Zentrum für Europäische Integrationsforschung
Center for European Integration Studies
Rheinische Friedrich-Wilhelms-Universität Bonn

Working Paper

Bernd Hayo

Money-Output Granger Causality Revisited: An Empirical Analysis of EU Countries

B98-08
1998

Money-Output Granger Causality Revisited:

An Empirical Analysis of EU Countries

Bernd Hayo*

ZEI

University of Bonn

Walter-Flex-Str. 3

53113 Bonn

Germany

Tel. +49 (0)228/73-1878

Fax +49 (0)228/73-1809

e-mail: hayo@sfbb4.econ1.uni-bonn.de

* Thanks to an anonymous referee, Dale Henderson, Matthias Göcke, Bernd Kempa, and to the participants of the Economic Seminars at the Universities of Bamberg and Münster for helpful comments. All remaining shortcomings are the responsibility of the author.

Money-Output Granger Causality Revisited:

An Empirical Analysis of EU Countries

Abstract

In this paper, the evidence collected in the large literature on testing for Granger-causality from money to output is revisited. Using a broad data base of 14 EU-countries plus Canada, the US and Japan, and quarterly data from the mid 60s to the mid 90s, a number of hypotheses from this literature is evaluated. It is found that very few general conclusions can be sustained. For instance, in most countries it is not the case that the use of data in levels creates a bias in favour of finding Granger-causality effects of money on output compared to using differences. Neither does the significance of money lags decline when increasing the number of variables included in the model. What appears to be robust, though, is that allowing for asymmetries clearly increases the likelihood of finding significant causality effects. Based on the Granger-causality test results, a number of country groups are obtained using cluster analysis, which are characterised by a similar behaviour with respect to the money-output relation.

Keywords: Money-Output Causality, Granger Causality, EU countries

JEL: E40, E50

1 . Introduction

The question whether money causes output appears to be important for many economists working in the area of macroeconomics. One often applied method to investigate the empirical relationship between money and real activity is Granger-causality analysis (Granger (1969)). Using this approach, the causality question can be sharply posed as whether past values of money help to predict current values of output. This concept, however, should be clearly distinguished from any richer philosophical notion of causality (cf. Holland (1986)).

There exists a voluminous literature on Granger-causality tests, selectively reviewed below. The first thing a student of this literature notices regarding the scope of most articles is that the Granger-causality tests were mainly applied to US data. While concentrating on the US, the studies vary with respect to the specification of the tests, the variables and the sample period. It should be clear that for testing a theory claiming to describe economic reality in industrialised market economies one ought to be more prudent than to rely on the experience from only one country (see also Pikkarainen and Virén (1989)).

This study seeks to fill the gap in the literature by attempting to systematically explore the question of Granger-causality using a much broader data base and a collection of different modelling specifications. In this paper data from 17 industrial countries are used. The core of this selection is made up of European countries, with Canada, Japan and the US representing non-European economies. Concentrating on these cases allows the use of quarterly data for a relatively long time span (mid 1960s to mid 1990s) and of a broad country data base at the same time.

While data availability and quality is one great advantage of employing data on Europe, there is an important additional issue which deserves mentioning. With great probability, most countries of the European Union will join together in 1999 to form a monetary union (EMU). For this reason, a new central bank will be shaped - the European Central Bank (ECB) - which will then conduct monetary policy for EMU. Although the prime responsibility of the ECB shall be to ensure price stability, there will be some leeway for setting the money supply reflecting other objectives, like output and employment, as well. But then it would be very helpful if the effect of money on output - if there is one at all - could be more precisely described. Even if it turned out that no clear Granger-causality effects can be found, it may be interesting to see whether there exist certain groups of national economies displaying a similar behaviour with respect to changes in the money stock or the money growth rate. A caveat of this type of analysis is its vulnerability to the Lucas critique, as the formation of EMU may erase most of the informational content of historical data. On the other hand, many EU countries do not appear to show a very fast adjustment to structural changes and thus there are good grounds to believe that at least during the start-up phase of EMU old national patterns will continue to be important.

In the remaining part of this paper, I will select important studies from the literature on money-output Granger-causality, interpret their main findings as a general hypothesis and put these to the test. Along these lines, five stylised facts of the literature are extracted in section two, and section three gives an overview of the data base and the econometric approach. In the fourth section, new Granger-causality tests for 17 countries are reported and their outcomes are shown. With the help of these results, the five stylised facts from the literature are then evaluated. In section five, an attempt is made to group countries using a cluster analysis according to the results of the aforementioned tests. Finally, a short conclusion is put forward.

2 . Reviewing some Stylised Facts of Money-Income Granger-Causality Tests

The literature on money-income causality testing is far too voluminous to be reviewed here in any detail and I will refrain from doing so. Additional references can be obtained from the articles cited below. Instead, I will combine the results of a number of important studies to generate five hypotheses on the existence, strength and type of Granger-causality between money and output.

The seminal contribution to this topic is Sims (1972). Based on his early study we can formulate the following hypothesis:

H1: In a model with only two variables, money Granger-causes output.

In a later study, Sims (1980) analysed the question in a vector autoregression (VAR) employing additional variables (prices and interest rates). He found:

H2: The statistical significance of the effect of money on output will be lower when including other variables in a multivariate test.

King and Plosser (1984) argue that the strong influence of broader monetary aggregates is due to reverse causality, with the money supply reacting to an increase in output. They demonstrate that narrow money (especially central bank money) has a weaker effect on real activity. We can derive the following testable proposition:

H3: The use of narrow money is less likely to support Granger-causality from money to output than broad money.

In a paper by Christiano and Ljungquist (1988) it is shown that the results of Granger-causality tests are dependent upon the use of (log-) level variables or growth rates. However, they argue in favour of using level variables, since they find in a simulation study that the power of the tests on growth variables is very low, and thus there is the danger of making a false inference. Stock and Watson (1989) propose that the problem lies in the handling of the trend behaviour of the money variables. They show that by removing the trend from the monetary variable and including the residual in the Granger-causality framework, it is possible to restore the influence of money on output which seemed to have broken down when extending the sample to include the 1980s. Finally, in a recent study by Hafer and Kutan (1997), the trend removal suggested by Stock and Watson (1989) is rejected. Instead, they claim that the instability of results in Granger-causality test simply depends on the question whether the variables are modelled as trend- or difference stationary. If the modelling takes place assuming that the variables are trend stationary, money is typically found to be Granger-causing output in the US. The reverse result holds for the assumption that the variables are difference stationary. The main results of these studies can be synthesised into the following hypothesis:

H4: Assuming that variables are trend stationary and modelling them in (log-) levels with a deterministic trend is more likely to lead to significant test results than assuming difference stationarity and employing growth rates.

Thoma (1994) argues that there are reasons to believe that the effect of money on output is conditional on the direction of the impulse, i.e. an increase in money growth may affect output differently than a decrease. Moreover, he shows for monthly data on M1 that the state of the business cycle has considerable influence on the results. When real activity declines, the effect of money on output becomes stronger, while the opposite takes place during a recovery.

H5: Allowing for asymmetric effects of money on output growth and including the state of the business cycle greatly influences results and strengthens the causal effect of money.

In the next section, the approach employed for testing these hypotheses is explained in some more detail.

3 . Econometric Procedure and Data Base

The basic principle of Granger-causality analysis (see Granger (1969)) is to test whether past values of a monetary aggregate help to explain current values of output. There are different types of these tests:

Simple Granger-causality tests operate in a single equation with two variables and their lags (autoregressive-distributed lag models). It is tested whether the lags of the lagged money variables are equal to zero. If this hypothesis can be rejected, it is said that money causes output.

Multivariate causality tests include more variables beside money and output in the equation. The principle remains the same, except that now the influence of other variables can affect the test results. For instance, it may be that an effect on output does in fact run via the interest rate. In a two-variable test without an interest rate variable this effect might erroneously be allocated to money.

Finally, there are Granger-causality tests taking place in a vector autoregression (VAR). Here the multivariate model will be extended to allow for the simultaneity of all included variables. The test of the lags of the money variables takes place in the output equation only. The empirical results presented in this paper are all calculated within a VAR-model. However, the number of variables included in the model varies from two (money and output) to four (money, output, prices and interest rates).

The five hypotheses listed in the preceding section will be tested using a data base consisting of 14 EU-countries plus Canada, Japan and the US, with quarterly observations from the mid 1960s to mid 1990s (see the Appendix for more information on the data base). The choice of some of the variables is partially dictated by data availability over this time span.

The following variables are being used in this study (all in logarithms except interest rates):

- Real GDP (Y),
- Narrow Money (M),
- Broad Money (MQ),
- Interest Rate (R),
- Consumer Price Index (P).

The variable employed as a proxy for output is real GDP. This is seen as being superior to industrial production, since the share of the industrial sector in the overall value-added of the industrial economies is declining. The consumer price index over all goods has been chosen as a deflator. For most countries narrow money is defined as M1 and broad money as M3. As an interest rate, a long-term government bond rate is included where available. There are two main reasons for this choice: First, the data for long-term government bond yields are defined more consistently for different countries and are available over longer-time periods. Second, long-term interest rates can be seen as reflecting future short-term rates. Thereby it is possible to include expectational effects as well.

Here the analysis of Granger-causality concentrates on testing the lagged coefficients of money variables in the output equation within a VAR-model. No evidence regarding impulse-response functions or variance decompositions is considered, as these approaches are not valid, except in the two-variable case, for assessing the existence of Granger-causality (see Dufour and Tessier (1993)).

