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To the extent that this is the case, the UK's eventual accession to EMU could have non-trivial consequences. However, based on unrestricted VAR models, various interest rate shocks are simulated and it is found that the differences in the transmission effects are relatively small.

While the importance of possible identification problems is stressed, the paper hypothesizes that the introduction of a common currency is likely to deepen capital markets and raise competition among credit intermediaries, resulting in a declining dependence on banks in Germany.

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August 2000

Abstract

This paper investigates the credit channel in Germany and the United Kingdom. The financial systems of these two countries show substantial structural differences, which leads one to expect that their real sectors respond differently to changes in monetary policy. To the extent that this is the case, the UK's eventual accession to EMU could have non-trivial consequences. However, based on unrestricted VAR models, various interest rate shocks are simulated and it is found that the differences in the transmission effects are relatively small. While the importance of possible identification problems is stressed, the paper hypothesizes that the introduction of a common currency is likely to deepen capital markets and raise competition among credit intermediaries, resulting in a declining dependence on banks in Germany.

Keywords: monetary policy, credit channel

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1. Introduction

Since the start of the European Monetary Union (EMU) in January 1999 eleven European countries pursue a single monetary policy with a common interest rate set by the European Central Bank (ECB). Charged with maintaining price stability in the common currency area, the ECB has based its monetary strategy on two pillars, namely monetary developments as indicated by the money stock M3 and future inflation. Arguably, this dual strategy was chosen in light of the tremendous uncertainties associated with the introduction of a single currency.

Since then, the ECB has taken a number of interest rate decisions to ensure that inflation remains under control, defined as a ceiling of 2 percent. However, the recent changes in the ECB's refinancing rate may affect real activity in individual member countries to different degrees, an issue, which has remained at the core of the policy debate. As several empirical studies have found, the monetary transmission mechanism in Europe showed substantial differences in the pre-EMU period, and it remains unclear whether these differences will soon disappear. Importantly, this will depend on structural changes in the euro zone, affecting the various channels through which monetary policy is transmitted to the real economy. One of these channels concerns bank credit, and the extent to which the intra-EMU differences diminish over time is likely to depend on the future integration of financial markets.

The challenges facing the ECB could increase if the rest of the European Union (i.e., Denmark, Greece, Sweden, and the United Kingdom) decided to join the EMU. This applies especially to the United Kingdom whose financial structure deviates substantially from the rest. With commercial banks traditionally playing a much smaller role compared with other countries in the euro zone, there is reason to believe that changes in monetary policy affect the British economy in a significantly different way. Obviously, this could have important implications for Britain's decision to join the EMU in the first place.

Whether the transmission mechanism in the UK is actually so different is the focus of this paper. Specifically, we examine the extent to which the effects of monetary

policy through the credit channel in the UK differed from the transmission mechanism in Germany, the largest EMU member, prior to the introduction of the euro. The rest of the paper is organized as follows: Section 2 focuses briefly on the theory of the credit channel and provides a short description of the German and British financial systems. Section 3 discusses the test approach. Section 4 presents the empirical results. Section 5 finally summarizes the main results and offers some brief conclusions, taking into account that EMU represents a major regime shift.

2. The Credit Channel and European Financial Markets

The way monetary policy decisions are transmitted to the real economy can take various forms. In the literature (e.g. Bernanke and Gertler (1995); Meltzer (1995); Mishkin (1995); Taylor (1995); and Bondt (1998)) at least four different channels are identified, namely the interest rate channel, the exchange rate channel, the channel of relative prices, and the credit channel. As regards the latter, two effects are generally distinguished, i.e., first, the impact of monetary policy on the loan supply of the banks (lending channel) and, second, its impact on the liquidity of the borrowers (balance sheet channel).

Working through the bank lending channel, a tightening of monetary policy is usually assumed to result in a decrease in bank reserves and to drain bank deposits from the banking system. Thus, banks are forced to readjust their portfolios by reducing their loan supply, given the imperfect substitutability between loans and other assets. An increase in the cost of funds to banks shifts the supply of loans inward and crowds out bank-dependent borrowers by raising the external finance premium.[1] Lenders are

1 A decrease in the supply of bank loans does not necessarily mean that bank dependent borrowers are completely excluded from credit. However, they may incur additional costs associated with establishing a credit relationship with a new lender (Bernanke and Gertler (1995)).

likely to ration the least creditworthy loan applicants or those borrowers whose creditworthiness is perceived to have declined (Bondt (1998, 1999)).[2]

The balance sheet of firms provides another channel through which monetary policy may affect real economic activity. More specifically, a tightening of monetary policy by raising interest rates reduces the firms' cash flow and thus causes their balance sheets to deteriorate. Apart from the negative demand shock the net cash flow of firms is further reduced if outstanding short-term or floating-rate debt exposes their balance sheets to increasing interest expenses. Furthermore, a rise in interest rates is often followed by a decline in asset prices, negatively affecting the value of loan collateral. Agency costs thus rise, reducing the availability of credit and amplifying the impact of the rate hike. Firms that have no access to credit markets may need to cut production and employment. In contrast, firms that do have access to commercial paper markets and other sources of short-term credit typically respond to a decline in cash flows by increasing their short-term borrowing (buffer stock effect) (Bernanke and Gertler (1995)).

The extent to which the credit channel has an impact on the economy is determined by the financial system, especially by the structure of the credit markets. The credit channel should have a smaller impact on those economies that have a deep and liquid capital market compared to economies where companies rely heavily on bank loans.

Traditionally, the German financial system is dominated by banks. Bank loans represent the major source of external financing, with financial flows channeled through credit institutions rather than through markets. On the other hand, the role of pension funds and other capital market institutions is comparatively underdeveloped (Schmidt (1999)). Relative to the size of the German economy public limited companies remain relatively unimportant, and the extent of market capitalization in terms of GDP continues to be significantly smaller than in the Anglo-Saxon countries (How-

2 However, it is disputed in the literature to what extent banks' credit supply is determined by refinancing conditions of the national central banks. See for example Romer and Romer (1990).

ells and Bain (1998)). The portfolio of households is thus dominated by bank instruments, with equities, held directly or indirectly, playing a relatively small part.

