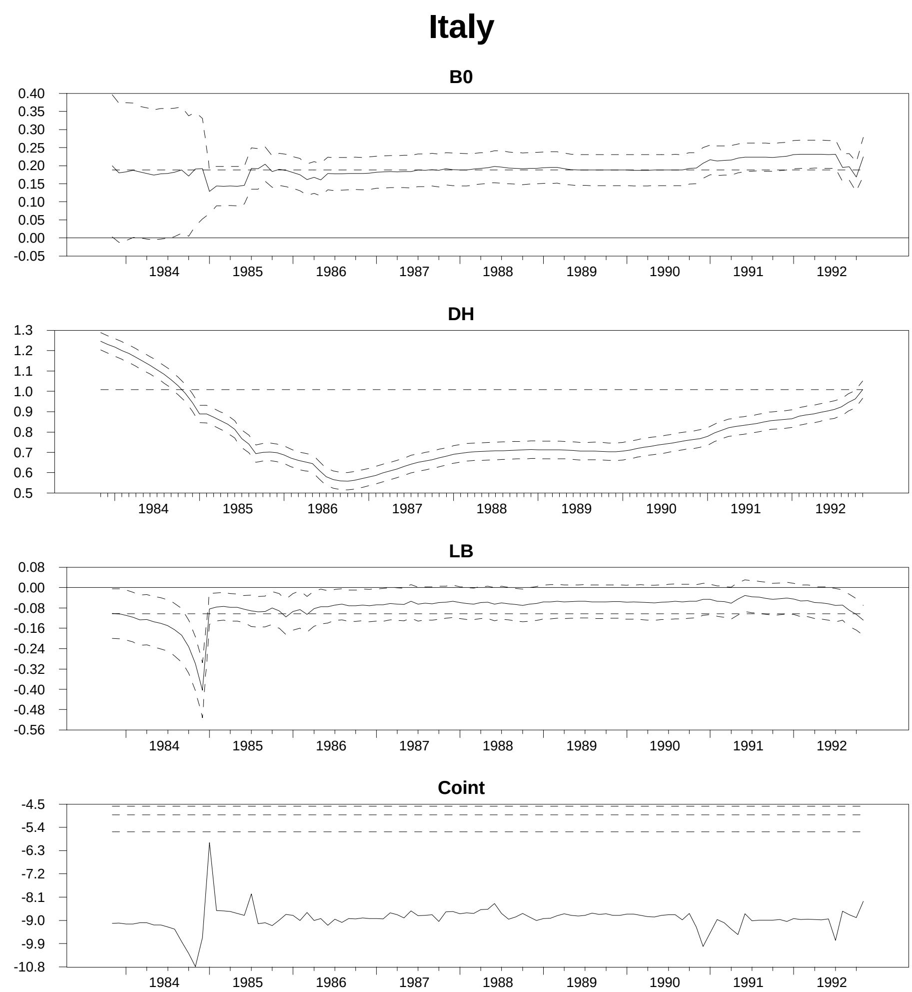
The horizontal dotted lines in the upper three figures show the estimated values for the full sample period. The lower graph - labelled "Coint" - shows the results of Engle-Granger cointegratoin tests. The three upper dotted lines in that graph depict the 1, 5, and 10 percent "exact" critical values from the response surface regression in MacKinnon (1991).

Figure 10: Parameters of the ECM model



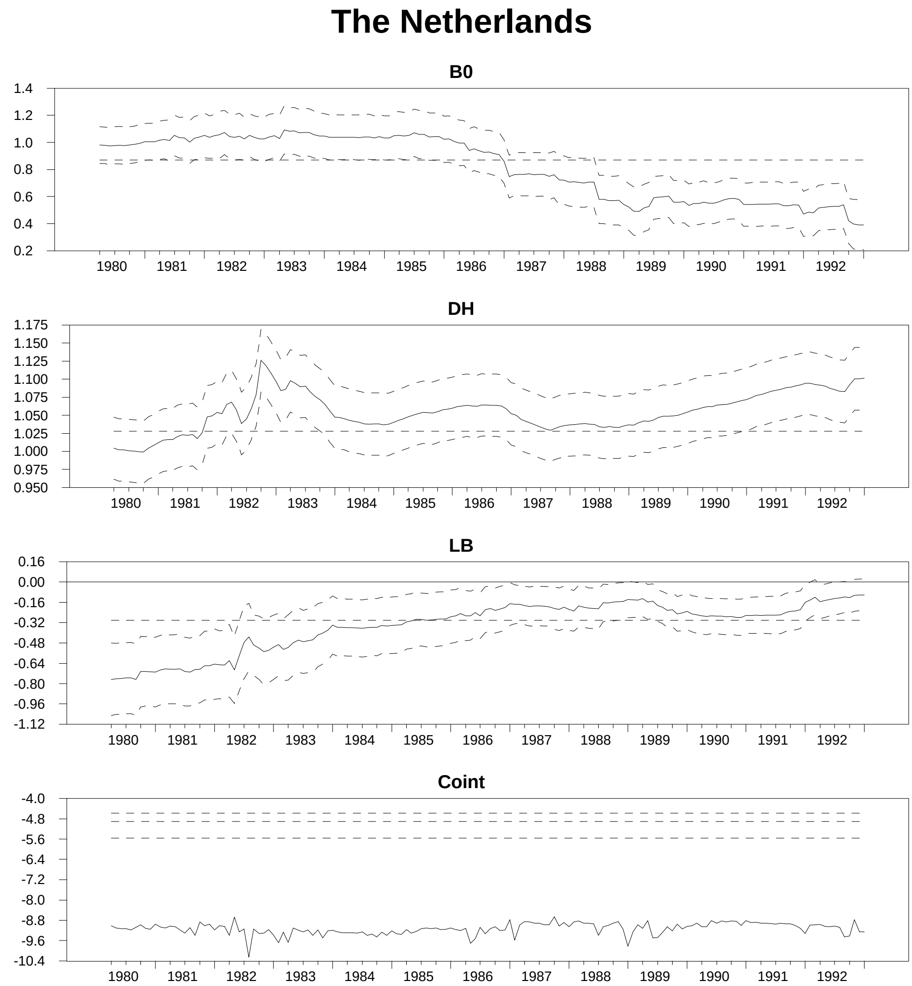
The horizontal dotted lines in the upper three figures show the estimated values for the full sample period. The lower graph - labelled "Coint" - shows the results of Engle-Granger cointegratoin tests. The three upper dotted lines in that graph depict the 1, 5, and 10 percent "exact" critical values from the response surface regression in MacKinnon (1991).

Figure 11: Parameters of the ECM model



The horizontal dotted lines in the upper three figures show the estimated values for the full sample period. The lower graph - labelled "Coint" - shows the results of Engle-Granger cointegratoin tests. The three upper dotted lines in that graph depict the 1, 5, and 10 percent "exact" critical values from the response surface regression in MacKinnon (1991).

Figure 12: Parameters of the ECM model



The horizontal dotted lines in the upper three figures show the estimated values for the full sample period. The lower graph - labelled "Coint" - shows the results of Engle-Granger cointegratoin tests. The three upper dotted lines in that graph depict the 1, 5, and 10 percent "exact" critical values from the response surface regression in MacKinnon (1991).