In a first step, a two-variable VAR is estimated containing only money and output. In a second step, a three-variable system with the price level added is estimated. Finally, in a third step the interest rate is included too. The Granger-causality tests in all these models are calculated as F-type tests on the lags of the money variables in the real GDP equation. Clearly, these steps are necessary to assess the validity of **H1** and **H2**. To allow for an evaluation of **H3**, these procedures are alternatively computed for narrow and broad money variables.

H4 can be tested by comparing the results of the Granger-causality tests using variables in (log-) levels and growth rates. In the VAR in levels a deterministic trend is added to every one of the equations. As it turns out, in most cases the trend does not appear to make any difference to the test results, which supports the finding by Krol and Ohanian (1990) that the trend removing procedure suggested by Stock and Watson (1989) is not very helpful when applied to other countries. The deterministic trend variable has not been removed in the testing down process even if it was not significant. All estimated models contain seasonal dummy variables.

Before coming to the actual estimation, it is prudent to take a look at the time series characteristics of the variables. A model in levels with integrated variables can display serious distortions in the test statistics and the Granger-causality tests become even theoretically invalid. Applying unit root tests to the series (see Appendix Table A1) leads us to conclude that most of the variables are integrated of order one.

However, there are a number of exceptions to this result. Especially with respect to the price level there exists considerable evidence that it may be integrated of order two. Strictly following these tests would imply mixing growth rates and level variables in many models. But under these circumstances, using both level and growth variables in the models makes the economic interpretation extremely cumbersome. Moreover, the power of most statistical tests and estimation procedures dealing with difference-stationary variables is greatly reduced in small samples (see for instance Banerjee et al. (1993)). Therefore one should not put too much emphasis on the results of these tests. This is an additional reason why no attempt has been made to estimate models containing both level and growth rate variables.

On the other hand, the estimate of models in levels is only acceptable from a statistical point of view if the variables are cointegrated. Table A2 in the Appendix summarises the cointegration tests on different combinations of the variables. While there do exist some cases where there is an indication of cointegration even in the case of only money and output, it is usually for the four-variable system that cointegration is found in almost all countries for both narrow and broad money variables. Consequently, special caution should be exercised in the interpretation of the two-variable and three-variable causality tests with variables in levels.

Another important issue is the lag length selection of the VAR. As shown for example by Thornton and Batten (1985), the choice of a specific lag length can have a significant influence on the test results. Unfortunately, there does not exist a generally best method for choosing the lag length. The approach taken here is the following: In a first step, a VAR with eight lags in levels or seven lags in differences is estimated. Then it is checked with an LM-test whether the residuals of the equations contain autocorrelation. If no trace of serial correlation can be found, the number of lags is reduced according to a Hendry-type testing down procedure (e.g. Hendry (1993)), with a nominal significance level of 5%. Within this reduced VAR system the Granger-causality tests then take place. If it should turn out that there is autocorrelation, the lag length is increased to twelve or eleven respectively, and then the testing down process starts. When there is still serial autocorrelation in the residuals, another four lags are added before testing down, and so forth.

Next, the outlined five hypotheses are put to the test employing data from Europe and the U.S., Canada and Japan as an external reference group.

4 . Testing the Hypothesis Using Data for 17 Countries

To avoid an overload of information in the tables, no numerical figures are given.[1] Starting with narrow money, the results of the Granger-causality tests are given in Table 1. In the left half of the table, the tests for causality running from money to output are summarised (marked as $M \rightarrow Y$). The results for the bivariate framework are given in columns two and three. In column two, tests on the (log-) level VAR are presented, and in column three tests conducted within a system with differenced variables are reported.

[1] All the omitted information is available upon request.

Tab. 1: Granger-causality tests for *narrow* money

	M → Y						Y → M					
	M,Y		M,Y,P		M,Y,P,R		M, Y		M,Y,P		M,Y,P,R	
Country	Lev	Diff	Lev	Diff	Lev	Diff	Lev	Diff	Lev	Diff	Lev	Diff
Austria	(*) 12	* 11	** 12	* 7	** 8	** 10	**	**	**	**	**	**
Belgium	** 8	** 7	** 8	* 7	** 7	** 7			*		*	
Denmark	* 5	* 4	* 5	* 6	* 5	* 4						
Finland	9	8	13	6	9	* 11			**			
France	5	* 3	7	7	5	7			**		*	*
Germany	5	4	5	3	* 4	3						*
Greece	** 10	** 11	* 8	* 4	* 7	* 8						
Ireland	* 4	3	* 4	(*) 11	* 6	7	(*)	*		*		
Italy	** 3	* 2	** 3	** 3	** 7	** 3	(*)					
Nether	* 8	11	(*) 14	10	13	11			*	*	**	**
Portugal	5	4	5	4	5	4						
Spain	** 5	** 11	** 13	** 15	** 20	* 5		**	**	**	**	
Swede	* 3	2	4	3	3	4						
UK	1	0	** 2	1	18	** 17						
Canada	** 10	** 5	** 10	** 9	** 10	** 8						
Japan	** 2	6	4	6	8	9	**				*	**
US	8	7	8	11	** 7	7	**	*	**	**	*	**

Notes: One (two) stars indicate statistical significance at a level of 5% (1%). Additionally, the star in brackets reflects a p-value between 5% and 10%. The numbers show the actual lag length of the VARs.

The main information given in the table is the statistical significance level and the lag length of the respective VAR. In the following discussion, only significance at a 1% (**) or 5% (*) level is considered as supporting Granger-causality. Test statistics which are significant at a level of 10% ((*)) are merely shown to give an impression of the robustness of the results. A corresponding structure is used in columns four and five for the three variable VAR, and columns six and seven for the four variable VAR. In the right half of the table (denoted by Y→ M), a similar division is used to display the results for testing causality running from output to money. Table 2 summarises the Granger-causality test results for broad money in the same way.

The validity of **H1** can be checked in the light of the presented evidence. Regarding **H1** and narrow money (broad money), we find in Tables 1 and 2 evidence for Granger-causality in 10 out of 17 countries (7 out of 17) using the models in levels. For the VARs in differences the corresponding numbers are 8 cases for narrow and 6 for broad money.

At the same time, the direction of causality from output to money is supported by the tests using level variables and narrow (broad) money in 3 (6) countries. For growth rates, we find 3 (3) significant tests in the case of narrow (broad) money. I would not consider these results as more than a modest success of **H1**. Obviously, there are countries where we observe the causality running from money to output, but one should be careful in generalising this finding. Even less widespread is the evidence for reverse causation from output to money in a two-variable framework.

Tab. 2: Granger-causality tests for *broad* money

	M → Y						Y → M					
	M,Y		M,Y,P		M,Y,P,R		M, Y		M,Y,P		M,Y,P,R	
Country	Lev	Diff	Lev	Diff	Lev	Diff	Lev	Diff	Lev	Diff	Lev	Diff
Austria	** 14	* 14	** 7	** 7	** 8	** 8	**	**	**	**	**	**
Belgium	* 8	** 7	** 8	* 7	** 7	** 7						
Denmark	* 6	* 7	** 6	* 7	** 7	* 7		(*)	*	**	*	**
Finland	(*) 9	12	** 4	(*) 3	* 10	8		(*)	**	*	**	
France	2	1	8	7	6	7			*		**	
Germany	(*) 4	3	4	3	4	3	**		(*)		(*)	
Greece	** 6	* 5	** 8	** 7	** 5	** 7	*					
Ireland	4	3	4	3	7	5						
Italy	* 3	* 3	** 8	** 2	** 6	** 5	**					
Nether	8	11	12	14	12	11						
Portugal	4	4	4	4	5	4			*			
Spain	* 12	* 11	** 12	* 15	** 12	* 11	**	**	**	**	**	**
Swede	5	4	9	4	13	4	(*)				*	
UK	1	4	** 2	1	18	** 17						
Canada	6	6	11	7	** 7	* 7	**	**	**	**	**	**
Japan	* 5	(*) 5	7	6	(*) 7	(*) 5			**			
US	3	2	** 4	** 6	** 4	** 6						

Notes: One (two) stars indicate statistical significance at a level of 5% (1%). Additionally, the star in brackets reflects a p-value between 5% and 10%. The numbers show the actual lag length of the VARs.

Coming to **H2**, which says that the significance of money will decline when adding additional variables to the VAR, we can compare the number of significant correlations for the two, three and four variable cases given in Tables 1 and 2. Starting with the models in levels and narrow (broad) money, we find 10 (7) significant test statistics using two, 9 (9) using three, and 9 (9) using four variables. For the VARs in growth rates the relevant numbers are 8 (6), 7 (7), and 9 (9). Thus there does not appear to be a reduction of the significance of lagged money connected with the increase in the number of included variables. Moreover, as has been noted above, for many countries there is evidence of cointegration among the time series in levels only in the four variable case.

H3 postulates that using a narrower money aggregate will produce less evidence of Granger-causality from money to output. Since the relevant numbers of significant cases are already given in the preceding paragraphs, we can simply conclude that there is no such evidence present in the data analysed here. Although for some countries it makes a difference whether one uses narrow or broad money to test for money-output causality (e.g. Ireland, France, Germany or Sweden), in general we do not find a strong indication that using broad money implies a greater likelihood of finding a significant relationship.