According to BIS data, securities accounted for only 6% of overall liabilities of non-financial enterprises in Germany in 1993 (Table 1). As a consequence, the firms' balance sheets showed a high level of bank finance followed by bond finance, while equity finance played a fairly minor role. Another important characteristic of the German system is that it allows for active participation of financial intermediaries in company supervision boards, which reduces the information asymmetry between borrowers and lenders. Furthermore, the relationship between banks and firms is frequently characterized by the so-called »Hausbank«: Companies establish a long-term relationship with a bank that provides most of the financial services and acts as a lead bank. Presumably, this bank is in a better position to assess the risk of its loans and can commit itself to supporting the firm with long-term loans at low interest rates. (Edwards and Fischer (1994)). At the same time, however, it is interesting to note that the share of collateralization in Germany is very high.

		Germany		UK	
		1993	1983	1993	1983
Liabilities of non-financial enterprises (in % of total)	Loans	94	98	81	97
	Securities	6	2	19	3
Loans from banks or OFI* by maturity (as a % of total credit)	Short-term	16	19	31	46
	medium- and long term	84	81	69	54
Collateralisation of loans (as a % of sector's lending)	Banks	very high	n.a.	32 (real estate)	n.a.
	OFI*	very high	n.a.	92 (real estate)	n.a.

* other financial institutes, Source: BIS (1995)

Table 1: Credit characteristics.

By contrast, the UK possesses probably the most developed, open, diverse and strongly market-oriented financial system within the European Union (Henderson (1993)). Compared to the countries that decided to join the EMU at inception the role of banks is less important, while capital markets play a key role in terms of overall financing. Securities represent a rela-tively large share of overall credit in the UK, and

the financial system relies to a considerably larger extent on market mechanisms. In contrast to Germany, banks in the UK are not permitted to develop ownership and control relationships with their corporate customers (Tsatsaronis (1995)). The UK banking sector has traditionally been highly segmented, and investment and commercial banking activities are strictly separated.

Furthermore, the UK differs from Germany with regard to the maturity of debt and the extent to which interest rates are adjustable. While the maturity structure affects the speed at which credit responds to changes in the interest rate, the marginal cost of funding is influenced by the variability of the short-term interest rate and the flexibility of the loan contracts. As Table 1 shows, 84 % of loans in Germany are medium- and long term compared with only 69% in the UK. The share of credit with adjustable interest rates is rather high in the UK, especially for households (Table 2). By contrast, the bulk of credit in Germany is at fixed rates.

		Germany	UK
Short term and adjustable medium and long-term	households	36	90
	businesses	40	48
Predominantly fixed	households	<64	10
	businesses	60	52

Note: Short-term is defined as credit with an original maturity of up to and including one year.
Source: BIS (1995)

Table 2: Credit at adjustable interest rates (breakdown by recipients in % of total in 1993).

Against this background, one should expect the credit channel in Germany to be comparatively stronger. Companies and households are to a large extent bank-dependent, and with the debt ratio being relatively high, rising interest rates should weaken the firms' and households' balance sheet positions and accelerate the effects of the monetary contraction. These effects could be reinforced by widespread collateral requirements. On the other hand, the relatively high share of medium and long-term loan contracts and fixed interest rates, an important characteristic of the »Hausbank« concept, could cushion the impact of the interest rate hike (Schmidt (1999)). In the UK, by contrast, the transmission of a monetary shock should occur relatively faster. Loan contracts have a shorter maturity, and interest rates are to a larger extent

adjustable. At the same time however, firms rely to a lesser extent on bank credit, suggesting that the impact of a change in monetary policy through the credit channel should be comparatively weaker.

3. The Test Approach

In line with similar studies, which examine the transmission mechanism of monetary policy, we employ an unrestricted Vector Autoregression model (VAR) in order to estimate the impulse response to a (negative) interest rate shock. As is well-known, this approach treats all variables as endogenous, with each equation having exactly the same set of regressors. A general VAR model is defined as follows:

$$X_t = \sum_{i=1}^{k} \mathrm{A}_i \mathrm{X}_{t-i} + \varepsilon_t \qquad (1)$$

where X_t is a column vector of observations at time t on all variables in the model. ε_t is a column vector of random disturbance values, which may be contemporaneously correlated with one another but are assumed not to be autocorrelated over time. A_i are matrices of parameters, which are non-zero (Lütkepohl (1991)). Since all regressors are lagged variables, they are assumed to be contemporaneously uncorrelated with the disturbance.[3]

A VAR can be specified in different ways if the time series under consideration are non-stationary. A VAR will generate efficient estimates but will ignore long-run relationships if it is specified in differences (Ramaswamy and Slok (1998)). By contrast, estimating the VAR in levels will induce no loss of information on the long-run

3 In practice, however, the disturbances in the VAR model are often contemporaneously correlated. Forcing the innovation of this variable to be zero by assuming that there is no correlation may give a misleading picture of the actual dynamic relationship between the variables. In order to solve this problem the model can be transformed through orthogonalization. However, orthogonalized residuals lead to impulse responses that are sensitive to the ordering of the variables. See, for example, Lütkepohl (1991) and Rudebusch (1996).

properties of the system but incur some loss of information due to the reduced efficiency of estimation (Bagliano and Favero (1998)).

The Johansen maximum likelihood procedure uses a vector error correction model with reduced rank estimation to test for cointegration and find potentially long-run equilibrium relationships among the variables.[4] More specifically, Johansen (1988, 1991) uses an autoregressive model as a starting point for the vector X_t, which includes the variables y_1 to y_p with each n observations and k lags.

$$X_t = \prod_1 X_{t-1} + \prod_2 X_{t-2} + ... + \prod_k X_{t-k} + \mu + \varepsilon_t \tag{2}$$

This model can be transformed into error correction form:

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + ... + \Gamma_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \mu + \varepsilon_t \tag{3}$$

with

$$\Gamma_i = -(I - \Pi_1 - ... - \Pi_i), \quad i = 1,..., k-1$$

$$\Pi = -(I - \Pi_1 - ... - \Pi_k)$$

The Johansen procedure tests for the rank of the Π matrix to determine whether there exist linear combinations of variables that are stationary. The left-hand side of the equation and the differenced terms on the right side are stationary and ΠX_{t-k} is a linear combination of I(1) variables if X_t is a vector of I(1) variables. Stationarity of ΠX_{t-k} depends on the rank of matrix Π. The variables can be cointegrated if 0<rank (Π)=r<p indicating that there are r linear combinations which are cointegrated.

