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DISCUSSION PAPER

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Summary

This paper empirically assesses the impact of specialisation on the synchronisation of regional business cycles in two core countries of EMU, namely France and Germany. Several specialisation indices are introduced and some first stylised facts about inter-regional business cycle correlations are derived. Second, region pair specific and pooled estimations are enacted and tested for robustness in order to calculate the impact of specialisation on the degree of business cycle synchronisation. However, our regression results confirm the hypothesis of a positive impact only partly, but they underline the problem of a common monetary policy for uncommon regions which has already existed in the DM- and in the Franc-zone before.

Zusammenfassung

Der vorliegende empirische Beitrag untersucht die Auswirkungen realwirtschaftlicher Veränderungen auf den konjunkturellen Gleichlauf regionaler Konjunkturzyklen. In einem ersten Schritt werden zunächst verschiedene Maßzahlen zur Bestimmung der regionalen Spezialisierung sowie einige stilisierte Fakten bezüglich des Synchronisationsverhaltens regionaler Konjunkturzyklen vorgestellt. In einem zweiten Schritt wird auf der Basis ökonometrischer Verfahren der quantitative Einfluss von Strukturveränderungen auf den Synchronisationsgrad ermittelt. Zwar kann die aufgestellte Hypothese einer messbaren Einwirkung nur partiell bestätigt werden, die Resultate reflektieren jedoch das schon in der DM- und Franc-Zone bestehende Problem einer gemeinsamen Geldpolitik für unterschiedliche Regionen.

JEL-Codes: E32, F15, R23

Keywords: Agglomeration, Specialisation, Regional Employment, European Monetary Union, Regional Business Cycles, Synchronisation

1 INTRODUCTION

One obvious caveat against EMU is that for example its **one size fits all** monetary policy cannot do justice to such a heterogeneous area as the EMU11. There has been considerable theoretical and empirical research on this general issue, but the latter has usually emphasised differences **across countries**, assuming implicitly (instead of testing explicitly) that countries are **homogenous entities**. However, the implicit assumption of homogenous entities is **not warranted**. The general concern about the cost of having a common policy for a heterogeneous area mainly stems from two aspects:

1) The common monetary policy stance might not be optimal for all regions because the latter might be at different stages of the business cycle.

2) The common monetary policy might have quite different effects in regions with a low degree of intra-industrial trade. In both cases, regionally asymmetric shocks would result and raise the claim for stabilising transfer mechanisms (*Belke* and *Gros* 1998).

Several authors tried to find (exogenous) factors endogenising the OCA-criterion **degree of synchronisation**, e.g., *Frankel* and *Rose* (1998), *Imbs* (1999) among others. In our paper, we go one step further and endogenise the degree of the **regional business cycle synchronisation** by the former exogenous OCA-criterion **degree of specialisation**, approximated by several **specialisation indices**.

The structure of our paper is as follows: In the first chapter we introduce the theoretical background, combining the empirical literature of the European national and regional business cycles with the **New Economic Geography**. After explaining the used data in detail, the method of constructing the "specialisation index" and the estimation procedures, we will have a short view on the descriptive statistics of the synchronisation of regional business cycles in the core EMU countries France and Germany. In chapter four we will discuss the empirical results of our individual and our pooled regressions. Chapter five concludes.