Regarding **H4**, the question whether money-output causality can be more often found using (log-)level variables than growth rates, we find slight evidence in favour of this hypothesis only in the bivariate case. This can be easily confirmed by looking at Tables 1 and 2 or referring directly to the numbers given in the preceding discussion of **H1**. Still, I would not regard this as sufficient evidence for granting **H4** a high degree of generality, especially since the two-variable case is subject to nonstationarity problems when using level variables.

It might be interesting to add that one gets reverse causality results for Canada and the US using either narrow or broad money aggregates. While for Canada there is strong evidence of money-output causality for narrow money and weaker evidence for broad money, the opposite result holds for the US. However, the explanation of this finding is not straightforward. Serletis and King (1994) report a similar result and point towards the different size of the economies. While this explanation might be true, it is still not fully satisfactory, since it does not lay open the economic mechanisms leading to this observation.

Finally there is **H5** and its claim that asymmetric effects and the influence of the business cycle might be present. Thoma (1994) argues that it may well be the case that there exist asymmetries in the reaction of output to money. Before we come to the evaluation of his specific suggestion for modelling the asymmetries, we first attempt to capture reactions of output depending on the sign of money growth and the phase of the business cycle. In this framework, it only makes sense to look at variables in growth rates. The lag lengths chosen are those of Tables 1 and 2. Now the money growth series is decomposed into two variables containing respectively positive (ΔMPlus) and negative growth values (ΔMMin). A problem for some countries using this splitting rule is that the number of non-zero observations in Δ MMin is very limited.[2]

In a second step, these variables are connected with the phase of the business cycle. A variable reflecting the business cycle is constructed as the residual of a regression of output growth on a constant and a deterministic trend term (see Thoma (1994)). This variable is multiplied with

[2] In the case of narrow money for Japan there is not a single negative money growth figure.

ΔMPlus and ΔMMin giving ΔMCyP and ΔMCyM respectively. These four variables are substituted for money growth in the output growth equation of the VAR.

Thus we have as new variables:

ΔMPLus = ΔM for ΔM > 0, and zero otherwise,

ΔMMin = ΔM for ΔM < 0, and zero otherwise,

ΔMCyP = ΔMPLus multiplied by phase of business cycle,

ΔMCyM = ΔMMin multiplied by phase of business cycle.

We would expect that there is a greater chance of rejecting the null hypothesis of no Granger-causality from money to output, since the model is now somewhat more general than before. However, there is evidence of collinearity between ΔMPLus and ΔMCyP as well as ΔMMin and ΔMCyM, which will tend to increase the standard errors. It should also be noted that the regression models reported in Tables 1 and 2 are not fully nested in these models due to the variables capturing the phase of the business cycle. There are also differences because of variations in the degrees of freedom used in the computation of the F-test statistics.

The actual results of the regressions for narrow money are reported in Table 3.

Tab. 3: Asymmetric approach for *narrow* money

	ΔMMin = 0	ΔMPlus = 0	ΔMMin = ΔMPlus = 0	ΔMCyM = 0	ΔMCyP = 0	ΔMCyM = ΔMCyP = 0	All ΔM = 0
Austria	**	**	**	**	**	**	**
Belgium		**	**	*	**	**	**
Denmark		**	**		**	**	**
Finland	*	(*)	**	**	*	**	**
France		*			*	*	*
Germany							
Greece	**	**	**				**
Ireland	*	*	**	**	**	**	**
Italy		*	*				*
Nether	**	**	**	**	**	**	**
Portugal				*	*	*	
Spain		**	**	*		*	**
Swede		*		*		**	*
UK	**		**	**		**	**
Canada		*					**
Japan		**	*	*	**	**	**
US				*		*	*

Notes: One (two) stars indicate statistical significance at a level of 5% (1%). Additionally, the star in brackets reflects a p-value between 5% and 10%.

In Table 4, the corresponding results for broad money are given:

Tab. 4: Asymmetric approach for *broad* money

	ΔMMin = 0	ΔMPlus = 0	ΔMMin = ΔMPlus = 0	ΔMCyM = 0	ΔMCyP = 0	ΔMCyM = ΔMCyP = 0	All ΔM = 0
Austria		(*)	(*)		*	**	**
Belgium	*	**	**	**	**	**	**
Denmark		*			**	**	*
Finland		*	*			*	**
France	(*)	(*)	*		**	**	*
Germany							
Greece		**	**				*
Ireland				(*)			(*)
Italy	*		*		*	*	*
Nether	**	**	**	**	**	**	**
Portugal					*		
Spain	*		*	(*)	*	**	**
Swede					**	**	(*)
UK	**	(*)	**	**	(*)	**	**
Canada	**	**	**	**	*	**	**
Japan	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
US		*					

Notes: One (two) stars indicate statistical significance at a level of 5% (1%). Additionally, the star in brackets reflects a p-value between 5% and 10%.

First we look at differences between the results in Tables 1 and 2 and the findings in Tables 3 and 4. Comparing the results for the *narrow* money four-variable model in differences to the ones allowing for asymmetries, we observe more evidence for Granger-causality in the latter case. This assertion holds for France, Ireland, Netherlands, Portugal, Sweden, Japan and the US.

Next we look at traces indicating differences in the significance of effects through positive, respectively negative, money growth on output growth. In Belgium, Denmark, France, Italy, Spain, Sweden, Canada and Japan Granger-causality from narrow money to output is present when the money growth rate is positive, and in Finland and the UK when it is negative. For the other countries we observe either a two-way or no causal relationship.

It is also interesting to consider the influence of the business cycle on Granger-causality tests. Here statistically significant effects can be found for all countries except Germany, Greece, Italy and Canada. The result that Granger-causality is only present in a specific phase of the business cycle is found for Denmark, France, Spain, Sweden, UK and the US. In the case of the first two countries, the business cycle affects the influence of negative money growth and for the other countries it alters the effect of positive money growth.

For *broad* money, the general picture stays the same except that the effects for specific countries can be very different compared to what was found for narrow money. Countries that have displayed no traces of money-output Granger-causality in the symmetric approach (four-variables VAR in differences) but show evidence now are Finland, France, Greece, Netherlands, Portugal and Spain. More precisely, asymmetric effects due to positive broad money growth are observed for Denmark, Finland, Greece, and the US, and asymmetric effects caused by negative money growth can be detected for Italy, Spain and the UK. Further, we find an influence of the state of the business cycle for broad money as well. The only countries not affected are Germany, Greece, Ireland and the US.

Tab. 5: Thoma approach for *narrow* money

	ΔMTM = 0	ΔMTP = 0	ΔMTM = ΔMTP = 0	ΔMTCyM = 0	ΔMTCyP = 0	ΔMTCyM = ΔMTCyP = 0	All ΔMT = 0
Austria	**	**	**	*	**	**	**
Belgium	(*)	**	**	*	**	**	**
Denmark		*	*		**	**	**
Finland	**	*	**	**	**	**	**
France					*	*	
Germany							
Greece		**	**				*
Ireland	*		*	*	**	**	**
Italy	*	**	**				*
Nether	**	(*)	**	**	**	**	**
Portugal							
Spain	**		**	**		*	**
Swede		(*)		*	(*)	**	*
UK	**		**	**	**	**	**
Canada		**	**	*	**	**	**
Japan			**	**	**	**	**
US	*		*	*		(*)	*

Notes: One (two) stars indicate statistical significance at a level of 5% (1%). Additionally, the star in brackets reflects a p-value between 5% and 10%.

The concrete approach chosen by Thoma (1994) proceeds somewhat differently. Instead of splitting the information in the money growth variable into series containing positive and negative growth, he looks at whether money growth is increasing or decreasing. He bases the construction of variables used to capture asymmetries on the following transformations:

ΔMTP = ΔM for ΔΔM > 0, and zero otherwise,

ΔMTM = ΔM for ΔΔM < 0, and zero otherwise,

ΔMTCyP = ΔMTP multiplied by phase of business cycle,

ΔMTCyM = ΔMTM multiplied by phase of business cycle.

The results of using these variables in the output equation are given in Table 5 for narrow money. For broad money, the values calculated using the Thoma-procedure are recorded in Table 6.

Tab. 6: Thoma approach for *broad* money

	ΔMTM = 0	ΔMTP = 0	ΔMTM = ΔMTP = 0	ΔMTCyM = 0	ΔMTCyP = 0	ΔMTCyM = ΔMTCyP = 0	All ΔMT = 0
Austria	**	*	**		**	**	**
Belgium	**	**	**	**	**	**	**
Denmark		*	(*)		**	**	**
Finland	*	**	**	**	*	**	**
France	**		**		**	*	*
Germany							
Greece	**	**	**				*
Ireland	(*)				*	(*)	(*)
Italy	*		*		*	(*)	*
Nether		**	**	**	**	**	**
Portugal					*		
Spain	(*)			**	*	**	**
Swede					**	**	*
UK	**		**	**		**	**
Canada		*	*		*	*	*
Japan		**	**	**	**	**	**
US						*	*

Notes: One (two) stars indicate statistical significance at a level of 5% (1%). Additionally, the star in brackets reflects a p-value between 5% and 10%.

Starting the interpretation of the results again with *narrow* money, the same list of countries, except Portugal, as in Table 3 display a statistically significant effect of lagged money on output. For *broad* money, differences to Table 4 occur only in the case of Ireland and Japan.

In general it can be said that the asymmetric effects are not similarly distributed over different countries. For instance, there is no evidence that periods of negative money growth have a larger impact than periods with positive growth or vice versa. Furthermore, opposite to what Thoma (1994) claims for the US, internationally, there is no evidence that allowing for business cycle effects leads to statistically more significant effects of money on output than simply constructing variables according to the sign of the money growth rate.