Π can be decomposed into

$$\Pi = \alpha \cdot \beta'$$

so that the error correction form can be written as:

4 Variables are cointegrated if there exists a linear combination of the variables which is stationary although each variable is integrated. Generally, the variables in a K-dimensional process yt are cointegrated of order (d,b) if all components of yt are I(d) and there exists a linear combination cyt with c=(c1, ... ,ck) ≠0 which is I(d-b). See Lütkepohl (1991).

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + ... + \Gamma_{k-1} \Delta X_{t-k+1} + \alpha\beta' X_{t-k} + \mu + \varepsilon_t \qquad (4)$$

β is the cointegration matrix and the columns of β include r cointegrating relationships. Matrix α includes the error correction coefficient and determines the weight of cointegration relationships in the single equations.

According to the Johansen procedure, the coefficients in (4) are estimated by maximizing the likelihood (ML) function. The ML is solved for p eigenvalues. The corresponding eigenvectors are the rows in the β matrix, and the number of the true eigenvalues, which are $\neq 0$, is equal to the true rank of cointegration of the system. The identification of β requires at least r restrictions per each of the r cointegrating relations.

The existence of cointegration requires solving an important identification problem in order to evaluate correctly the effects of monetary policy: Policy actions which are endogenous responses to current developments in the economy must be separated from exogenous policy actions. Only if exogenous policy actions are correctly identified will the dynamic analysis of the VAR system give reliable inferences of the monetary transmission mechanism (Giovanetti, Marimon (1998)). The problem is that for r>1 strong restrictions are needed to derive reasonable results from the estimation procedure. Unfortunately, however, for the transmission of monetary policy through the credit channel such strong dynamic restrictions are not provided by economic theory. Therefore, we decided to estimate the model as an unrestricted VAR in levels and compare it with a VAR estimated on the basis of the Johansen procedure.[5]

5 Several empirical studies have preferred the specification of the VAR models in unrestricted levels. See for example Bagliano and Favero (1998), Ramaswamy and Slok (1998), Bernanke and Blinder (1988), and Leeper, Sims and Zha (1996).

4. Empirical Evidence

The interest rate, which best reflected the monetary authorities' benchmark rate in Germany before the introduction of the EMU, was the tender rate that applied to repurchase transactions (BIS (1995)). The rate on current account credit (DM 1 million) was taken as the most appropriate lending rate of banks. For the UK, the clearing banks' base rate, which sets the terms by which the banks' marginal demand for money is met, was chosen. The prime rate, which is the interest rate charged by commercial banks to their most creditworthy customers, was used as the lending rate. The estimations are based on the time period from 1989:2 to 1998:12 using monthly data, with a sample size of 119 observations. All data were obtained from the Datastream database.

Selecting the appropriate order of the Augmented Dickey Fuller test (ADF) on the basis of the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC), we found the lending rate and policy rate variables to be I(1) over the sample period for the UK. In the case of Germany, the time series also followed a stochastic trend (the lending rate series appeared at the borderline I(1)/I(2)).

For both countries we tested a two-variable VAR with a constant. As regards Germany, we also included two dummy variables to account for the reunification in 1990 and the crisis of the European Monetary System (EMS) in 1992. The SBC criteria and the log-likelihood ratio statistics (LL) suggested a VAR of order 3. To achieve satisfactory diagnostic test results two additional dummies for 1993 and 1996 were included and the sample size was reduced to 1991:1 to 1998:10. For the UK a VAR(2) was estimated, and a dummy for 1992 was included. Examining the residuals suggested including a dummy for 1990. In both cases we also tested for contemporaneous correlation of interest rate shocks and found that the orthogonalised and generalised impulse responses were not very different. The results are depicted in Figures 1a-b:

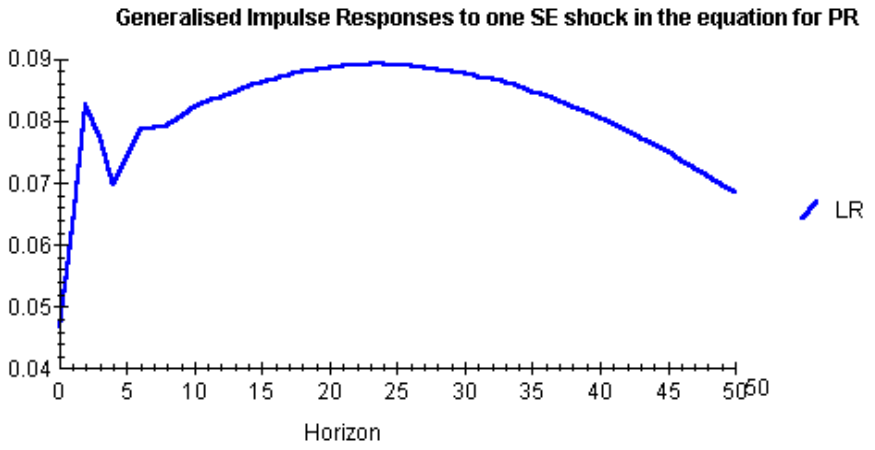


Figure 1a: Germany unrestricted VAR(3).

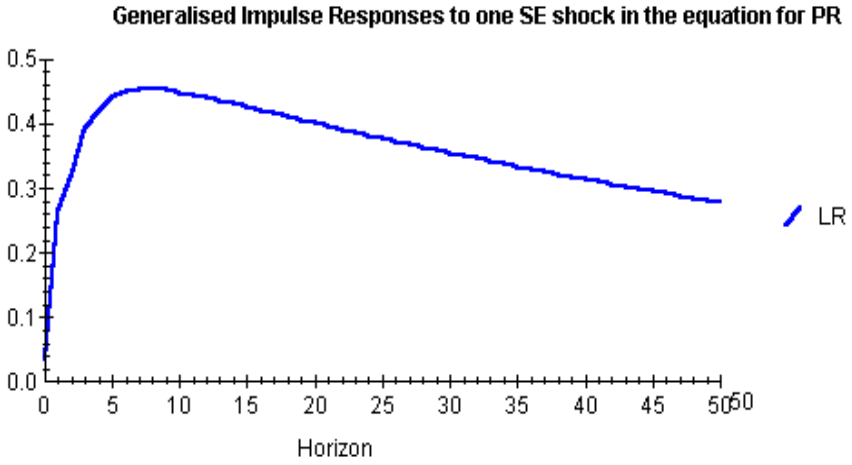


Figure 1b: UK unrestricted VAR(2).