2 THEORETICAL BACKGROUND

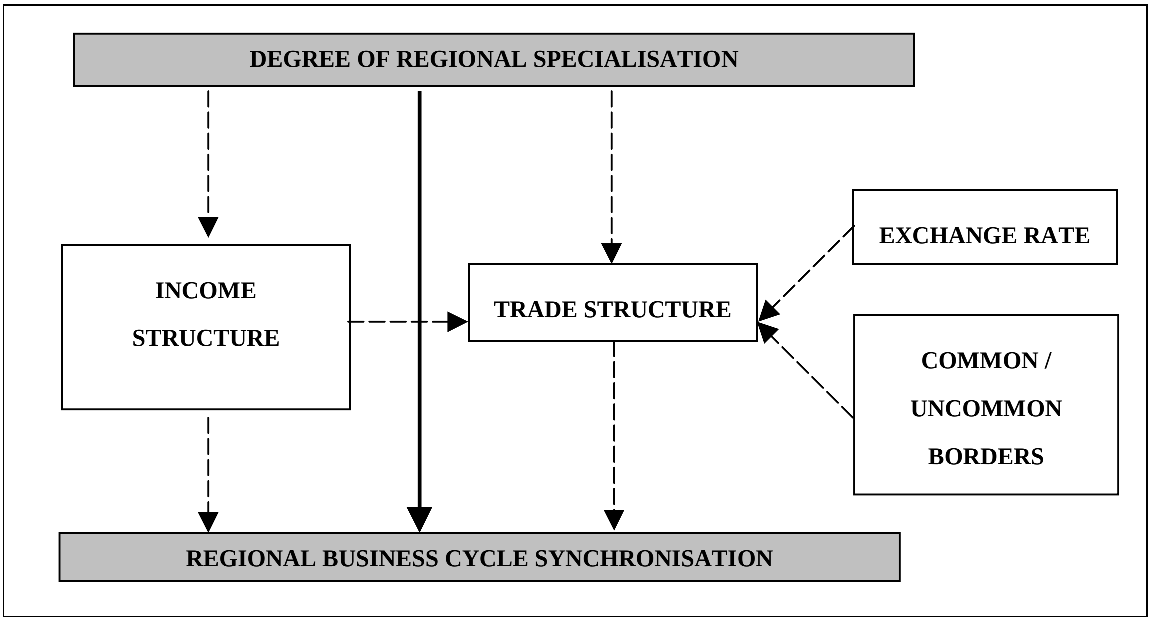
Increasing synchronisation of **national** business cycles within Europe was investigated empirically by many authors. As the main reasons, the shaping of the European Monetary System in 1979 (*Artis* and *Zhang* 1997), increasing international trade (*Frankel* and *Rose* 1997), identical income and sectoral structures between two economies (*Imbs* 1999) or the existence of a common border (*Clark* and *Wincoop* 1999) have been identified.

Artis and *Zhang* (1997) investigate the filtered time series of industrial production in different countries (**national** cycles) and regress these filtered series on the filtered U.S. and German benchmark cycle. As their main result, these authors emphasise that the continental European countries display a business cycle behaviour which has become increasingly synchronous to the German and less so to the U.S. cycle after the creation of the EMS in 1979. Based on his own analysis, *Fatás* (1997) concludes that the synchronisation of **regional** business cycles to an European aggregate has increased since the start of the EMS. He applies the growth rate of employment within a region as an indicator of its business cycle stance and makes use of the fact that the first differences filter of logarithms approximately correspond to the realisations of the growth rate. *Fatás* as well as *Forni* and *Reichlin* (1997) were the first who stressed the potential importance of the regional dimension. Both *Fatás* as well as *Artis* and *Zhang* emphasise the role of the **exchange rate regime**, i.e. the EMS, in determining the cyclical behaviour of macroeconomic time series and the degree of bilateral correlation of the business cycles. By this, they merely focus on the role of a **nominal** variable. However, the impact of real variables on the degree of synchronisation is still neglected.

Focusing on different *real* impact variables, *Frankel* and *Rose* (1998) examine the impact of **aggregated foreign trade** on the synchronisation of national business cycles. They draw the conclusion that an increase in foreign trade generally leads to more synchronicity of the cyclical movements of the national economic time series. However, *Imbs* (1999) qualifies the main result gained by *Frankel* and *Rose*. His results significantly reduce the potential role of foreign trade in explaining co-movement of national business cycle indicators. Instead, he finds that **relative economic structures, relative sectoral production patterns and relative total economy incomes** are the main determinants of the degree of synchronisation of national business cycles. *Clark* and *Wincoop* (1999) investigate the evidence of the within-country and across-countries business cycle synchronisation for Europe and the U.S. As one result, the correlation of economic variables within the U.S. were higher than in Europe. They conclude that these differences were due to the **existence of (national) borders**, but there seems to be evidence that this border effect has become smaller in Europe in the eighties of the last century.

Our study takes up the above starting-points and tries to trace back the synchronisation of regional cycles to **idiosyncratic sectoral developments** within different regions for two main EMU countries (France and Germany). The latter are - as a stylised fact - characterised by the **emergence of agglomerations**. That is, certain regions experience a change in their employment figures and at the same time economic activity becomes concentrated in certain industry branches. This in turn has a sustained impact on the economic performance and the degree of specialisation of the respective regions. As shown in figure 1, we assume the degree of regional specialisation to be the driving force of the shape of the regional income structure, the regional intra-industrial trade and at least the regional business cycle synchronisation, while we do not stress the interdependences between the income structure and the structure of trade.

