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by

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Abstract

The paper presents some stylized facts of Euroland's business cycle using aggregated data. The main results are: The determination of turning points in Euroland's business cycle is not very sensitive to the detrending method used, although the level of the recent output gap depends on it. Investment, net exports and stock building explain the largest share of the swings in real GDP. The types of expenditures - except for net exports - are pro-cyclical with almost no lag or lead. The results for monetary variables are unclear, most of them show no clear-cut cyclical behavior. Prices are counter-cyclical, whereas labor productivity and real wages are pro-cyclical. The cyclical component of industrial production in all member countries shows a positive and over time increasing correlation coefficient with the one in the rest of Euroland.

Keywords: Business Cycles, Stylized Facts, European Monetary Union

JEL-Classification: E32

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1. Introduction[1]

Following an influential paper by Lucas (1977) empirical business cycle research has tried to figure out stylized facts which theories has to explain. With the start of the European Monetary Union (EMU) Euroland's business cycle is of particular interest. In the following a brief look of its regularities in the past is given. Therefore, aggregated data are used. The sources of the series and the methods of aggregation are shown in the appendix. In part 2, turning points are determined, using some alternative measures of the business cycle. Furthermore, the size of the business cycle fluctuations is of interest. Lundberg-components are applied to evaluate how important the different types of expenditures are for the swings of real GDP (part 3). In part 4, the cyclical behavior of some prominent macroeconomic variables is discussed, that is we analyze whether they are pro-, counter- or non-cyclical relative to the reference cycle of real GDP. Part 5 examines the lags and leads of selected time series compared to economic activity. Part 6 discusses whether the obtained results are stable over time. The paper closes with some conclusions on business cycle analysis in Euroland.

2. Measuring Euroland's Business Cycle and Dating the Turning Points

The following discussion refers to an understanding of business cycle a as deviation from a trend or a potential GDP rather than a definition drawing on absolute declines, which is sometimes referred to as "classical" business cycles (Horn 1995). As a consequence, expansions and contractions used here are more or less of the same length, whereas the competing definition will lead to contractions normally much shorter than expansions. To put it in another way,

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1 Thanks to K.J. Gern, J. Gottschalk, E. Langfeldt, J. Scheide, H. Strauß and M. Schlie who provided helpful comments on an earlier draft of this paper and to R.Schmidt, who has estimated the labour market variables for Euroland. O. Dieckmann, European Commsion Brussels, kindly provided some of the data used in this paper. I am still responsible for all remaining errors.

"growth cycles" (Zarnowitz 1992: 203 ff.) will count as business cycles in the following.

In order to isolate cyclical features, time series have to be detrended. Unfortunately, almost all detrending methods suggested in the literature have some shortcomings. Hence, Tichy (1994) as well as Canova (1998a,b) recommend the use of more than one detrending method to avoid an isolated view of the business cycle.[2] Some authors go even further and argue that there is no sense in detrending at all (see Horn 1995). Therefore the cycle should be measured in terms of first differences of the times series. To avoid a strong influence of single irregular observations some ad hoc rules are employed. For example, an expansion or a contraction should continue at least two quarters to count as a cycle. However, this method of defining a cycle can only answer questions whether or not an economy is in a downswing. They give only limited information relating to the question to what extent the economy is suffering. But this is the central point for policy makers. They need to know how far the economy is still away from its capacity limits. This becomes quite clear if one looks, for example, at the so-called Taylor rule or to various money supply rules[3]. Hence, in this paper a trend is used to isolate the cyclical component of a time series, although one has to admit that finding the "correct" trend is a tricky business.

There is a widespread discussion on the appropriate method of defining the cyclical component of real economic activity. Broadly speaking, one can distinguish structural measures that are based on some theoretical concept like a production function and non structural measures of the trend component of real GDP. Because of the lack of adequate data one is practically restricted to non structural measures. In the group of non structural measures one can use multivariate (like the Blanchard/Quah-decomposition) and univariate (like detrending or Hodrick-Prescott-filtering) methods. We focus on univariate methods to keep the discussion simple and reproducible for practitioners. The following univariate detrending methods are considered and applied to real

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2 Note the defence of HP-filtering by Burnside (1998).

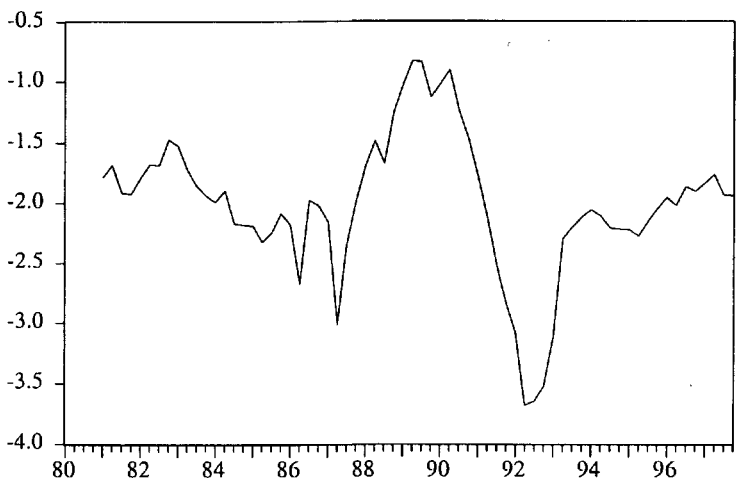
3 Compare Scheide (1998) for a critical discussion of both concepts with respect to Euroland.