The rise in the lending rate after an interest rate shock was found to peak after approximately 1-2 quarters in the UK. As expected, a rise in the official interest rate in Germany peaked significantly later, i.e. 2 years after the shock. Furthermore, the increase of the real lending rate was significantly smaller compared to the UK.

According to the Johansen procedure (unrestricted, intercept, no trend) [6] all vectors appeared to be cointegrated of order 1 (see appendix Tables A1 and A2).[7] Interestingly, the cointegrated VARs revealed a very similar pattern compared to the unrestricted models (Figures 2a-b).

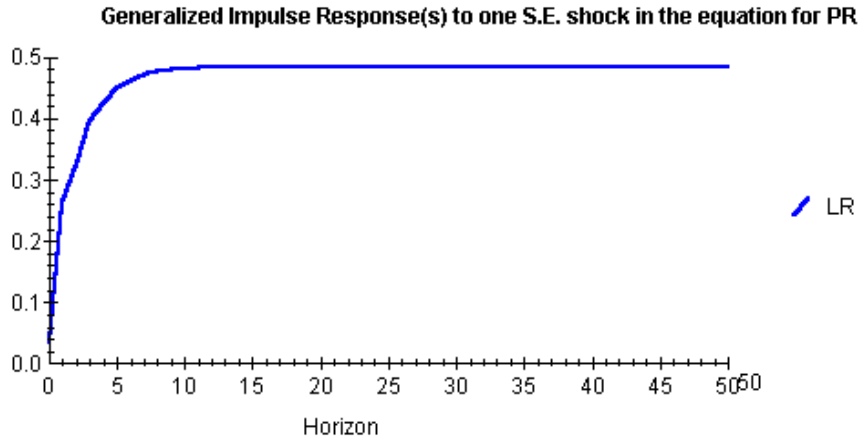


Figure 2a: UK cointegrated VAR(2), r=1, unrestricted, intercept, no trend.

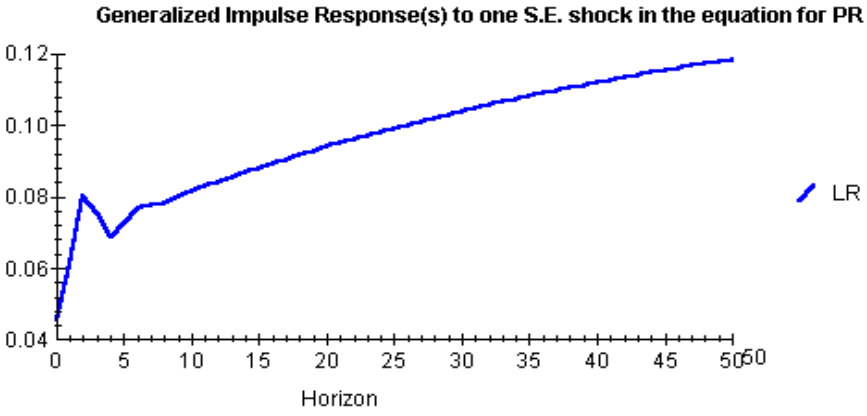


Figure 2b: Germany cointegrated VAR(3), r=1, unrestricted, intercept, no trend.

6 We included an intercept because we found the constant in all cases highly significant.

7 The model selection criteria selected for all cases a higher order. The complete agreement between the three procedures for selecting the number of cointegrating relations is very rare. See Peasaran and Peasaran (1997).

For the UK the long-run equilibrium suggested that the generalized impulse responses of the lending rate to a one-percent interest shock is approximately half a percent reached after 10-11 months, with the shock having a persistent effect. For Germany, however, the results implied that the lending rate reacts much more slowly to the shock and reaches only 0.08 percent after 10 months. These findings are consistent with our expectation that interest changes in the UK are directly transmitted into the lending sector whereas in Germany banks buffer and smooth the interest rate shock.

If companies can easily find alternative resources when interest rates are hiked, the real effects on output should be less pronounced compared to the case where companies are unable to raise capital in the commercial paper market. Thus, we were interested in the extent to which companies substitute bank credit for external funding after a monetary policy shock. Therefore, we estimated a VAR that included four endogenous variables: the policy rate (PR), the value of loans to industrial and commercial companies (LRLOAN), the net issue of commercial paper (LRNCI for UK and LRNIC for Germany) by industrial and commercial companies, and industrial production (LIPROD). The order of the variables was such that the policy rate was the first variable, assuming that it is the only one with a potential immediate effect on all other variables (i.e. at least with respect to lending and the issue of commercial paper). As the second variable we chose the loan rate. This selection appeared reasonable, given that the loan supply can be expected to contract following a monetary tightening, with the volume of alternative funding likely to rise. Finally, industrial production is likely to be affected only with a lag, hence real activity entered our model as the last variable.[8]

Changes in monetary accounting prevented us from using long time series for testing our hypothesis. This applied especially to the Bundesbank in the context of German reunification, so that we decided to focus only on the post-reunification period. Arguably, this period appears more interesting in light of the substantial

8 The ordering of the variables in the VAR is only important with respect to potential contemporaneous correlation. The ordering has to be such that the first variable is the only one with a potential immediate impact on all other variables. The second variable may have an immediate impact on the last K-2 variables and so on (Lütkepohl (1991)).

changes in the financial markets in Germany and in the UK in recent years.[9] German data on bank loans to companies were obtained from the Deutsche Bundesbank and from the Office of National Statistics for the UK. Data on the net issue of commercial paper (issued by non-banks) were taken from Datastream in the case of Germany, whereas for the UK data were provided by the Office of National Statistics.[10] Datastream also provided data on industrial production for the two countries. Quarterly data were transformed into monthly data,[11] and all time series, except the policy rate, were deflated and seasonally adjusted, entering the model in logs.

All variables were found to be I(1), except industrial production in the UK (borderline I(0)/I(1)) and LRNIC for Germany (I(0)). However, when the order of the test was increased the test statistic did not exceed the critical value so we decided to consider LRNIC to be I(1). For the UK we estimated a VAR(4).[12] We found all diagnostic tests for the single equations satisfactory, apart from the equation of LRLOAN, which showed that the residuals were not normally distributed due to a substantial outlier in mid-1997 for which a dummy variable was included. The dummy and the constant proved to be significant. We then tested for contemporaneous correlation and found that the variance matrix of the errors in the VAR models was not diagonal.