Thus to evaluate **H5** based on the evidence presented in Tables 3-6, we can safely claim that asymmetric effects indeed matter. However, the results vary depending on the specification of asymmetry and no simple conclusion emerges with respect to the general behaviour of countries in the sample. Thus although we find evidence in favour of **H5**, it is not obvious whether this tells us much about economic structures, since the results appear to be strongly dependent on the specific country one is looking at.

5 . Clustering countries according to the Granger-causality tests

Even if it is not possible to deduce general conclusions about money-output Granger-causalities, maybe it is possible to isolate particular groups of countries displaying a very similar behaviour with respect to the variables of interest. For instance, one could imagine that the core EU countries show money-output test results which are very close to each other.

To investigate this question, a rather crude cluster analysis has been employed. Every column in the Table 1-6 was defined as a variable and the countries were defined as cases. The coding of the cases has been done in the follwing way:

- Significant at a level of 1% → Coded as 10
- Significant at a level of 5% → Coded as 5
- Significant at a level of 10% → Coded as 1
- Not significant at a level of 10% → Coded as 0

This approach can be seen as a reasonable compromise between obtaining information reflecting the different strengths of the statistical relationships as well as not pretending to be very exact. Other specifications have been tried, for instance modelling the variable as a simple dummy variable with significant results at a level of 5% coded as unity, and the results do not appear to be very sensitive to the particular formulation of these variables. To assist us in finding a structure within the diverse group of countries of this sample, a cluster analysis based on the squared Euclidean distance is used. Here we concentrate on a graphical representation of the clusters called dendrogram, which features the relative similarity of the countries in an easy-to-survey way.

The question arises as to which Granger-causality test results should be included in the analysis. Instead of displaying all possible combinations of variables or even including all variables, three possible selections of variables will be shown containing only the results of the money-output tests in the framework of symmetric and asymmetric four variable VARs. The potential problems associated with the lower dimensional VARs have already been mentioned. We concentrate on the formulation of asymmetry as put forward by Thoma (1994), with and without business cycle influence. This allows the inclusion of Japan as a separate case. It should be noted, however, that the results are relatively robust to the inclusion of variables and that the presented results can be regarded as fairly representative. Employing these 12 variables in the clustering gives the following dendrogram (see Figure 1):

Fig. 1: Cluster analysis for money-output causality

```
Dendrogram using Average Linkage (Between Groups)

                        Rescaled Distance Cluster Combine

   C A S E      0         5        10        15        20        25
 Label     Num  +---------+---------+---------+---------+---------+

 Germany     6   -+---+
 Portugal   11   -+   +-----+
 Sweden     13   -----+     +-+
 Ireland     8   -----------+ +-----------------------+
 France      5   -------------+                       +-----+
 Spain      12   ---------------+---------------------+     I
 US         17   ---------------+                           +-----+
 Netherla   10   -----+-----+                               I     I
 Japan      16   -----+     +-------------------------+     I     I
 Finland     4   -----------+                         +-----+     I
 UK         14   -------------------------------------+           I
 Greece      7   ---------------+---------+                       I
 Italy       9   ---------------+         +-----------------------+
 Denmark     3   -------+---------------+ I
 Canada     15   -------+               +-+
 Austria     1   ---------------+-------+
 Belgium     2   ---------------+
```

Depending on the specific cut-off point to distinguish between different country clusters, we can isolate the following three groups:

- Germany, Portugal, Sweden, Ireland, France, Spain, and the USA
- Netherlands, Japan, Finland, and the UK
- Greece, Italy, Denmark, Canada, Austria, Belgium

Allowing for more heterogeneity within groups and combining the first two clusters, the dimensionality of the cluster space could be reduced to two. Trying to get more homogeneous groups would result in an increase of the number of clusters. Pursuing this route, the only cluster left with a larger number of countries would include Germany, Portugal, Sweden, Ireland, and France.

Clearly, the three cluster identified above do not reflect any precise a priori expectations. But the groups do seem to contain countries which are characterised by economic similarities. Cluster 1 includes Germany and France, which one would expect to see in one cluster. Sweden is a country which was characterised over the sample period as a country with a high welfare state component. Up to a certain point this is also true for Germany and France. However, the cluster also includes Portugal and Spain, the economies of which are strongly interlinked but which do not have obvious similarities to the aforementioned countries.

In the second cluster, it is more difficult to synthesise plausible a priori candidates for similar behaviour. Here it is helpful to refer to the larger two-cluster interpretation of Figure 1, where one could at least put the Netherlands together in the group with Germany and France, and Finland together with Sweden, its neighbour and most important economic partner.

Within the third cluster, we notice a close similarity between Greece and Italy. Both countries are part of the Southern region of the EU. A different connection can be discovered when adding Belgium to this group. These three countries have the largest debt-to-GDP ratios of EU countries. Moreover, a large debt-to-GDP ratio can also be found in Japan. Finally, in accordance with Serletis and King (1994), the US and Canada are attributed to non-overlapping clusters, indicating their different economic behaviour based on money-output tests.

Fig. 2: Cluster analysis involving *narrow* money variables

```
Dendrogram using Average Linkage (Between Groups)

                         Rescaled Distance Cluster Combine

    C A S E      0         5        10        15        20        25
  Label     Num  +---------+---------+---------+---------+---------+

  Belgium     2   -+-------------+
  Canada     15   -+             +-----+
  Austria     1   ---------------+     +-------+
  Denmark     3   ---------------------+       +-------------------+
  Greece      7   -------------+---------------+                   I
  Italy       9   -------------+                                   I
  Ireland     8   -------------+---------+                         I
  Japan      16   -------------+         +-----------------+       I
  Finland     4   -------+-----+         I                 I       I
  Netherla   10   -------+     +---------+                 I       I
  UK         14   -------------+                           +-------+
  Germany     6   ---+-+                                   I
  Portugal   11   ---+ +-+                                 I
  France      5   -----+ +---------------------------+     I
  Sweden     13   -------+                           +-----+
  Spain      12   -------------+---------------------+
  US         17   -------------+
```

Next we can ask whether the identified country groupings vary with respect to the choice of the money aggregate. In Figure 2, only variables containing *narrow* money test results are included in the analysis (6 variables).

The core cluster just mentioned consists now of only Germany, Portugal, France and Sweden. Applying the three cluster scheme again would lead to similar groups as before, with Ireland being the only exception. For narrow money, Ireland becomes part of the second cluster listed above.

Finally, the analysis is applied to *broad* money and the results are shown in Figure 3:

Fig. 3: Cluster analysis involving *broad* money variables

```
Dendrogram using Average Linkage (Between Groups)

                         Rescaled Distance Cluster Combine

    C A S E      0         5        10        15        20        25
  Label     Num  +---------+---------+---------+---------+---------+

  Ireland     8   -+-+
  Portugal   11   -+ +---+
  Sweden     13   ---+   +-------------+
  Germany     6   -------+             +-----------------+
  France      5   ---------------------+                 +-------+
  Netherla   10   -+---------+                           I       I
  Japan      16   -+         +---------------------------+       I
  Finland     4   -----------+                                   I
  Denmark     3   ---+-----------+                               +-+
  Canada     15   ---+           +-----+                         I I
  Italy       9   -------+-------+     +-------------+           I I
  US         17   -------+             I             I           I I
  Spain      12   ---------------------+             +-----------+ I
  Austria     1   -------------------+-----+         I             I
  Greece      7   -------------------+     +---------+             I
  Belgium     2   -------------------------+                       I
  UK         14   -------------------------------------------------+
```

Here the natural three-cluster grouping displayed above does not really hold. But we do find the core cluster again, this time including Ireland, but the rest is less homogeneous. Combining the countries into two clusters gives us the same results displayed in Figures 1 and 2. There is one big exception, though, and this is the behaviour of the UK, which is for broad money strikingly different to all other countries included in the sample.

Thus the use of specific monetary aggregates has only a limited influence on the results of the analysis. More generally, the extracted clusters do not conform easily to a simple division of EU countries into categories like North versus South, or richer versus poorer countries, or older versus newer members. However, by allowing for less clear divisions it is still possible to put economic meaning into the respective country groupings. With respect to the control countries Canada, Japan and the US it needs to be said that the EU countries do not generally appear to be more similar than these over the underlying time period. If strong EU convergence has occurred, it cannot be discovered in a sample size as long as this one. Using a much shorter sample, though, leads to a strong decline in the power of the underlying causality tests.

6 . Conclusion

The preceding discussion in section three has made pretty clear that general hypotheses based upon Granger-causality tests are not very robust with respect to different variables, time periods or countries. However, there appears to be a Granger-causality effect present in many of the economies under investigation. This effect will be much more pronounced when allowing for a number of asymmetric influences. But more general statements about money-output causality cannot really be supported. All the other substantial findings are more or less connected with specific countries, like the reverse causality results for Canada and the US, the existence of significant two-way causalities in Austria and Spain, and the statistically insignificant effects for Germany. One important lesson to draw from this conclusion is that concentrating research on one country, here the US, does not help very much in assessing general questions connected with Granger-causality. For instance, the specific claim made by Davis and Tanner (1997) that money still causes economic activity when appropriately adjusting the time period is likely to be correct only in the context of the US economy.