GDP: (log)-linear deterministic detrending, a segmented trend and the Hodrick-Prescott-filter.

Most of the methods need some additional assumption before they can be used. In the case of the segmented trend - a linear trend allowing for at least one structural break - we need an assumption at which point in time the structural break occurs. A method to search for a possible structural break in the trend of real GDP is applied (Kim 1997, Zivot and Andrews 1992). The following test equation for a unit root is used:

$$(1) \quad \Delta y_t = \mu + \beta t + \gamma D t_t + \alpha y_{t-1} + \sum_{i=1}^{i} c_i \Delta y_{t-i} + e_t$$

Figure 1: Test for a Single Structural Break in the Deterministic Trend of Real GDP in Euroland



where y denotes the time series under investigation, D a dummy variable and t the deterministic trend. Then standard Dickey-Fuller-test are calculated for alternative breaking points. When the absolute value of the test statistic (Zivot-Andrews-statistic) reaches its maximum, a structural break is identified. This procedure follows the argument that an I(1)-variable can (and should) be

decomposed in an I(1)-trend-component and an I(0)-cyclical-component. This procedure compared to the original idea is simplified in two ways (Kim 1996: 72): First, we do not allow for a structural break in the constant, but only in the trend variable. Second, after one structural break is identified, the procedure is not applied again. Both restrictions reflect the fact that the time series is very short. Figure 1 shows the result of the test procedure. It identifies a structural break in Q.3, 1992. Therefore, we take this quarter as a breaking point in calculating the segmented trend of real GDP.[4]

In the case of the Hodrick-Prescott-filter the "industrial standard" is used and the smoothing parameter is set equal to 1600.[5] This implies that the average length of the cycle is assumed to be 4 to 6 years. Predicted values are not included. Hence, the size of the recent output gaps cannot be interpreted in a meaningful way (Baxter and King 1995: 20).

Figure 2 compares the results of the three detrending methods. It turns out that there are no obvious differences in the dating of business cycle turning points, only some regarding the sign of the current output gap.

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4 The estimated trend functions are (t-values in brackets):

- in case of the log-linear trend: $\ln(y)_t = \underset{(3104)}{13{,}6} + \underset{(53{,}8)}{0{,}0057}t + \hat{u}$, R2: 0,98.
- in case of the segmented log-linear trend: $\ln(y)_t = \underset{(2493)}{13{,}6} + \underset{(33{,}4)}{0{,}0062}t + \hat{u}$ up to 2.Q., 1992, R2: 0,96, $\ln(y)_t = \underset{(*)}{13{,}6} + \underset{(21{,}3)}{0{,}0002}t + \hat{u}$ beginning in 3.Q, 1992, R2: 0,90.

5 This value can be interpreted as a signal to noise-ratio. In their original paper Hodrick and Prescoot argue, that " a five percent cyclical component is moderately large as is a one-eighth of one percent change in the rate of growth in a quarter" (Hodrick/Prescott 1997: 4). This leads to $1600 = \left(\frac{5}{1/8}\right)^2$ (see Hodrick and Prescott 1997: 4, Brandner and Neusser: 70 ff.).

Table 1: Business Cycle Turning Points and Output Gaps in Euroland Using Alternative Measures of the Cycle 1980 I - 1997 IV

	Method				
Turning point	Hodrick-Prescott-filter	Linear determi-nistic trend	Segmented trend	Change over previous quarter[a]	Change over previous year
Trough	1982. IV	1982. IV	1982. IV	1982.IV	1982.IV
Peak	1984. I	1984. I	1984. I	(-)	(-)
Trough	1987. I	1987. I	1987. I	(-)	(-)
Peak	1992.I	1991.II	1991.II	1987.IV	1988.I
Trough	1993. III	1993. IV	1993. III	1993.I	1993.I
Peak	1995.I	1995.I	1995.I	1997.IV	1995.I
Trough	1997.I	1997.I	1997.I	(-)	(-)
Mean	-0.01	-0.00	-0.13	0.50	2.06
Median	-0.09	-0.62	-0.27	0.51	2.32
Maximum	1.92	4.34	5.37	1.85	4.71
Minimum	-1.85	-2.72	-3.19	-1.09	-1.76
Std. Dev.	0.87	1.86	1.73	0.80	1.39
			Autocorrelations		
Order 1	0.76	0.91	0.86	0.11	0.80
Order 2	0.59	0.83	0.75	0.15	0.64
Order 3	0.43	0.74	0.64	0.18	0.48
Order 4	0.28	0.65	0.53	0.11	0.29
Order 8	-0.16	0.24	0.08	-0.09	0.06
Order 12	-0.34	-0.11	-0.24	-0.25	-0.10