Figure 1: The relationship and the interdependences between the degree of specialisation and the synchronisation of regional business cycles



In order to examine the nature of the relationship between the degree of regional specialisation and the fluctuation of the regional business cycle, we intend to **quantify the sectoral change** caused by European integration for the last two decades. For this purpose, we construct several annual indices (in the following called **specialisation indices**) for two core EMU countries, which we will introduce in section 3. Since it is generally acknowledged that a **disaggregated representation** of a business cycle displays higher informational contents than its aggregated representation (different regional developments cancel out at the aggregated level) and the agglomeration phenomenon can more accurately be grasped by a higher resolution we decided to choose the **regional** dimension as emphasised and focused on by *Fatás* (1997), *Forni* and *Reichlin* (1997) and *Clark* and *Wincoop* (1999) as well.

Our paper is motivated by the seminal study of *Artis* and *Zhang* who for the first time explicitly tested for the synchronisation of European business cycles dependent on the exchange rate regime. However, our analysis differs from the latter in several respects. First, in contrast to *Artis* and *Zhang*, our procedure is not limited to the analysis of benchmark cycles but we correlate all possible region pairs. Second, we emphasise the **regional** dimension in the same way as *Fatás* (NUTS1) by approximating the regional cycle by the **growth rate of total regional employment**. Third, we do not emphasise the role of nominal impact variables, as e.g. the exchange rate regime, in determining the cyclical behaviour of macroeconomic time series. Finally, we dispense with investigating the correlation between regional cycles and national or European cycles. Instead, we focus on the impacts of a change in the regional sectoral pattern of **production** on the degree of correlation of regional **employment** cycles. Supplementary, we are interested in a solution to the empirical issue whether the probability of asymmetric shocks will increase in the light of EMU if the industries will agglomerate in several regions.

All above cited papers investigate the sources of the co-fluctuations empirically, but **only a few** (*Fatás*, *Clark* and *Wincoop*) deliver a detailed analysis of the **regional** level. However, one of the latter exceptions is the study by Clark and Wincoop who identify correlations between regional cycles based on border effects and on a measure of the **national** specialisation. In other words, they apply the same national measure for each region of the respective nation.

In this contribution, we focus on the degree of regional specialisation determining the synchronisation of the regional business cycles. However, we do not believe that this specialisation pattern is given as an exogenous variable – instead we suppose that the degree of specialisation will be an endogenous variable as well. One theory which tries to explain the choice of an industry to locate in a certain region is the so-called **New Economic Geography**. The latter **explicitly** conveys us some detailed theoretical information about the impact of by increasing economic integration on the development of industrial structures. Moreover, it **implicitly** gives some information about the resulting **degree of specialisation**. Assuming **increasing returns** in the production of **differentiated goods** as well as **monopolistic competition**, models of the New Economic Geography type endogenise the initially given factor endowment further – endogenous core-periphery patterns will be the result.

If firms find themselves a situation of increasing economic integration, there will be advantages for firms of one industry to cluster in a certain region – this agglomeration forces can further be reinforced by themselves and will tend to encourage concentration of industrial activity by **cumulative causations**. There are two mechanisms which potentially lead to these cumulative causations. The first example is *Krugman* (1991) who assumes highly mobile workers, while *Venables* (1996) or *Krugman* and *Venables* (1996) focuses on high firm mobility (we pick up this assumption later for choosing the variable which measures our specialisation index).

Centripetal or centrifugal forces are commonly regarded as the main reasons for this cumulative causations (for a survey see, e.g., *Krugman* 1998). These forces have an impact on the decision of mobile production factors to agglomerate or deglomerate geographically. However, these forces are themselves determined by the degree of integration or, even better, by the magnitude of transportation costs. The advantages of agglomerating geographically (centripetal forces) may be seen in larger markets offering intermediate goods. Besides other aspects, this might result in lower production costs for the sectors which produce final goods and/or in technological and knowledge spillovers between equal specialised firms or home market effects. Both of these concepts are generally known as the **forward linkages** and the **backward linkages**. When deglomeration is observed (centrifugal forces), this may be caused by increasing costs of environment pollution, decreasing scale effects or lower factor costs in the periphery or, equivalently and more generally, by a utility of agglomeration which is smaller than its costs. Even when the produced goods are homogeneous, price competition pressure is increasing when firms agglomerate, so there is an incentive to migrate to peripheral regions. The degree of economic integration plays an important role with respect to the

balance of power between both forces. Starting from a situation of low integration, an increase of the latter will lead to industrial concentration in order to profit from the up-coming trade centres. If this increase continues, the incentives of producing goods in the periphery and transporting them to the markets will raise. Deglomeration is the consequence and the centrifugal forces may dominate the centripetal ones (*Krugman* 1998).