Looking at the attempt of grouping countries according to the results of the causality tests presented in the preceding section does not improve the situation very much. Even though it is possible to extract a small number of country groups displaying similar behaviour, it is not always clear why they actually show that behaviour. Many of the countries in the grouping conform to a priori expectations, while others do not display obvious similarities. On the other hand, the main reason for employing exploratory data analysis is to uncover relationships which are not obvious. In any case, the result of the country clustering should make us careful with respect to simple generalisations, like North versus South, or core versus periphery.

Coming back to the question of EMU raised in the introduction, an ECB will find it hard to use monetary policy to influence output. There are at least two, if not three or more, groups of countries which are likely to react rather differently in economic activity to variations in money. This could be seen as supporting the view that the ECB ought not to attempt any stabilisation policy. However, at least three caveats should be borne in mind: First, the results of the Granger-causality tests do not really capture monetary policy. Second, statistical significance does not say a lot about economic significance (see McCloskey and Ziliak (1996)). Third, it may be the case that the money-output relationship will be heavily influenced by forming EMU, thereby rendering the tests based on historical data obsolete.

Consequently, it would be premature to exclude the ECB from considerations of stabilisation policy. However, great care should be exercised when using it, as there might result asymmetric outcomes between different EMU member countries.

Appendix

Data:

Most series have been taken from the OECD Main Economic Indicators CD-Rom 1/1996. Some series were obtained from the IMF International Financial Statistics. Finally, some data had to be estimated since they were not available, like quarterly GDP for Belgium. Most estimations were done using ADL-models and the method of Chow and Lin (1971).

Nominal GDP and money aggregates are calculated in million units of the respective national currency, interest rates in per cent per annum, and the consumer price indices have 1990 as a base year. Real GDP was computed using the CPI. A complete listing of data sources and extrapolations is available upon request.

Unit root tests:

Tab. A1: Unit root tests (ADF-test)

			Variables		
Country	LM	LMQ	LGDPR	LCPI	INT
Austria	I(1)	I(2)	I(1)	I(1)	I(0)
Belgium	I(1)	I(1)	I(1)	I(2)	I(1)
Denmark	I(1)	I(1)	I(1)	I(1)	I(1)
Finland	I(1)	I(2)	I(1)	I(1)	I(1)
France	I(1)	I(1)	I(0)	I(2)	I(1)
Germany	I(1)	I(1)	I(1)	I(1)	I(0)
Greece	I(1)	I(1)	I(0)	I(2)	I(1)
Ireland	I(1)	I(1)	I(1)	I(2)	I(1)
Italy	I(2)	I(2)	I(0)	I(2)	I(1)
Netherlands	I(1)	I(1)	I(1)	I(2)	I(1)
Portugal	I(1)	I(1)	I(1)	I(1)	I(1)
Spain	I(2)	I(2)	I(0)	I(2)	I(1)
Sweden	I(1)	I(1)	I(0)	I(1)	I(1)
UK	I(1)	I(1)	I(1)	I(1)	I(1)
Canada	I(1)	I(0)	I(0)	I(2)	I(1)
Japan	I(0)	I(0)	I(1)	I(2)	I(1)
USA	I(1)	I(1)	I(1)	I(2)	I(1)

Notes: Critical values are taken from MacKinnon (1991).

Cointegration:

Tab. A2: Cointegration Tests (Johansen-Method)

Länder	LY, LM	LY, LMQ	LY, LM, LP	LY, LMQ, LP	LY, LM, LP, R	LY, LMQ, LP, R
Austria	(*/*)	(**/**)	(**/**)	(**/**)	(**/**)	(**/**)
Belgium	(-/-)	(-/-)	(**/*)	(-/-)	(**/**)	(**/**)
Denmark	(-/-)	(-/-)	(**/**)	(**/**)	(**/**)	(*/*)
Finland	(-/-)	(*/*)	(*/*)	(*/*)	(-/-)	(**/**)
France	(-/-)	(-/-)	(-/*)	(-/-)	(-/-)	(-/-)
Germany	(-/*)	(*/**)	(-/-)	(**/**)	(**/*)	(**/**)
Greece	(-/**)	(-/-)	(-/-)	(-/-)	(-/*)	(**/**)
Ireland	(-/-)	(-/*)	(**/**)	(*/**)	(*/**)	(**/**)
Italy	(*/*)	(*/*)	(*/*)	(-/*)	(*/**)	(-/-)
Netherlands	(-/-)	(-/-)	(*/**)	(-/*)	(*/**)	(-/**)
Portugal	(-/-)	(-/-)	(-/-)	(-/-)	(-/*)	(-/-)
Spain	(**/**)	(*/*)	(**/**)	(**/**)	(**/**)	(**/**)
Sweden	(-/*)	(-/-)	(*/-)	(-/-)	(-/**)	(**/**)
UK	(-/-)	(-/-)	(-/-)	(-/-)	(**/**)	(**/**)
Canada	(-/-)	(-/-)	(-/-)	(*/*)	(-/-)	(**/**)
Japan	(*/**)	(-/-)	(**/**)	(-/*)	(-/**)	(*/**)
USA	(-/*)	(-/-)	(-/-)	(**/**)	(**/**)	(-/*)

Notes: One (two) stars indicate statistical significance at a level of 5% (1%). The first digit within the brackets reflects the results of the maximum eigenvalue test, the second of the trace test. Critical values are taken from Osterwald-Lenum (1992).

References

Banerjee, A., J. Dolado, J.W. Galbraith and D.F. Hendry (1993), *Co-integration, error-correction, and the econometric analysis of non-stationary data*, Oxford: Oxford University Press.

Chow, G.C. and A. Lin (1971), Best linear unbiased interpolation, distribution, and extrapolation of time series by related series, *Review of Economics and Statistics* 53, p. 372-375.

Christiano, L.J. and L. Ljungqvist (1988), Money does Granger-Cause Output in the Bivariate Money-Output Relation, *Journal of Monetary Economics* 22, p. 271-234.

Davis, M.S. and J.E. Tanner (1997), Money and Economic Activity Revisited, *Journal of International Money and Finance* 16, p. 955-968.

Dufour, J.-M. and D. Tessier (1993), On the Relationship between Impulse Response Analysis, Innovation Accounting and Granger Causality, *Economics Letters* 42, p. 327-333.

Granger, C.W.J. (1969), Investigating Causal Relations by Econometric Models and Cross-spectral Methods, *Econometrica* 37, p. 24-36.

Hafer, R.W. and A.M. Kutan (1997), More Evidence on the Money-Output Relationship, *Economic Inquiry* 35, p. 48-58.

Hendry, D.F. (1993), *Econometrics: Alchemy or Science?*, Oxford: Blackwell.

Holland, P.W. (1986), Statistics and Causal Inference, *Journal of the American Statistical Association* 81, p. 945-960.

King, R.G. and C.I. Plosser (1984), Money, Credit and Prices in a Real Business Cycle, *American Economic Review* 74, p. 363-380.

Krol, R. and L.E. Ohanian (1990), The Impact of Stochastic and Deterministic Trends on Money-Output Causality: A Multi-Country Investigation, *Journal of Econometrics* 45, p. 291-308.

MacKinnon, J.G. (1991), Critical values for cointegration tests, in: R.F. Engle and C. Granger (eds.), *Long-run Economic Relationships*, Oxford: Oxford University Press, p. 267-276.

McCloskey, D. and S.T. Ziliak (1996), The Standard Error of Regression, *Journal of Econometric Literature* 34, p. 97-114.

Osterwald-Lenum, M. (1992), A Note with Quantiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics, *Oxford Bulletin of Economics and Statistics* 54, p. 461-471.

Pikkarainen, P. and M. Virén (1989), Granger Causality between Money, Output, Prices and Interest Rates: Some Cross-Country Evidence from the Period 1875-1984, *Weltwirtschaftliches Archiv* 125, p. 74-82.

Serletis, A. and M. King (1994), Deterministic Trends and Money-Output Causality, *Applied Financial Economics* 4, p. 143-147.

Sims, C.A. (1972), Money, Income and Causality, *American Economic Review* 62, p. 540-542.

Sims, C.A. (1980), Comparison of Interwar and Postwar Business Cycles: Monetarism Reconsidered, *American Economic Review* 70, p. 250-259.

Stock, J.H. and M.W. Watson (1989), Interpreting the Evidence on Money-Income Causality, *Journal of Econometrics* 40, p. 161-181.

Thoma, M.A. (1994), Subsample Instability and Asymmetries in Money-Income Causality, *Journal of Econometrics* 64, p. 279-306.

Thornton, D.L. and D.S. Batten (1985), Lag-length Selection and Tests of Granger Causality between Money and Income, *Journal of Money, Credit and Banking* 17, p. 164-178.