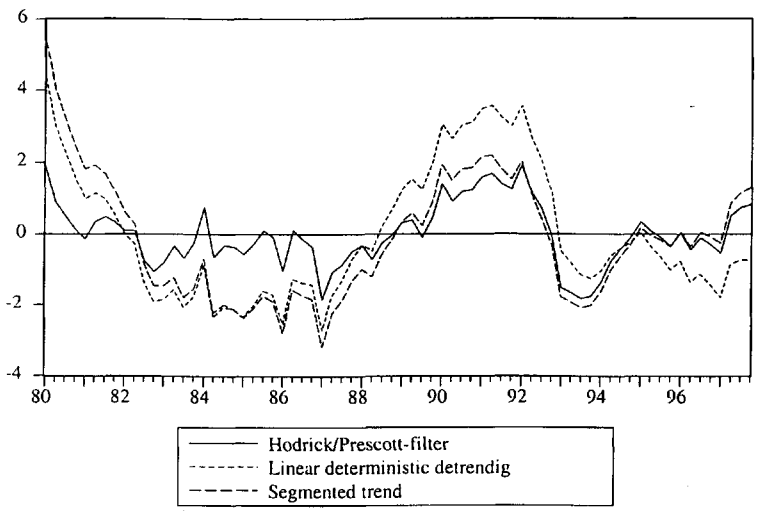
[a]Turning point determination based on a 3-quarter-moving average.

Source: Own calculations.

Table 1 shows the output gaps together with turning points given by the changes over previous quarter or previous year, respectively. A peak is given by a local maximum of the output gap, troughs are defined its local minima. Since the start of the European Exchange Rate Mechanism there are only three complete cycles (measured from trough to trough). This sets limits to any empirical analysis. Compared with Germany the recession in Euroland in 1982 looks a little bit less bad. One possible explanation for this is the expansionary economic policy in France at that time.

The Hodrick-Prescott-filter shows a positive output gap already in the course of 1997. However, the filter is not valid with respect to this question, because it is not appropriate at the beginning and the end of the sample. For this reason Baxter and King (1995: 20) recommend the use of twelve quarters of additional data before interpreting the filter. In contrast to the filter, the linear detrending leads to the conclusion, that the output gap in Europe is still negative. It implies an annual trend growth of Euroland's real GDP since 1980 of about 2.4 p.c. To some extend, the segmented trend method is a compromise between the flexible Hodrick-Prescott-filter and pure deterministic detrending. This method leads to a trend growth of 2.6 p.c. before the break in 1992 and of only 1.7 p.c. thereafter. The consequence is a positive output gap in 1997. This is in contrast to recent estimates of the OECD.[6]

Figure 2: Output Gaps in Euroland Using Alternative Detrending Methods



6 The joint report of five institutes on the European economy provides a comparison between output gaps based on a Hodrick-Prescott-filter and the estimates of the OECD (CPB, IfW, NIESR, OFCE, PROMETEIA 1998: 9 ff.).

Although there is a wide range of uncertainty concerning the size of the output gap in Euroland, all competing methods lead more or less to the same dating of turning points. Hence, one can conclude that Euroland is right now in an upswing. All methods used - including first differences and changes over previous year - confirm a substantial cyclical behavior of Euroland's real GDP. The length of the cycle does not change by very much: The autocorrelation coefficient of order 12 is negative in all cases, in most of them this does hold for autocorrelation of order 8 as well.

3. The Importance of Different Types of Expenditures

Very often in practical business cycle analysis the question arises, which demand category of the economy is responsible for the fluctuations in economic activity. To have a first look at this, Lundberg-components of real GDP growth are calculated.[7] The results are given in table 2. The rows show the contribution of each demand category to the change of real GDP for any year since 1980 in percentage points. At the end of the table averages and standard deviations are given and compared to the same numbers for the U.S. and West Germany, respectively.

It turns out, not surprisingly, that on average private consumption has the biggest contribution to growth. This is of course due to the fact that this category comprises 60 p.c. of real GDP. If instead the volatility of the series as measured by the standard deviation of the Lundberg-components is taken into account, the judgment is different: Net exports and investment seem to be responsible for to large extent for the fluctuations in economic activity. Periods with weak or even negative GPD-growth (1981, 1982, 1993, 1996) are typically characterized by weak investment. On the average, the change in stock building

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7 Say real GDP is given by GDP = X+Y, where X and Y stands for types of expanditures or sectors, respectively. Then, the Lundberg-components for the period t are given by $\frac{GDP_t - GDP_{t-1}}{GDP_{t-1}} = \frac{X_t - X_{t-1}}{GDP_{t-1}} + \frac{Y_t - Y_{t-1}}{GDP_{t-1}}$. See Tichy (1994) for a more comprehensive analysis.