As shown in Figures 3a-c, bank loans to industrial and commercial companies in the UK appear to rise after four months, peaking about 16 months after the shock. After 31 months corporate borrowing falls below baseline. The initial increase probably reflects the buffer stock effect, according to which companies require bank loans to finance inventories.[13] After a short rise in output the interest shock affects industrial production with a lag of approximately four months. Real activity declines,

9 For Germany estimations were performed for the time period 1991:7 to 1998:12 whereas for the UK the period from 1992:1 to 1998:12 was considered.

10 In the case of the UK, the net issue by the non-financial corporate sector was computed as total ordinary shares issued by UK industrial and commercial companies minus convertible shares minus other shares.

11 The adjustment was made for each country's industrial production index, the GDP deflator, and in the case of the UK, also company lending and lending to residents.

12 Although the model selection criteria suggested a lower lag order, satisfactory results for the LM-test were achieved with a lag order of 4.

13 Another possible response is to liquidate assets, that is, reduce bank deposits.

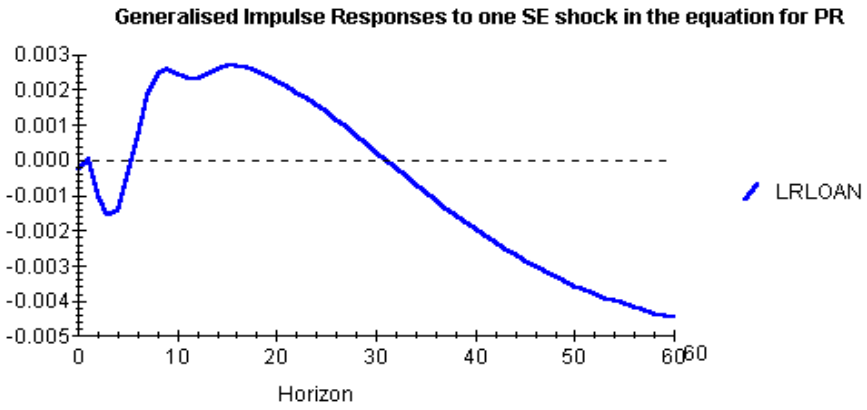
bottoms out and after four to five quarters it tapers off slowly.[14] Although the condition of long-run money neutrality was not imposed, the response of industrial production seems to be zero in the very long run. When the dampening effect on industrial production is close to its peak bank loans begin to fall and bottom out only about 5 years after the shock.

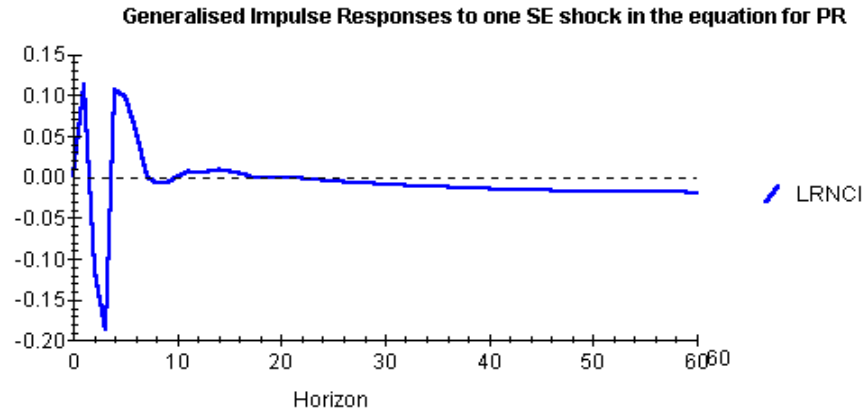
The net issue of commercial paper revealed a highly volatile pattern shortly after the interest rate shock. However, it remained difficult to identify the cause of the volatility. Experimenting with different models did not change the volatility pattern, and our diagnostic tests did not indicate any structural breaks. After three months the amount of commercial paper was found to rise by 0.1 percent from baseline, declining after seven months without returning to the baseline even in the very long run (150 months). Thus, compared with bank loans, which were estimated to increase only by 0.003 from baseline, the impulse for securitized instruments appeared significantly larger. However, with industrial production negatively affected, investment appeared to decrease, reducing the need for firms to raise funds.

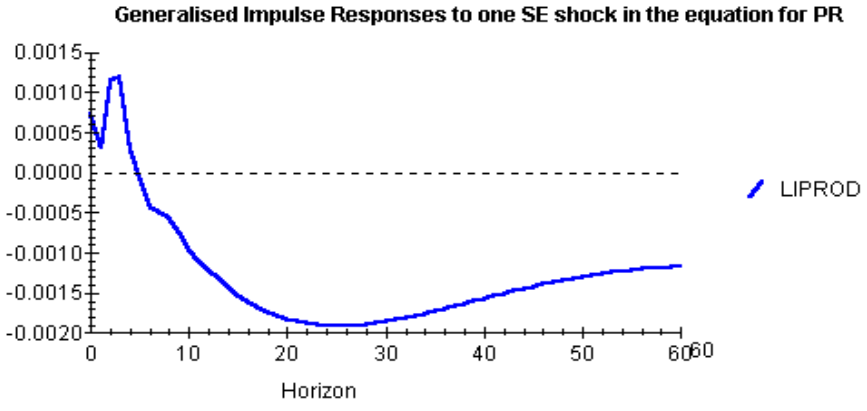
The plots of the long-run equilibrium with two cointegrating vectors (according to the maximal eigenvalue test and the test based on trace of the stochastic matrix) revealed different results (see appendix, Table A3). The »perverse« response of bank loans was much more persistent compared to the unrestricted VAR model. Also, the rise in loans was considerably more pronounced (about 0.01 to baseline). The commercial paper response was estimated to start at a level of 0.05, followed by a very sharp decline and a subsequent increase after three months - like in the unrestricted VAR model. However, after a rise to 0.1 loans were found to return to the 0.05 level, which appeared the equilibrium level.