2008		
B01-08	**Euro-Diplomatie durch gemeinsame „Wirtschaftsregierung“**	*Martin Seidel*
2007		
B03-07	**Löhne und Steuern im Systemwettbewerb der Mitgliedstaaten der Europäischen Union**	*Martin Seidel*
B02-07	**Konsolidierung und Reform der Europäischen Union**	*Martin Seidel*
B01-07	**The Ratification of European Treaties - Legal and Constitutional Basis of a European Referendum.**	*Martin Seidel*
2006		
B03-06	**Financial Frictions, Capital Reallocation, and Aggregate Fluctuations**	*Jürgen von Hagen, Haiping Zhang*
B02-06	**Financial Openness and Macroeconomic Volatility**	*Jürgen von Hagen, Haiping Zhang*
B01-06	**A Welfare Analysis of Capital Account Liberalization**	*Jürgen von Hagen, Haiping Zhang*
2005		
B11-05	**Das Kompetenz- und Entscheidungssystem des Vertrages von Rom im Wandel seiner Funktion und Verfassung**	*Martin Seidel*
B10-05	**Die Schutzklauseln der Beitrittsverträge**	*Martin Seidel*
B09-05	**Measuring Tax Burdens in Europe**	*Guntram B. Wolff*
B08-05	**Remittances as Investment in the Absence of Altruism**	*Gabriel González-König*
B07-05	**Economic Integration in a Multicone World?**	*Christian Volpe Martincus, Jennifer Pédussel Wu*
B06-05	**Banking Sector (Under?)Development in Central and Eastern Europe**	*Jürgen von Hagen, Valeriya Dinger*
B05-05	**Regulatory Standards Can Lead to Predation**	*Stefan Lutz*
B04-05	**Währungspolitik als Sozialpolitik**	*Martin Seidel*
B03-05	**Public Education in an Integrated Europe: Studying to Migrate and Teaching to Stay?**	*Panu Poutvaara*
B02-05	**Voice of the Diaspora: An Analysis of Migrant Voting Behavior**	*Jan Fidrmuc, Orla Doyle*
B01-05	**Macroeconomic Adjustment in the New EU Member States**	*Jürgen von Hagen, Iulia Traistaru*
2004		
B33-04	**The Effects of Transition and Political Instability On Foreign Direct Investment Inflows: Central Europe and the Balkans**	*Josef C. Brada, Ali M. Kutan, Taner M. Yigit*
B32-04	**The Choice of Exchange Rate Regimes in Developing Countries: A Mulitnominal Panal Analysis**	*Jürgen von Hagen, Jizhong Zhou*
B31-04	**Fear of Floating and Fear of Pegging: An Empirical Anaysis of De Facto Exchange Rate Regimes in Developing Countries**	*Jürgen von Hagen, Jizhong Zhou*
B30-04	**Der Vollzug von Gemeinschaftsrecht über die Mitgliedstaaten und seine Rolle für die EU und den Beitrittsprozess**	*Martin Seidel*
B29-04	**Deutschlands Wirtschaft, seine Schulden und die Unzulänglichkeiten der einheitlichen Geldpolitik im Eurosystem**	*Dieter Spethmann, Otto Steiger*
B28-04	**Fiscal Crises in U.S. Cities: Structural and Non-structural Causes**	*Guntram B. Wolff*
B27-04	**Firm Performance and Privatization in Ukraine**	*Galyna Grygorenko, Stefan Lutz*
B26-04	**Analyzing Trade Opening in Ukraine: Effects of a Customs Union with the EU**	*Oksana Harbuzyuk, Stefan Lutz*
B25-04	**Exchange Rate Risk and Convergence to the Euro**	*Lucjan T. Orlowski*
B24-04	**The Endogeneity of Money and the Eurosystem**	*Otto Steiger*
B23-04	**Which Lender of Last Resort for the Eurosystem?**	*Otto Steiger*
B22-04	**Non-Discretonary Monetary Policy: The Answer for Transition Economies?**	*Elham-Mafi Kreft, Steven F. Kreft*
B21-04	**The Effectiveness of Subsidies Revisited: Accounting for Wage and Employment Effects in Business R+D**	*Volker Reinthaler, Guntram B. Wolff*
B20-04	**Money Market Pressure and the Determinants of Banking Crises**	*Jürgen von Hagen, Tai-kuang Ho*
B19-04	**Die Stellung der Europäischen Zentralbank nach dem Verfassungsvertrag**	*Martin Seidel*

B18-04	**Transmission Channels of Business Cycles Synchronization in an Enlarged EMU**	*Iulia Traistaru*
B17-04	**Foreign Exchange Regime, the Real Exchange Rate and Current Account Sustainability: The Case of Turkey**	*Sübidey Togan, Hasan Ersel*
B16-04	**Does It Matter Where Immigrants Work? Traded Goods, Non-traded Goods, and Sector Specific Employment**	*Harry P. Bowen, Jennifer Pédussel Wu*
B15-04	**Do Economic Integration and Fiscal Competition Help to Explain Local Patterns?**	*Christian Volpe Martincus*
B14-04	**Euro Adoption and Maastricht Criteria: Rules or Discretion?**	*Jiri Jonas*
B13-04	**The Role of Electoral and Party Systems in the Development of Fiscal Institutions in the Central and Eastern European Countries**	*Sami Yläoutinen*
B12-04	**Measuring and Explaining Levels of Regional Economic Integration**	*Jennifer Pédussel Wu*
B11-04	**Economic Integration and Location of Manufacturing Activities: Evidence from MERCOSUR**	*Pablo Sanguinetti, Iulia Traistaru, Christian Volpe Martincus*
B10-04	**Economic Integration and Industry Location in Transition Countries**	*Laura Resmini*
B09-04	**Testing Creditor Moral Hazard in Souvereign Bond Markets: A Unified Theoretical Approach and Empirical Evidence**	*Ayse Y. Evrensel, Ali M. Kutan*
B08-04	**European Integration, Productivity Growth and Real Convergence**	*Taner M. Yigit, Ali M. Kutan*
B07-04	**The Contribution of Income, Social Capital, and Institutions to Human Well-being in Africa**	*Mina Baliamoune-Lutz, Stefan H. Lutz*
B06-04	**Rural Urban Inequality in Africa: A Panel Study of the Effects of Trade Liberalization and Financial Deepening**	*Mina Baliamoune-Lutz, Stefan H. Lutz*
B05-04	**Money Rules for the Eurozone Candidate Countries**	*Lucjan T. Orlowski*
B04-04	**Who is in Favor of Enlargement? Determinants of Support for EU Membership in the Candidate Countries' Referenda**	*Orla Doyle, Jan Fidrmuc*
B03-04	**Over- and Underbidding in Central Bank Open Market Operations Conducted as Fixed Rate Tender**	*Ulrich Bindseil*
B02-04	**Total Factor Productivity and Economic Freedom Implications for EU Enlargement**	*Ronald L. Moomaw, Euy Seok Yang*
B01-04	**Die neuen Schutzklauseln der Artikel 38 und 39 des Beitrittsvertrages: Schutz der alten Mitgliedstaaten vor Störungen durch die neuen Mitgliedstaaten**	*Martin Seidel*
2003		
B29-03	**Macroeconomic Implications of Low Inflation in the Euro Area**	*Jürgen von Hagen, Boris Hofmann*
B28-03	**The Effects of Transition and Political Instability on Foreign Direct Investment: Central Europe and the Balkans**	*Josef C. Brada, Ali M. Kutan, Taner M. Yigit*
B27-03	**The Performance of the Euribor Futures Market: Efficiency and the Impact of ECB Policy Announcements (Electronic Version of International Finance)**	*Kerstin Bernoth, Juergen von Hagen*
B26-03	**Souvereign Risk Premia in the European Government Bond Market (überarbeitete Version zum Herunterladen)**	*Kerstin Bernoth, Juergen von Hagen, Ludger Schulknecht*
B25-03	**How Flexible are Wages in EU Accession Countries?**	*Anna Iara, Iulia Traistaru*
B24-03	**Monetary Policy Reaction Functions: ECB versus Bundesbank**	*Bernd Hayo, Boris Hofmann*
B23-03	**Economic Integration and Manufacturing Concentration Patterns: Evidence from Mercosur**	*Iulia Traistaru, Christian Volpe Martincus*
B22-03	**Reformzwänge innerhalb der EU angesichts der Osterweiterung**	*Martin Seidel*
B21-03	**Reputation Flows: Contractual Disputes and the Channels for Inter-Firm Communication**	*William Pyle*
B20-03	**Urban Primacy, Gigantism, and International Trade: Evidence from Asia and the Americas**	*Ronald L. Moomaw, Mohammed A. Alwosabi*
B19-03	**An Empirical Analysis of Competing Explanations of Urban Primacy Evidence from Asia and the Americas**	*Ronald L. Moomaw, Mohammed A. Alwosabi*