Table 2: Lundberg-Components of the Real Demand Components of GDP in Euroland 1980 I - 1997 IV

	Year	Change of GDP	Private con-sump-tion	Govern-ment con-sump.	Change in stocks	Invest-ment	Net ex-ports
	1981	0.10	-0.26	0.40	-1.42	-0.44	1.82
	1982	-0.31	-0.21	0.29	0.14	-0.62	0.09
	1983	1.64	0.67	0.29	0.60	-0.42	0.50
	1984	2.65	1.00	0.32	0.35	0.21	0.76
	1985	2.40	1.45	0.44	0.00	0.45	0.07
	1986	2.62	2.06	0.44	0.60	0.55	-1.03
	1987	2.39	2.33	0.49	-0.19	0.74	-0.98
	1988	3.85	2.02	0.47	0.24	1.19	-0.07
	1989	3.65	2.08	0.08	0.24	1.20	0.06
	1990	4.35	2.58	0.38	0.70	0.80	-0.10
	1991	3.43	2.60	0.31	0.14	0.50	-0.11
	1992	1.34	1.36	0.31	-0.24	-0.10	0.02
	1993	-1.00	-0.54	0.19	-0.58	-1.62	1.54
	1994	2.68	0.90	0.09	0.89	0.46	0.35
	1995	2.41	1.15	0.03	0.21	0.72	0.30
	1996	1.61	1.15	0.26	-0.62	0.23	0.59
	1997	2.47	0.85	0.07	0.47	0.41	0.67
Average		2.13	1.25	0.29	0.09	0.25	0.26
Standard Deviation		1.41	0.94	0.14	0.56	0.69	0.70
		U.S. (1981-1996)					
Average		2.59	1.90	0.29	0.04	0.54	-0.17
Standard Deviation		1.99	1.01	0.25	0.82	0.91	0.58
		West Germany (1981-1994)					
Average		2.10	1.16	0.26	0.01	0.15	0.59
Standard Deviation		1.97	1.02	0.28	0.51	0.99	0.79

Source: Eurostat (1998), own calculations and estimations.

relative to previous years' GDP is negative as well. The Lundberg-component of net exports is positive, but not as high as for West-Germany. Hence, foreign trade is less important for the European cycle than for the cycle of West Germany. However, the Lundberg-component is still positive, whereas it is negative on the average for the U.S. In general, the Euroland data look more similar to the German than to the U.S. data. It seems that Euroland lies

somewhat in between a very large country like the U.S. and West Germany, which is often seen as a small open economy.

Turning to the importance of the different sectors of the economy in Euroland, Eurostat (1998) reports that the services sector counts for more than 50 p.c. of GDP. However, this does not imply that this sector is the driving force behind the cycle. Unfortunately, time series for sectors of the economy are not yet available on the European level. Hence, one of the most popular stylized facts, the co-movement of the cycle of the sub-sectors of the economy, cannot be discussed here.

4. The Cyclical Behavior of Selected Macroeconomic Time Series

Searching for lag or lead relationships as compared to the cyclical component of real GDP simple cross-correlations of the cyclical component of the time series under investigation and the business cycle are used. Following the previous discussion, only deviations from a Hodrick-Prescott-filter are taken as a measure for the cyclical component of each series.

Table 3 shows the results for Euroland and gives the correlation coefficients for selected lags and leads. The columns stand for lags or leads, respectively. For example, the correlation of private consumption lagged 8 quarters and GDP is -0.21. The rows show several groups of time series. The maximum of the absolute value of the correlation coefficient's for each time series is denoted by a *. Note however, that this does not imply that the correlation has to be significant in any statistical sense.

Table 3: Cross Correlations of the Cyclical Component of Selected Time Series with the Cyclical Component of Current Real GDP in Euroland 1980 I - 1997 IV

Time Series	t-8	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4
					Demand Components					
Private consumption	-0.22	0.08	0.20	0.34	0.51	0.75*	0.66	0.66	0.60	0.54
Government consumption	0.02	-0.23	-0.23	-0.20	-0.16	-0.17	-0.03	0.04	0.19	0.28*
Investment	-0.07	0.32	0.46	0.61	0.75	0.87*	0.80	0.70	0.57	0.37
Stock building	0.19	0.30	0.32	0.34	0.37	0.42*	0.29	0.17	0.03	-0.07
Net exports[a]	-0.10	-0.17	-0.19	-0.22	-0.26	-0.33	-0.39	-0.43*	-0.41	-0.32
					Monetary Time Series					
Narrow money supply	0.16	0.40*	0.39	0.37	0.30	0.21	0.07	-0.04	-0.08	-0.12
Broad money supply	-0.18	0.02	-0.00	0.02	-0.06	-0.12	-0.10	0.01	0.13	0.29*
Velocity, narrow money	-0.38	-0.31	-0.19	-0.05	0.16	0.42	0.44	0.47*	0.45	0.40
Velocity, broad money	-0.39	-0.12	0.07	0.25	0.47	0.73*	0.67	0.59	0.47	0.30
Long-term interest rates	-0.05	0.08	0.17	0.26	0.36	0.38	0.40*	0.36	0.28	0.20
Short-term interest rates	-0.11	-0.17	-0.07	0.07	0.25	0.37	0.48	0.53	0.56*	0.56
					Labour Market Variables					
Employment[b]	-0.09	0.38	0.50	0.62	0.71	0.78*	0.77	0.71	0.63	0.51
Unemployment[b]	0.08	-0.36	-0.46	-0.56	-0.68	-0.77	-0.81*	-0.79	-0.69	-0.54
Labour productivity[b,c]	-0.11	-0.00	0.09	0.18	0.36	0.63*	0.27	0.03	-0.11	-0.20
					Prices and Wages					
Real wages[b,d]	-0.20	-0.10	0.02	0.13	0.30	0.55	0.56	0.63*	0.63	0.60
Consumer prices	-0.39	-0.39*	-0.36	-0.31	-0.29	-0.30	-0.23	-0.16	-0.18	-0.01

The hypothesis of a coefficient equal zero is rejected, if the empirical value lies outside the range +/- $2/\sqrt{T}$ = +/- 0.24 where T denotes the numbers of observations (72). - [a]level in p.c. of real GDP. - [b]Estimates based on the five largest countries (Germany, France, Italy, Spain, Netherlands). - [c]Real GDP per employee. - [d]Compensation of employees per employee.