However, some recent studies reveal that the relationship between agglomeration and the degree of specialisation is far from being purely monotonic. Examples are, e.g., *Ricci* (1999) and *Puga* (1999). The latter combines the assumptions of labour mobility (in the tradition of *Krugman*) and of firm mobility (in this respect following *Venables*) in a two regions and two sectors model in order to get a more realistic model. Based on his model he demonstrates how the industrial structure will change if economic integration increases. In a situation with low integration, the industries will distribute symmetrically over the two regions. This would imply a low degree of specialisation. Increasing integration strengthens the centripetal forces and leads to agglomeration of the industrial sector in just one region, so the degree of specialisation will increase too. This degree will again decrease if the economic integration will further increase, strengthening the centrifugal forces. Thus, he is able to identify a theoretically founded relationship between the process of **economic integration**, the **agglomeration of industries** in certain regions and the **degree of specialisation**. Thus, our assumption that the OCA-criterion **degree of specialisation** is an endogenous variable is not rejected by these model based considerations.

In Europe, the integration **of nations** is now an issue since four decades. With respect to the national level, there exists a variety of empirical studies on the level of national specialisation, the sources of national business cycles and the importance of industry-specific shocks, especially when they are classified as asymmetric. As indicated above, some studies combine regional measures of the **national** specialisation with the co-movement of regional cycles. However, we want to stress the relationship between regional cycles and **regional** industrial specialisation. Our main innovation is to use some features of the New Economic Geography in order to construct several regional **specialisation indices**. We investigate the impacts of these indices on a representative regional business cycle indicator, namely (growth of) total regional employment. In the next chapter we explain the construction of the respective indices, and in chapter four the business cycle impacts of the latter are estimated via some regressions.

3 THE SPECIALISATION INDICES, DATA AND STYLISED FACTS

3.1 The Specialisation Indices

In order to quantify the degree of the relative specialisation in regional production patterns and to use these results for our regressions (section 4.1) we employ relative specialisation indices surveyed by *Krieger-Boden* (1999) and explained in table 1. Instead of using the method of *DeNardis* et al. (1996) – they employed the mean quadratic difference weighted with their regional share in aggregated value added for 56 regions out of nine countries - we use the former measures because the interpretation of the results is very simple.

A change in our specialisation indices can principally be put down to the fact that the relative shares of the sectors have changed. There is no general statement possible, in **what** sector one region has specialised. However, the latter is not the focus of our paper. A second problem is raised when there are just a few sectors. The more industrial sectors are available, the more meaningful is the index. In our context this might indeed be a problem but cannot be completely solved because of the limited data availability.

Table 1: Indicators as measures of the degree of specialisation

Relative measures of specialisation			
Index of Conformity (CON)	**Finger-Kreinin-Index (FIN)**	**Coefficient of Specialisation (SPEC)**	**Balassa-Aquino-Index (BAL)**
$\frac{\sum_{i=1}^{n} a_i \cdot b_i}{\sqrt{\left[\left[\sum_{i=1}^{n} a_i^2\right] \cdot \left[\sum_{i=1}^{n} b_i^2\right]\right]}}$	$\sum_{i=1}^{n} \min[a_i ; b_i]$	$\sum_{i=1}^{n} [a_i - b_i]^2$	$\sqrt{\sum_{i=1}^{n} b_i \cdot \left[\frac{a_i}{b_i} - 1\right]^2}$
0 to 1	0 to 1	0 to 2	0 to ∞

Note: The variable n corresponds to the amount of sectors, a_i is the share of sector i in country a and b is the share of sector j in country b.