As far as Germany is concerned, we estimated an unrestricted VAR(2) model and included a dummy for 1995 in order to achieve normally distributed residuals in the loan equation. In contrast to the UK, however, we did not observe a buffer stock effect (Figures 4-5). Rather, bank loans appeared to contract immediately after the

14 This result is consistent with the findings of Dale and Haldane (1995).





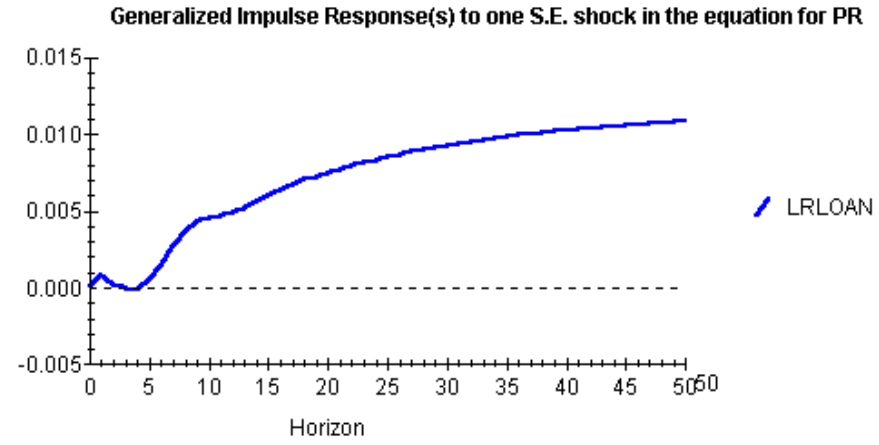


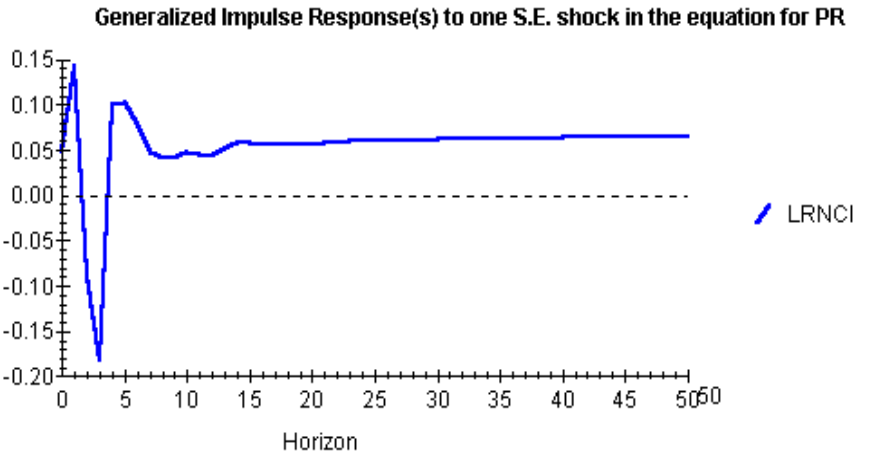
Figures 3a-c: UK unrestricted VAR(4).

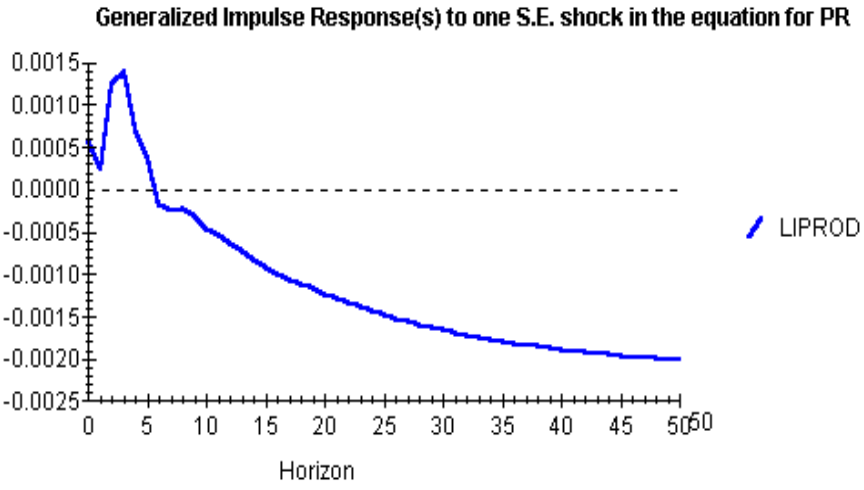
shock and bottom out about 50 months after the shock. The volatile pattern of the commercial papers during the first few months after the shocks resembled the profile we observed for the UK, although the impact was not as large as in the latter. According to our findings, a shift in the companies' portfolios from bank loans to commercial paper seems to take place only after a period of more than two years after the shock. This might not be very surprising, taking into account that in Germany a substantial share of loan contracts is medium- and long-term. Real activity was found to fall immediately, bottoming out after 36 months. However, the shock seemed to have a persistent effect, given that the variables did not appear to have returned to the baseline even after 150 months.

The cointegrated VAR showed a very different picture, however. According to our empirical results, commercial loans do not fall but rise slightly. Moreover, industrial production was estimated to remain almost unaffected, and commercial paper remained on a relatively high level after a short and highly volatile period (see appendix, Table A4).

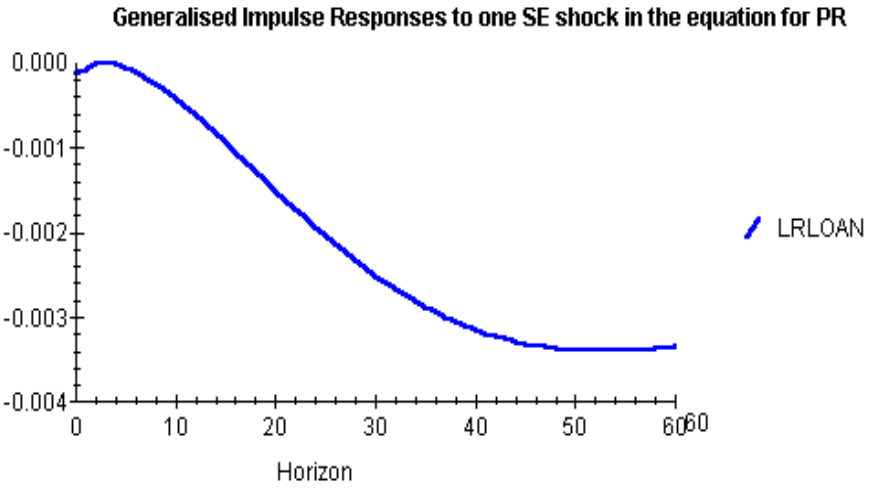
In summary, the dynamic response of the activity variable was found to ensure that a negative monetary shock leads to a fall in output, with the dampening effect bottoming out with a lag of roughly two years in the UK and two and a half years in Germany. Whereas industrial production in the UK goes below baseline already after three months, the shock appeared to have a negative impact on German output only after 12 months. For the UK we found evidence for a buffer stock effect in the corporation sector. Following a decline in demand through the interest rate channel manufacturing firms increase their demand for bank loans to finance inventories and other obligations. However, there was no such evidence in the case of Germany, which could be due to the fact that German companies are allowed to a comparatively greater extent to build up hidden reserves, which can be liquidated in times of cash-flow shortfalls. While our results for Germany indicated a shift in companies' funding towards commercial paper, our findings for the UK were less clear. The unrestricted VAR model showed a decline of commercial paper approximately after 20