Source: Own Calculations.

Private Consumption appears to be strongly pro-cyclical. There is virtually no lag or lead. Government consumption is non-cyclical coincidentally, but pro-cyclical if a lag of 4 quarters is taken into account. Although some of the correlation's with the business cycle are negative the findings are more in line with a passive behavior of public expenditures reacting to the business cycle, rather than with a strong anticyclical behavior of government outlays. Investment is

clear-cut procyclical. Contrary to widespread beliefs, investment does not lead the reference cycle. Net exports are counter-cyclical with a substantial lag. One might argue that this result is plausible for a relatively great area like Euroland, but it is supported by similar findings for smaller countries. The main reason could be that imports occur normally to be strong pro-cyclical, whereas exports show no clear-cut cyclical behavior. This sounds plausible here, because Euroland's exports go to regions which do not have a pronounced cycle yet, like Eastern Europe or Asia. But given the lack of data, one cannot analyze this interpretation. Stock Building is pro-cyclical with no lags or leads. There is a lot of literature why this might be the case, contrary to the production smoothing model of inventory investment. However, there is good reason for interpreting this data very cautiously, because they are calculated as a residual and, therefore, contain all errors made in the aggregating process. To sum up, the results confirm that using standard business cycle analysis can be sensibly applied to Euroland, as well.

Turning to monetary variables, the main results are the following: Narrow money supply variable shows a positive correlation and a lead compared to the reference cycle by about four quarters. Broad money supply is non-cyclical for virtually any lead or lag presented in table 3. But there are some stronger correlations with higher lags (t+8: 0.67). Narrow money appears to be a better business cycle indicator, whereas broad money tends to follow the cycle and is usually found to be more closely related to the coming inflation.

Nominal long-term interest rates show a positive correlation and seems to have a lag of one quarter. This is in line with the view that long-term interest rates are not only the result of monetary policy but reflect also inflation expectations and therefore the stance of the business cycle. Short-term interest rates show a negative correlation when leading the reference cycle and a positive one, when lagging the business cycle. The first result indicates that monetary policy has an influence on the business cycle. The latter finding can be interpreted as a hint of the existence of a monetary reaction function: Monetary policy tries to make at least some attempts to dampen the cycle. But

one has to take the aggregation method used here is particular problematic for interest rates.[8]

The analysis of the labor market variables gives the following results: Employment is pro-cyclical and unemployment is counter-cyclical with almost no lag or lead. Additionally, the calculations show a strong pro-cyclical behavior of labor productivity. Some authors argue that such results should be regarded as evidence for real sources (i.e. productivity shocks) of the business cycle. However, this stylized fact can be explained along the lines of more traditional business cycle theories. One explanation might be labor hoarding (for a discussion of the relevance of recent business cycle theories for practitioners see IMF 1998). Moreover, Keynesian models of the cycle would predict significant lag/lead structures here. A pro-cyclical movement of productivity therefore cannot discriminate between the competing explanations of the cycle. An analysis of hours worked could help here, but there are no such data on the pan-European level. Real wages are pro-cyclical and lagging. Again, this finding might be of interest concerning the factors affecting the cycle. Some authors argue that a pro-cyclical development of real wages has the same roots as the pro-cyclical behavior of labor productivity. On the other hand, there are again explanations more in line with a demand orientated view of the cycle like, for example, a cyclical variation of mark-up pricing.

Generally, the European data will not clarify the problems which arise in the analysis of single countries, but they produce a quite similar pattern. Therefore, it seems to be reasonable to analyze aggregated Euroland data at least in addition to the data from individual countries.

Table 4 gives an overview of the results compared to previous studies. They are broadly in line with stylized facts for industrial countries (see Boone and (1995) for the UK, Smeets (1992) for Germany, Serletis and Krause (1996), Stock and Watson (1998) for the U.S., and Maußner (1992), Tichy (1994) for surveys). There is, however, one exception. The broad quantity of money is clearly pro-cyclical in the studies cited above, whereas the analysis of the Euroland data leads to more or less non-cyclical coincident behavior.

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8 If one takes the German interest rates instead of GDP-weighted Euroland interest rates the correlations become stronger.

The list of stylized facts presented here is far from complete. In particular, some of the most disputed facts are not investigated. For example, one would expect to find a pronounced cyclical behavior of order inflows, capacity utilization and expectations as measured in surveys (see Tichy 1994: 73 for a longer list of often neglected stylized facts). However, the analysis is restricted mostly by the lack of data. One should keep these limits in mind before drawing conclusions on the factors driving the cycle.