B18-03	**The Effects of Regional and Industry-Wide FDI Spillovers on Export of Ukrainian Firms**	*Stefan H. Lutz, Oleksandr Talavera, Sang-Min Park*
B17-03	**Determinants of Inter-Regional Migration in the Baltic States**	*Mihails Hazans*
B16-03	**South-East Europe: Economic Performance, Perspectives, and Policy Challenges**	*Iulia Traistaru, Jürgen von Hagen*
B15-03	**Employed and Unemployed Search: The Marginal Willingness to Pay for Attributes in Lithuania, the US and the Netherlands**	*Jos van Ommeren, Mihails Hazans*
B14-03	**FCIs and Economic Activity: Some International Evidence**	*Charles Goodhart, Boris Hofmann*
B13-03	**The IS Curve and the Transmission of Monetary Policy: Is there a Puzzle?**	*Charles Goodhart, Boris Hofmann*
B12-03	**What Makes Regions in Eastern Europe Catching Up? The Role of Foreign Investment, Human Resources, and Geography**	*Gabriele Tondl, Goran Vuksic*
B11-03	**Die Weisungs- und Herrschaftsmacht der Europäischen Zentralbank im europäischen System der Zentralbanken - eine rechtliche Analyse**	*Martin Seidel*
B10-03	**Foreign Direct Investment and Perceptions of Vulnerability to Foreign Exchange Crises: Evidence from Transition Economies**	*Josef C. Brada, Vladimír Tomsík*
B09-03	**The European Central Bank and the Eurosystem: An Analysis of the Missing Central Monetary Institution in European Monetary Union**	*Gunnar Heinsohn, Otto Steiger*
B08-03	**The Determination of Capital Controls: Which Role Do Exchange Rate Regimes Play?**	*Jürgen von Hagen, Jizhong Zhou*
B07-03	**Nach Nizza und Stockholm: Stand des Binnenmarktes und Prioritäten für die Zukunft**	*Martin Seidel*
B06-03	**Fiscal Discipline and Growth in Euroland. Experiences with the Stability and Growth Pact**	*Jürgen von Hagen*
B05-03	**Reconsidering the Evidence: Are Eurozone Business Cycles Converging?**	*Michael Massmann, James Mitchell*
B04-03	**Do Ukrainian Firms Benefit from FDI?**	*Stefan H. Lutz, Oleksandr Talavera*
B03-03	**Europäische Steuerkoordination und die Schweiz**	*Stefan H. Lutz*
B02-03	**Commuting in the Baltic States: Patterns, Determinants, and Gains**	*Mihails Hazans*
B01-03	**Die Wirtschafts- und Währungsunion im rechtlichen und politischen Gefüge der Europäischen Union**	*Martin Seidel*
2002		
B30-02	**An Adverse Selection Model of Optimal Unemployment Assurance**	*Marcus Hagedorn, Ashok Kaul, Tim Mennel*
B29B-02	**Trade Agreements as Self-protection**	*Jennifer Pédussel Wu*
B29A-02	**Growth and Business Cycles with Imperfect Credit Markets**	*Debajyoti Chakrabarty*
B28-02	**Inequality, Politics and Economic Growth**	*Debajyoti Chakrabarty*
B27-02	**Poverty Traps and Growth in a Model of Endogenous Time Preference**	*Debajyoti Chakrabarty*
B26-02	**Monetary Convergence and Risk Premiums in the EU Candidate Countries**	*Lucjan T. Orlowski*
B25-02	**Trade Policy: *Institutional* Vs. *Economic* Factors**	*Stefan Lutz*
B24-02	**The Effects of Quotas on Vertical Intra-industry Trade**	*Stefan Lutz*
B23-02	**Legal Aspects of European Economic and Monetary Union**	*Martin Seidel*
B22-02	**Der Staat als *Lender of Last Resort* - oder: Die Achillesverse des Eurosystems**	*Otto Steiger*
B21-02	**Nominal and Real Stochastic Convergence Within the Transition Economies and to the European Union: Evidence from Panel Data**	*Ali M. Kutan, Taner M. Yigit*
B20-02	**The Impact of News, Oil Prices, and International Spillovers on Russian Fincancial Markets**	*Bernd Hayo, Ali M. Kutan*

B19-02	**East Germany: Transition with Unification, Experiments and Experiences**	*Jürgen von Hagen, Rolf R. Strauch, Guntram B. Wolff*
B18-02	**Regional Specialization and Employment Dynamics in Transition Countries**	*Iulia Traistaru, Guntram B. Wolff*
B17-02	**Specialization and Growth Patterns in Border Regions of Accession Countries**	*Laura Resmini*
B16-02	**Regional Specialization and Concentration of Industrial Activity in Accession Countries**	*Iulia Traistaru, Peter Nijkamp, Simonetta Longhi*
B15-02	**Does Broad Money Matter for Interest Rate Policy?**	*Matthias Brückner, Andreas Schaber*
B14-02	**The Long and Short of It: Global Liberalization, Poverty and Inequality**	*Christian E. Weller, Adam Hersch*
B13-02	**De Facto and Official Exchange Rate Regimes in Transition Economies**	*Jürgen von Hagen, Jizhong Zhou*
B12-02	**Argentina: The Anatomy of A Crisis**	*Jiri Jonas*
B11-02	**The Eurosystem and the Art of Central Banking**	*Gunnar Heinsohn, Otto Steiger*
B10-02	**National Origins of European Law: Towards an Autonomous System of European Law?**	*Martin Seidel*
B09-02	**Monetary Policy in the Euro Area - Lessons from the First Years**	*Volker Clausen, Bernd Hayo*
B08-02	**Has the Link Between the Spot and Forward Exchange Rates Broken Down? Evidence From Rolling Cointegration Tests**	*Ali M. Kutan, Su Zhou*
B07-02	**Perspektiven der Erweiterung der Europäischen Union**	*Martin Seidel*
B06-02	**Is There Asymmetry in Forward Exchange Rate Bias? Multi-Country Evidence**	*Su Zhou, Ali M. Kutan*
B05-02	**Real and Monetary Convergence Within the European Union and Between the European Union and Candidate Countries: A Rolling Cointegration Approach**	*Josef C. Brada, Ali M. Kutan, Su Zhou*
B04-02	**Asymmetric Monetary Policy Effects in EMU**	*Volker Clausen, Bernd Hayo*
B03-02	**The Choice of Exchange Rate Regimes: An Empirical Analysis for Transition Economies**	*Jürgen von Hagen, Jizhong Zhou*
B02-02	**The Euro System and the Federal Reserve System Compared: Facts and Challenges**	*Karlheinz Ruckriegel, Franz Seitz*
B01-02	**Does Inflation Targeting Matter?**	*Manfred J. M. Neumann, Jürgen von Hagen*
2001		
B29-01	**Is Kazakhstan Vulnerable to the Dutch Disease?**	*Karlygash Kuralbayeva, Ali M. Kutan, Michael L. Wyzan*
B28-01	**Political Economy of the Nice Treaty: Rebalancing the EU Council. The Future of European Agricultural Policies**	*Deutsch-Französisches Wirtschaftspolitisches Forum*
B27-01	**Investor Panic, IMF Actions, and Emerging Stock Market Returns and Volatility: A Panel Investigation**	*Bernd Hayo, Ali M. Kutan*
B26-01	**Regional Effects of Terrorism on Tourism: Evidence from Three Mediterranean Countries**	*Konstantinos Drakos, Ali M. Kutan*
B25-01	**Monetary Convergence of the EU Candidates to the Euro: A Theoretical Framework and Policy Implications**	*Lucjan T. Orlowski*
B24-01	**Disintegration and Trade**	*Jarko and Jan Fidrmuc*
B23-01	**Migration and Adjustment to Shocks in Transition Economies**	*Jan Fidrmuc*
B22-01	**Strategic Delegation and International Capital Taxation**	*Matthias Brückner*
B21-01	**Balkan and Mediterranean Candidates for European Union Membership: The Convergence of Their Monetary Policy With That of the Europaen Central Bank**	*Josef C. Brada, Ali M. Kutan*
B20-01	**An Empirical Inquiry of the Efficiency of Intergovernmental Transfers for Water Projects Based on the WRDA Data**	*Anna Rubinchik-Pessach*
B19-01	**Detrending and the Money-Output Link: International Evidence**	*R.W. Hafer, Ali M. Kutan*

B18-01	**Monetary Policy in Unknown Territory. The European Central Bank in the Early Years**	*Jürgen von Hagen, Matthias Brückner*
B17-01	**Executive Authority, the Personal Vote, and Budget Discipline in Latin American and Carribean Countries**	*Mark Hallerberg, Patrick Marier*
B16-01	**Sources of Inflation and Output Fluctuations in Poland and Hungary: Implications for Full Membership in the European Union**	*Selahattin Dibooglu, Ali M. Kutan*
B15-01	**Programs Without Alternative: Public Pensions in the OECD**	*Christian E. Weller*
B14-01	**Formal Fiscal Restraints and Budget Processes As Solutions to a Deficit and Spending Bias in Public Finances - U.S. Experience and Possible Lessons for EMU**	*Rolf R. Strauch, Jürgen von Hagen*
B13-01	**German Public Finances: Recent Experiences and Future Challenges**	*Jürgen von Hagen, Rolf R. Strauch*
B12-01	**The Impact of Eastern Enlargement On EU-Labour Markets. Pensions Reform Between Economic and Political Problems**	*Deutsch-Französisches Wirtschaftspolitisches Forum*
B11-01	**Inflationary Performance in a Monetary Union With Large Wage Setters**	*Lilia Cavallar*
B10-01	**Integration of the Baltic States into the EU and Institutions of Fiscal Convergence: A Critical Evaluation of Key Issues and Empirical Evidence**	*Ali M. Kutan, Niina Pautola-Mol*
B09-01	**Democracy in Transition Economies: Grease or Sand in the Wheels of Growth?**	*Jan Fidrmuc*
B08-01	**The Functioning of Economic Policy Coordination**	*Jürgen von Hagen, Susanne Mundschenk*
B07-01	**The Convergence of Monetary Policy Between Candidate Countries and the European Union**	*Josef C. Brada, Ali M. Kutan*
B06-01	**Opposites Attract: The Case of Greek and Turkish Financial Markets**	*Konstantinos Drakos, Ali M. Kutan*
B05-01	**Trade Rules and Global Governance: A Long Term Agenda. The Future of Banking.**	*Deutsch-Französisches Wirtschaftspolitisches Forum*
B04-01	**The Determination of Unemployment Benefits**	*Rafael di Tella, Robert J. MacCulloch*
B03-01	**Preferences Over Inflation and Unemployment: Evidence from Surveys of Happiness**	*Rafael di Tella, Robert J. MacCulloch, Andrew J. Oswald*
B02-01	**The Konstanz Seminar on Monetary Theory and Policy at Thirty**	*Michele Fratianni, Jürgen von Hagen*
B01-01	**Divided Boards: Partisanship Through Delegated Monetary Policy**	*Etienne Farvaque, Gael Lagadec*