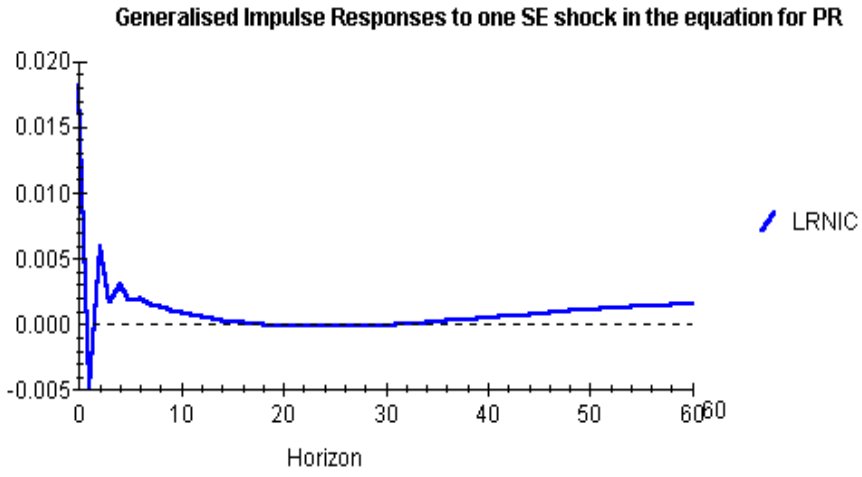


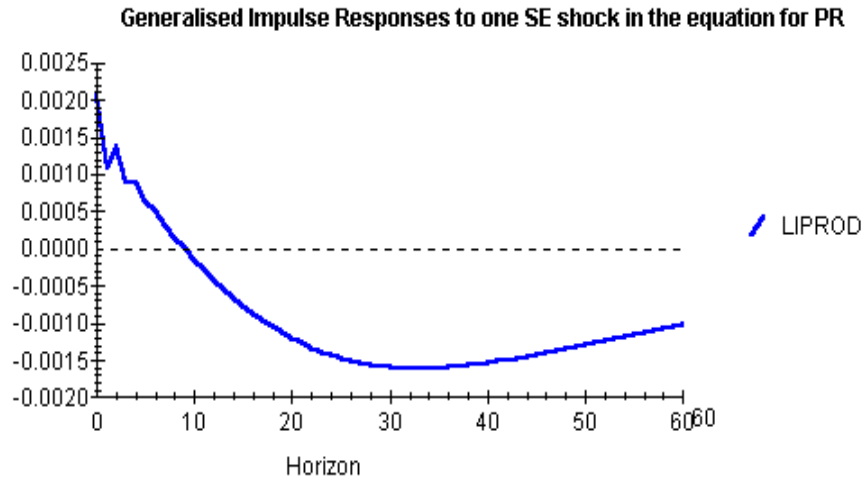


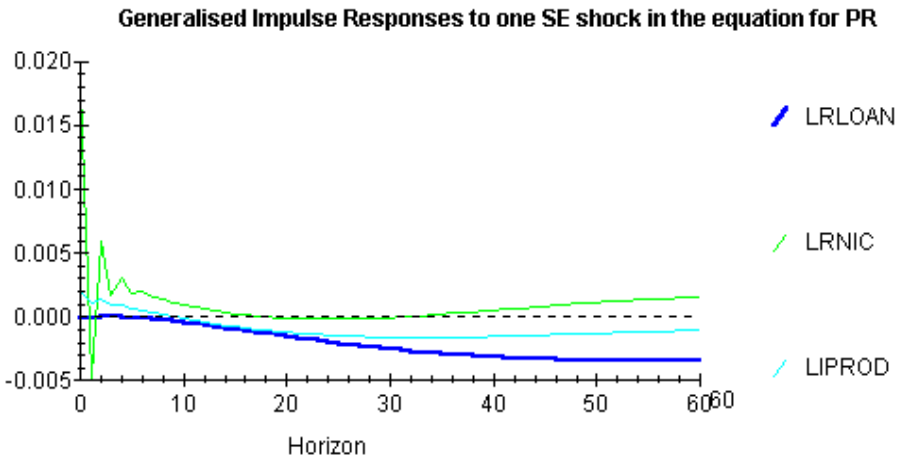


Figures 4a-c: UK cointegrated VAR(4), r=2.


Generalised Impulse Responses to one SE shock in the equation for PR
0.000
-0.001
-0.002
-0.003
-0.004
0
10
20
30
40
50
60
60
Horizon
LRLOAN


Generalised Impulse Responses to one SE shock in the equation for PR
0.020
0.015
0.010
0.005
0.000
-0.005
0
10
20
30
40
50
60
60
Horizon
LRNIC


Generalised Impulse Responses to one SE shock in the equation for PR
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
-0.0005
-0.0010
-0.0015
-0.0020
0
10
20
30
40
50
60
60
Horizon
LIPROD



Figures 5a-d: Germany unrestricted VAR(2).

months; the long-run solution, however, suggested that the issue of commercial paper remained relatively high. Focusing on total loans did not materially change the results, although the overall response to the shock appeared somewhat less pronounced, suggesting that the response of company sector was larger than that of the household sector.