Table 4: The Cyclical Behavior of Selected Euroland Time Series 1980 I-1997 IV

In column 2 (+) denotes pro-cyclical, (-) anti-cyclical, (0) non-cyclical behavior of the deviation from a HP(1600)-Trend of the time series (the level in case of the interest rates) relative to the deviation of real GDP. For Columns 3 and 4 compare to the studies cited.

Time Series	Euroland	Germany	US
	Components of real GDP		
Private Consumption	(+)	(+)	(+)
Government Consumption	(0)/(-)	(0)	(0)
Investment	(+)	(+)	(+)
Stock Building	(+)	(+)	(+)
Net-Exports	(-)	(-)	(-)
	Production and Employment		
Correlation of broad defined sectors	n.a.	(+)/(0)	(+)
Labor Productivity	(+)	(+)	(+)
Employment	(+)	(+)	(+)
Unemployment	(-)	(-)	(-)
Prices			
Consumer Prices	(-)	(-)	(-)
Real Wages	(+)	(+)	(0)/(+)
Monetary Variables			
Short term interest rates	(+)	(+)	(+)
Long term interest rates	(+)	(+)	(0)
Narrow Money Supply	(+)	(+)	(+)/(0)
Broad Money Supply	(0)	(+)	(+)
Velocity of (narrow) Money	(+)	(+)	(+)

Sources: Own calculations, Smeets (1992) Brandner and Neusser (1992), Serletis and Krause (1996), Stock and Watson (1998), Tichy (1994), Maußner (1992).

For a better understanding of the sources of the cycle the volatility of the series might provide additional insights. Table 5 shows volatility measures for

selected variables.[9] It turns out, that investment, stock building and net exports are the most volatile demand components. Private and government consumption are much smoother. Narrow money seems to be more volatile than broad money, but this might be due to the fact that monetary aggregates of different definitions have been aggregated. The volatility of interest rates looks relatively high, but one should note, that this definition of volatility is not a standard one concerning interest rates.

Table 5: Volatility of Selected Variables 1980 I - 1997 IV

Times Series	Absolute Volatility	Relative Volatility
Real GDP	0.87	1
Private Consumption	0.76	0.87
Government Consumption	0.54	0.62
Investment	2.18	2.51
Stock Building[a]	0.81	(-)
Net-Exports[a]	1.13	(-)
Narrow Money Supply	1.60	1.84
Broad Money Supply	0.76	0.88
Long Term interest rates[b]	2.21	2.55
Short Term interest rates[b]	2.81	3.24
Employment[c]	0.68	0.78
Unemployment[c]	4.32	4.99
Labor Productivity[c,d]	0.54	0.62
Consumer Prices	0.83	0.96

[a]Level in p.c. of real GDP. - [b]Level, c: Estimation based on five largest countries. - [d]Real GDP per employee.

Source: Own calculations.

9 For trending variables we take the standard deviation from a Hodrick-Prescott-filtered series a measure for volatility. For series which are analysed in levels (e.g. interest rates), the standard deviation of the time series itself is considered.

5. Are the Correlations Stable over Time?

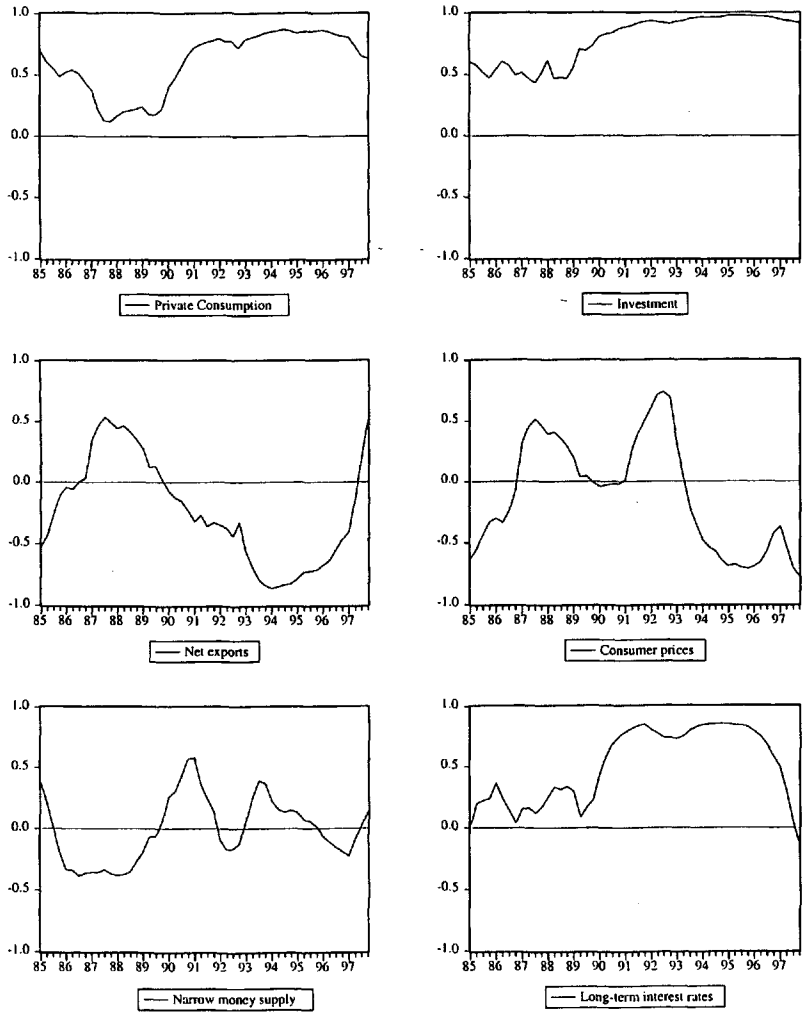
To accept the findings above as truly stylized facts, they should be stable over time. Therefore, cross correlations of five year moving averages for selected time series are calculated following (Smeets 1992). Five years are chosen, because Hodrick-Prescott-filtering with a damping factor of 1600 implies the assumption of an average length of the business cycle of about 4 to 6 years. Figure 3 shows the results. In general, the findings for the demand components of GDP look fairly stable. However, this does not hold for the net exports. Here even the sign of the correlation coefficient changes within a relatively small time period. The same is true for the price level. The narrow money supply appears to be non-cyclical, whereas the long-term interest rate seems to be pro-cyclical for the larger part of time under investigation. All in all, although there are some regularities concerning Euroland's business cycle and therefore, to some extent "business cycles are all alike", there are obviously specific factors in every single cycle (Schebeck and Tichy (1984)).