2000

B20-00	**Breakin-up a Nation, From the Inside**	*Etienne Farvaque*
B19-00	**Income Dynamics and Stability in the Transition Process, general Reflections applied to the Czech Republic**	*Jens Hölscher*
B18-00	**Budget Processes: Theory and Experimental Evidence**	*Karl-Martin Ehrhart, Roy Gardner, Jürgen von Hagen, Claudia Keser*
B17-00	**Rückführung der Landwirtschaftspolitik in die Verantwortung der Mitgliedsstaaten? - Rechts- und Verfassungsfragen des Gemeinschaftsrechts**	*Martin Seidel*
B16-00	**The European Central Bank: Independence and Accountability**	*Christa Randzio-Plath, Tomasso Padoa-Schioppa*
B15-00	**Regional Risk Sharing and Redistribution in the German Federation**	*Jürgen von Hagen, Ralf Hepp*
B14-00	**Sources of Real Exchange Rate Fluctuations in Transition Economies: The Case of Poland and Hungary**	*Selahattin Dibooglu, Ali M. Kutan*
B13-00	**Back to the Future: The Growth Prospects of Transition Economies Reconsidered**	*Nauro F. Campos*

B12-00	**Rechtsetzung und Rechtsangleichung als Folge der Einheitlichen Europäischen Währung**	*Martin Seidel*
B11-00	**A Dynamic Approach to Inflation Targeting in Transition Economies**	*Lucjan T. Orlowski*
B10-00	**The Importance of Domestic Political Institutions: Why and How Belgium Qualified for EMU**	*Marc Hallerberg*
B09-00	**Rational Institutions Yield Hysteresis**	*Rafael Di Tella, Robert MacCulloch*
B08-00	**The Effectiveness of Self-Protection Policies for Safeguarding Emerging Market Economies from Crises**	*Kenneth Kletzer*
B07-00	**Financial Supervision and Policy Coordination in The EMU**	*Deutsch-Französisches Wirtschaftspolitisches Forum*
B06-00	**The Demand for Money in Austria**	*Bernd Hayo*
B05-00	**Liberalization, Democracy and Economic Performance during Transition**	*Jan Fidrmuc*
B04-00	**A New Political Culture in The EU - Democratic Accountability of the ECB**	*Christa Randzio-Plath*
B03-00	**Integration, Disintegration and Trade in Europe: Evolution of Trade Relations during the 1990's**	*Jarko Fidrmuc, Jan Fidrmuc*
B02-00	**Inflation Bias and Productivity Shocks in Transition Economies: The Case of the Czech Republic**	*Josef C. Barda, Arthur E. King, Ali M. Kutan*
B01-00	**Monetary Union and Fiscal Federalism**	*Kenneth Kletzer, Jürgen von Hagen*
1999		
B26-99	**Skills, Labour Costs, and Vertically Differentiated Industries: A General Equilibrium Analysis**	*Stefan Lutz, Alessandro Turrini*
B25-99	**Micro and Macro Determinants of Public Support for Market Reforms in Eastern Europe**	*Bernd Hayo*
B24-99	**What Makes a Revolution?**	*Robert MacCulloch*
B23-99	**Informal Family Insurance and the Design of the Welfare State**	*Rafael Di Tella, Robert MacCulloch*
B22-99	**Partisan Social Happiness**	*Rafael Di Tella, Robert MacCulloch*
B21-99	**The End of Moderate Inflation in Three Transition Economies?**	*Josef C. Brada, Ali M. Kutan*
B20-99	**Subnational Government Bailouts in Germany**	*Helmut Seitz*
B19-99	**The Evolution of Monetary Policy in Transition Economies**	*Ali M. Kutan, Josef C. Brada*
B18-99	**Why are Eastern Europe's Banks not failing when everybody else's are?**	*Christian E. Weller, Bernard Morzuch*
B17-99	**Stability of Monetary Unions: Lessons from the Break-Up of Czechoslovakia**	*Jan Fidrmuc, Julius Horvath and Jarko Fidrmuc*
B16-99	**Multinational Banks and Development Finance**	*Christian E.Weller and Mark J. Scher*
B15-99	**Financial Crises after Financial Liberalization: Exceptional Circumstances or Structural Weakness?**	*Christian E. Weller*
B14-99	**Industry Effects of Monetary Policy in Germany**	*Bernd Hayo and Birgit Uhlenbrock*
B13-99	**Fiancial Fragility or What Went Right and What Could Go Wrong in Central European Banking?**	*Christian E. Weller and Jürgen von Hagen*
B12 -99	**Size Distortions of Tests of the Null Hypothesis of Stationarity: Evidence and Implications for Applied Work**	*Mehmet Caner and Lutz Kilian*
B11-99	**Financial Supervision and Policy Coordination in the EMU**	*Deutsch-Französisches Wirtschaftspolitisches Forum*
B10-99	**Financial Liberalization, Multinational Banks and Credit Supply: The Case of Poland**	*Christian Weller*
B09-99	**Monetary Policy, Parameter Uncertainty and Optimal Learning**	*Volker Wieland*
B08-99	**The Connection between more Multinational Banks and less Real Credit in Transition Economies**	*Christian Weller*

B07-99	**Comovement and Catch-up in Productivity across Sectors: Evidence from the OECD**	*Christopher M. Cornwell and Jens-Uwe Wächter*
B06-99	**Productivity Convergence and Economic Growth: A Frontier Production Function Approach**	*Christopher M. Cornwell and Jens-Uwe Wächter*
B05-99	**Tumbling Giant: Germany's Experience with the Maastricht Fiscal Criteria**	*Jürgen von Hagen and Rolf Strauch*
B04-99	**The Finance-Investment Link in a Transition Economy: Evidence for Poland from Panel Data**	*Christian Weller*
B03-99	**The Macroeconomics of Happiness**	*Rafael Di Tella, Robert MacCulloch and Andrew J. Oswald*
B02-99	**The Consequences of Labour Market Flexibility: Panel Evidence Based on Survey Data**	*Rafael Di Tella and Robert MacCulloch*
B01-99	**The Excess Volatility of Foreign Exchange Rates: Statistical Puzzle or Theoretical Artifact?**	*Robert B.H. Hauswald*
1998		
B16-98	**Labour Market + Tax Policy in the EMU**	*Deutsch-Französisches Wirtschaftspolitisches Forum*
B15-98	**Can Taxing Foreign Competition Harm the Domestic Industry?**	*Stefan Lutz*
B14-98	**Free Trade and Arms Races: Some Thoughts Regarding EU-Russian Trade**	*Rafael Reuveny and John Maxwell*
B13-98	**Fiscal Policy and Intranational Risk-Sharing**	*Jürgen von Hagen*
B12-98	**Price Stability and Monetary Policy Effectiveness when Nominal Interest Rates are Bounded at Zero**	*Athanasios Orphanides and Volker Wieland*
B11A-98	**Die Bewertung der "dauerhaft tragbaren öffentlichen Finanzlage"der EU Mitgliedstaaten beim Übergang zur dritten Stufe der EWWU**	*Rolf Strauch*
B11-98	**Exchange Rate Regimes in the Transition Economies: Case Study of the Czech Republic: 1990-1997**	*Julius Horvath and Jiri Jonas*
B10-98	**Der Wettbewerb der Rechts- und politischen Systeme in der Europäischen Union**	*Martin Seidel*
B09-98	**U.S. Monetary Policy and Monetary Policy and the ESCB**	*Robert L. Hetzel*
B08-98	**Money-Output Granger Causality Revisited: An Empirical Analysis of EU Countries (überarbeitete Version zum Herunterladen)**	*Bernd Hayo*
B07-98	**Designing Voluntary Environmental Agreements in Europe: Some Lessons from the U.S. EPA's 33/50 Program**	*John W. Maxwell*
B06-98	**Monetary Union, Asymmetric Productivity Shocks and Fiscal Insurance: an Analytical Discussion of Welfare Issues**	*Kenneth Kletzer*
B05-98	**Estimating a European Demand for Money (überarbeitete Version zum Herunterladen)**	*Bernd Hayo*
B04-98	**The EMU's Exchange Rate Policy**	*Deutsch-Französisches Wirtschaftspolitisches Forum*
B03-98	**Central Bank Policy in a More Perfect Financial System**	*Jürgen von Hagen / Ingo Fender*
B02-98	**Trade with Low-Wage Countries and Wage Inequality**	*Jaleel Ahmad*
B01-98	**Budgeting Institutions for Aggregate Fiscal Discipline**	*Jürgen von Hagen*
1997		
B04-97	**Macroeconomic Stabilization with a Common Currency: Does European Monetary Unification Create a Need for Fiscal Insurance or Federalism?**	*Kenneth Kletzer*
B-03-97	**Liberalising European Markets for Energy and Telecommunications: Some Lessons from the US Electric Utility Industry**	*Tom Lyon / John Mayo*
B02-97	**Employment and EMU**	*Deutsch-Französisches Wirtschaftspolitisches Forum*
B01-97	**A Stability Pact for Europe**	*(a Forum organized by ZEI)*

ISSN 1436 - 6053

Zentrum für Europäische Integrationsforschung
Center for European Integration Studies
Rheinische Friedrich-Wilhelms-Universität Bonn

Walter-Flex-Strasse 3
D-53113 Bonn
Germany

Tel.: +49-228-73-1732
Fax: +49-228-73-1809
www.zei.de