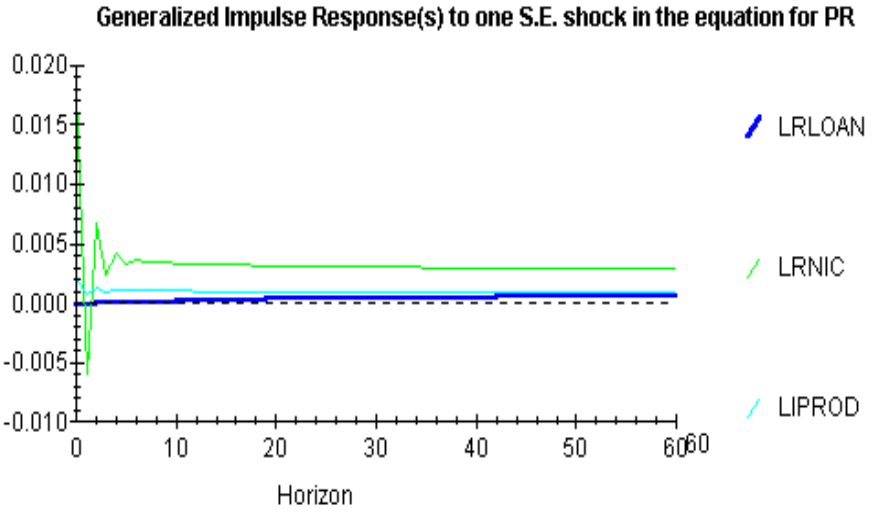


Figure 6: Germany: Cointegrated VAR(2), r=2.

5. Conclusions

Emphasizing the differences between the financial structures of Germany and the UK, this paper has examined the extent to which the real sector in the two countries responded differently to a tightening of monetary policy in the pre-EMU period. In so doing, it has focused on the credit channel theory, hypothesizing that the impact of a monetary shock should be relatively smaller in the UK, with British companies being relatively less bank-dependent. In testing this hypothesis, we studied the response of bank balance-sheet variables to a monetary shock both in small unrestricted and in cointegrated VAR models.

The unrestricted and cointegrated VARs produced – apart from the lending rate approach – different and partly contradicting results. One possible explanation could be that we imposed only statistical but not economi-cally inferred restrictions to identify the cointegrating model. From an economic viewpoint, the results of the unrestricted VAR appear more reasonable and suggest the following:

The overall effect on loans to the company sector and real activity in Germany seems to be not significantly different from that in the UK. There is some indication that although the financial structure in the two countries is quite diverse, the net response is similar. In the case of Germany, a hike in official interest rates does not appear to trigger a large shift in company funding from bank lending towards commercial paper, and the impact on bank lending was found to be relatively small. This observation might be explained by a slow adjustment in interest rates, indicating that German banks tend to be more hesitant to tighten credit vis-à-vis their clients. In addition, credit contracts in Germany have a longer maturity and are less adjustable which makes it more difficult for the financial sector to pass on higher interest rates. By contrast, a rise in official interest rates in the UK is almost immediately passed on to clients. However, we were unable to identify a substitution effect, with bank loans being replaced by commercial paper.

The introduction of the EMU will not leave the national financial systems of the member states unaffected, however. Generally, it is expected that »the introduction

of a single monetary policy will determine the establishment of a deep, liquid and standardised European money market and thus an increase of competition in this area« (ECB, 1999). This should encourage the issue of commercial paper and other securities by non-financial corporations. With the development of European continental capital markets, however, firms are expected to reduce their banking relations. This suggests that the credit channel will have a smaller impact in countries like Germany where corporate funding comes mainly from banks. On the other hand, increasing competition on financial markets could mean that in the long run the buffer function of the German banking system will not be maintained. Rather, one should expect the German »Hausbank« system to lose in significance. As a matter of course, the convergence of financial systems in the euro zone will happen only very gradually. But according to the empirical evidence presented in this paper this should not be a problem for a single monetary policy under the EMU.

Appendix

		Maximum Eigenvalue Test			Trace Test		
H0: rank=r	HA: rank=r	Statistic	95% Critical Value	90% Critical Value	Statistic	95% Critical Value	90% Critical Value
r = 0	r >= 1*	100.60	14.88	12.98	101.3	17.86	15.75
r <= 0	r = 2	0.71	8.07	6.5	0.71	8.07	6.5
Model Selection Criteria							
	Maximised LL		AIC		SBC		
r = 0	42.67		32.67		18.77		
r = 1	92.97		79.97		61.9		
r = 2	93.37		79.32		59.87		

* for the Maximum Eigenvalue Test r = 1

Table A1: Cointegration Analyses: Johansen results for the UK.

		Maximum Eigenvalue Test			Trace Test		
H0: rank=r	HA: rank=r	Statistic	95% Critical Value	90% Critical Value	Statistic	95% Critical Value	90% Critical Value
r = 0	r >= 1*	18.22	14.88	12.98	19.57	17.86	15.75
r <= 1	r = 2	1.35	8.07	6.5	1.35	8.07	6.5
Model Selection Criteria							
	Maximised LL		AIC		SBC		
r = 0	110.81		94.81		75.55		
r = 1	119.92		100.92		78.05		
r = 2	120.59		100.59		76.53		

* for the Trace Test r > 1

Table A2: Cointegration Analyses: Johansen results for Germany.

		Maximum Eigenvalue Test			Trace Test		
H0: rank=r	HA: rank=r	Statistic	95% Critical Value	90% Critical Value	Statistic	95% Critical Value	90% Critical Value
r = 0	r >= 1*	44.90	27.42	24.99	84.03	48.88	45.7
r <= 1	r = 2*	26.12	21.12	19.02	39.12	31.54	28.78
r <= 2	r = 3*	12.69	14.88	12.98	13	17.86	15.75
r <= 3	r = 4	0.30	8.07	6.5	0.3	8.07	6.5
Model Selection Criteria							
	Maximised LL		AIC		SBC		
r = 0	498.25		438.25		36.79		
r = 1	520.71		453.71		373.91		
r = 2	533.77		461.77		376.02		
r = 3	540.12		465.12		375.79		
r = 4	540.27		464.27		373.75		

* the Trace Test r > =

Table A3: Cointegration Analyses: Johansen results for the UK.

		Maximum Eigenvalue Test			Trace Test		
H0: rank=r	HA: rank=r	Statistic	95% Critical Value	90% Critical Value	Statistic	95% Critical Value	90% Critical Value
r = 0	r >= 1*	52.67	27.42	24.99	77.18	48.88	45.7
r <= 1	r = 2*	23.14	21.12	19.02	24.5	31.54	28.78
r <= 2	r = 3*	1.35	14.88	12.98	1.36	17.86	15.75
r <= 3	r = 4	0.00	8.07	6.5	0	8.07	6.5
Model Selection Criteria							
	Maximised LL		AIC		SBC		
r = 0	745.32		677.32		593.09		
r = 1	771.66		696.66		603.76		
r = 2	783.23		703.23		604.14		
r = 3	783.91		700.91		598.1		
r = 4	783.92		699.91		595.86		

* the Trace Test r > =

Table A4: Cointegration Analyses: Johansen results for Germany.

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