6. The Co-movement of Business Cycles Across the Member Countries

Another important question is whether there is a solid correlation of the business cycle across all member countries of EMU. If there is a significant positive correlation between the output gaps of the countries, this fact would indicate that the sources of Euroland's cycle are more of a macroeconomic rather than country-specific (for detailed discussion see Wynne and Koo 1997). For a first look at the data for every country in Euroland the industrial production representing the rest of Euroland is constructed[10]. For this purpose real GDP-weights are used. Table 5 shows that there is indeed a positive correlation coefficient for the most of the countries with the output gap of the rest of Euroland. However, this is clearly not the end of reasoning here. For

10 Artis and Zhang (1997) use the correlations with the largest economy of Euroland, Germany, and the US and UK respectively

Figure 3: Cross Correlations of Real GDP and Selected Time Series in Euro-land - Five Year Rolling Correlation Coefficients



example, one gets at least mixed results, if one uses the Blanchard/Quah-decomposition for identifying demand and supply shocks (Eble et al. 1997) as a proxy for asymmetric shocks. In the presence of such shocks monetary policy will face difficult challenges (for a discussion see Siebert 1998 and Scheide and Solveen 1998). Even the simple kind of analysis applied here raises some questions on the problems to come for a common monetary policy. There are countries that seem not to follow a common European cycle. For example, the correlations for Portugal with virtually all other countries are hardly significant (see table 6). The same holds for Belgium. The results do not change very much, if, instead of a trend extraction, the change over previous year is used. The calculation can be found in table 6 below the diagonal.

Table 6: Correlation Coefficients of Output Gaps in Manufacturing (above diagonal) and Change over Previous Year of Manufacturing Production (below diagonal) across Euroland 1980 I - 1997 IV

	Germany	France	Italy	Spain	Portugal	Netherlands	Ireland	Austria	Luxemb.	Finland	Belgium
Germa.	1.00	0.76	0.49	0.64	0.40	0.80	0.44	0.85	0.60	0.24	0.29
France	0.77	1.00	0.66	0.82	0.51	0.68	0.60	0.64	0.60	0.51	0.46
Italy	0.55	0.72	1.00	0.72	0.35	0.56	0.59	0.42	0.49	0.54	0.36
Spain	0.65	0.81	0.71	1.00	0.53	0.54	0.55	0.50	0.43	0.57	0.44
Port.	0.29	0.32	0.17	0.33	1.00	0.25	0.22	0.30	-0.03	0.26	0.19
Netherl.	0.78	0.70	0.62	0.54	0.17	1.00	0.56	0.75	0.69	0.28	0.33
Ireland	0.29	0.48	0.56	0.47	-0.12	0.46	1.00	0.35	0.51	0.45	0.45
Austria	0.83	0.68	0.54	0.54	0.17	0.71	0.33	1.00	0.60	0.22	0.21
Luxb.	0.60	0.59	0.52	0.44	0.00	0.65	0.33	0.54	1.00	0.29	0.54
Finland	0.27	0.47	0.43	0.53	0.18	0.30	0.51	0.30	0.24	1.00	0.31
Belg.	0.33	0.42	0.32	0.44	0.09	0.37	0.27	0.24	0.59	0.20	1.00

Calculated with a Hodrick/Prescott-Filter.

Source: OECD, Own Calculations.

However, the correlations are calculated for the average of the sample-period. It is another question whether the correlation coefficients are increasing over time. This would indicate that more and more a common European business cycle is developing and therefore the problem of diverging cycles between the member countries for policy makers might be smaller than expected. Economic theory would suggest that the correlations are likely to increase because a move to more fixed exchange rates should decrease the degree to which national

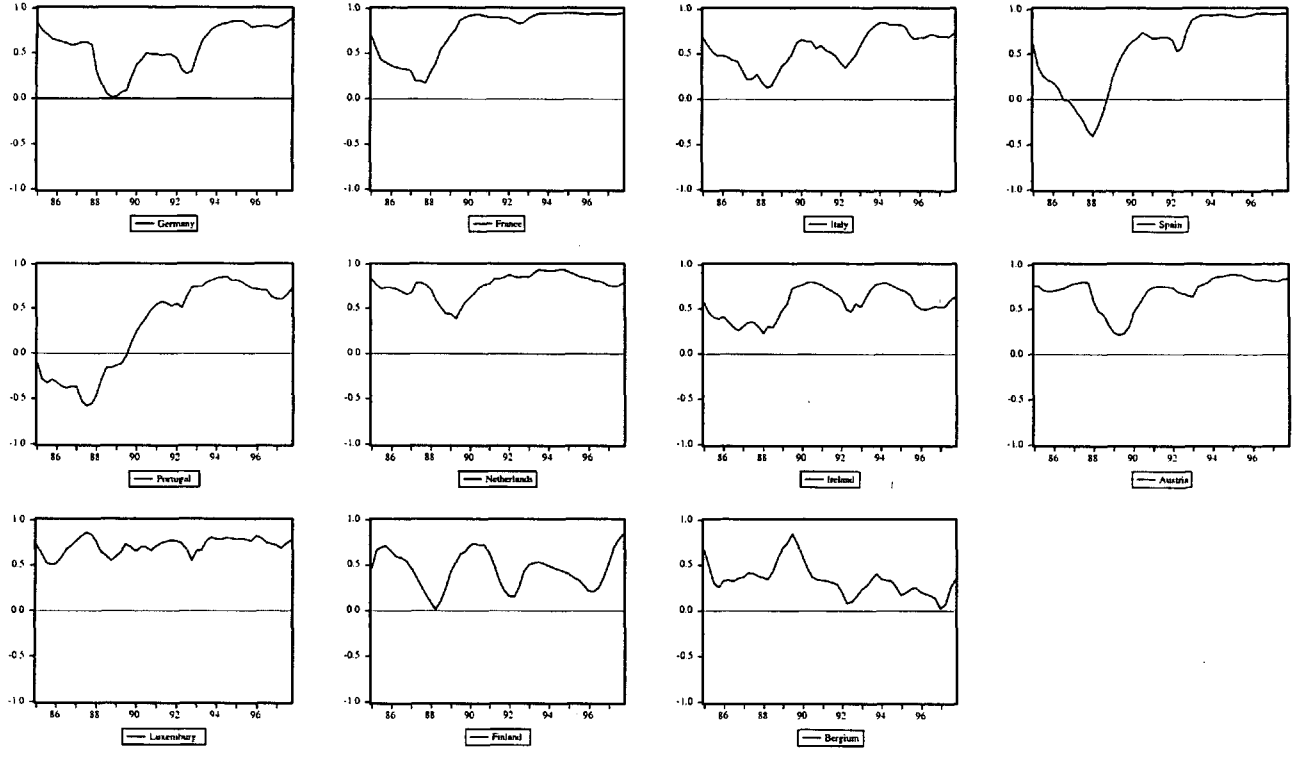
economies are insulated from the effects of foreign or global disturbances. (Kouparitias 1997).

To shed a light on this question, rolling five-year-correlations are calculated. The results indicate, that there is indeed more and more a common European cycle. Especially countries like Portugal and Spain are more in line with the rest of Europe after they joined the European Monetary System. However, there are some correlations which move in the opposite direction, namely in the case of Belgium. Due to the lack of data, one has to use the industrial production instead of GDP to catch all 11 members. Using a broader defined variable in measuring the business cycle is could lead to different results in the presence of structural change in the sectoral production structure.

7. Conclusions

This paper gives some stylized facts of Euroland's business cycle. All in all, the use of constructed aggregated data series makes economic sense. The results are broadly in line with findings for individual countries like Germany or the US. This leads to a second important conclusion: Experiences from past business cycles are still useful. The introduction of the Euro does not lead to a completely new pattern of macroeconomic variables. Moreover, the analysis of Lundberg-components leads to the conclusion that Euroland might more seen as small and open economy rather than a big and closed one like the U.S.

Figure 4: Correlations of Manufacturing Output Gaps Across Euroland - Five Year Rolling Correlation Coefficients



Appendix: Sources of the Times Series and the Methods of Aggregation

All times series are from the OECD, Quarterly National Accounts or from the OECD, Main Economic Indicators. If necessary, the data are rebased to constant prices of 1990 (or to an index 1990 = 100) and seasonally adjusted with the Census X-11 procedure. The time series measured in local currencies are converted into a single currency using the ECU-central rate. Most of the types of expenditure can then just be summed up. However, this does not hold for exports and imports unless the intra-EMU-trade is eliminated. Hence, only the behaviour of net exports is under investigation, only. Note that the increase of stocks is defined as a difference between GDP and the sum of all other components, i.e. this variable includes all statistical errors and omissions. The German series are adjusted, if necessary, for the effect of German unification. The aggregating procedure of EMU monetary aggregates is basically the same as described above: individual countries' monetary aggregates are converted at actual ECU-central rates and added. All other series are GDP-weighted averages. The weight is given by the share of the resprective country real GDP relative to total Euroland GDP. For more details compare Döpke et. al. 1998: 17 ff.

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