As a first index we employ the **index of conformity**, used, e.g., by *Imbs* (1999) in order to measure the degree of national specialisation. It is constructed analogously to the usual correlation coefficient without consideration of the statistical mean. The results are values between zero (perfect specialisation) and one (perfect diversification). Second, the **Finger-Kreinin index** is used (see, e.g., *Amiti* 1997) which is defined as the sum of the minima of the industrial shares of two regions. The higher the value of this index (maximum 1), the more identical sectoral patterns the both regions realise. The third index we apply is the **specialisation coefficient**, e.g., proposed by *Krugman* (1993) and *Clark* and *Wincoop* (1999). However, in order to stress differences in performance between two regions (which might not come out as clearly as appropriate) we calculate the quadratic difference instead of the total amount of the differences of the relative shares. Finally, the **Balassa-Aquino index**, constructed as the standard error of the Balassa index weighted with sector shares, is the last index we use. Its interpretation is more difficult than with respect to the three ones discussed before, because in the case of total specialisation of both regions the value of this index will raise to infinity. This may lead to problems for our estimation, because in this case the index might not be stationary from a time series point of view.[1]

3.2 Data

The first variable which has to be defined is the specialisation index. In order to construct four variants of this index, we use the time series of the **nominal gross value added** for 16 European **regions** from 1975 to 1994 instead of the time series of the **national** gross value added (mill. ECU) as used in *Clark* and *Wincoop*. The data for the **regional gross value added** and **regional GDP** were taken from EUROSTAT for the years 1975 to 1995 respectively 1980 to 1997. Our choice of this variable significantly deviates from *Imbs* (1999) who estimates a specialisation index based on the sectoral total employment. We do not use employment data because they are level merely available for three sectors on the regional such that the specialisation index would not be very meaningful. In order to avoid such kind of problems inherent in the use of an index of sectoral total employment, we decided to use the regional gross value added for **six**

1 An additional popular approach is to calculate Gini coefficients after constructing a Lorenz curve. The Gini coefficient is widely used in the economic literature, but as commonly known neither two intersecting Lorenz curves nor the corresponding Gini coefficients may be interpreted. For this reason we just use the four above explained indices.

different sectors (agricultural, forestry and fishery products, fuel and power products, manufactured products, building and construction, market services and non-market services). However, this indicator is only available for a small amount of sectors in European regions. Our definition of regions corresponds to level one of the Nomenclature of Territorial Units for Statistics (NUTS), Eurostat version 1999 (see table 2). The NUTS was established by Eurostat to provide comparable regional breakdowns of the Member States of the European Union.

Table 2: French and German NUTS 1 Regions

NUTS 1 Code	Our Code	Region
def + de6	G1	Schleswig-Holstein & Hamburg
de9 + de5	G2	Niedersachsen & Bremen
dea	G3	Nordrhein-Westfalen
de7	G4	Hessen
deb + dec	G5	Rheinland-Pfalz & Saarland
de1	G6	Baden-Württemberg
de2	G7	Bayern
de3	G8	Berlin
Fr1	Fr1	Ile de France
Fr2	Fr2	Bassin Parisien
Fr3	Fr3	Nord-Pas-De-Calais
Fr4	Fr4	Est
Fr5	Fr5	Ouest
Fr6	Fr6	Sud-Ouest
Fr7	Fr7	Centre-Est
Fr8	Fr8	Méditerranée

As the second variable, we approximate the regional business cycle (like *Fatás* 1997) by using the regional employment time series. We apply **annual percentage changes** of this time series in order to be able to reject the non-stationarity of the **regional employment** variable.[2] We used the regional employment data listed by *Fatás* for eight

2 In this respect, we follow *Fatás* (1997). Additionally, we conducted unit root tests which clearly could reject the non-stationarity for the first differences. Results are available on request.

German and eight French regions for the years 1970 to 1997. Reducing the eleven West-German regions should avoid using the so-called city-states in Germany being only large cities.[3] Both the availability of a fairly large time span ranging from 1970 to 1997 and the procyclical behaviour of this variable make this procedure appear highly advantageous for our purposes.[4] When we test for the robustness of our regression results we implement the difference in relative income between two regions as an additional explaining control variable. This is done by means of the CPI deflated regional GDP, divided by the European (here consisting solely of Germany and France) GDP-aggregate in order to normalise the size of the regional income. Missing values for the French regions in 1981 were interpolated.

3.3 Stylised Facts

A variety of stylised facts for business cycles are accepted as valid for the **national** level by many scholars, but for the **regional** level such relatively indisputable facts are missing. In particular, this could be caused by the fact that adequate regional time series are not available or not existent. First steps in this direction are undertaken by *Fatás* and *Clark* and *Wincoop*; in their investigations they find that the co-movements of economic variables between European regions are **decreasing** (analogously to the results gained by us later on in this section) but not to a statistically significant extent. On the contrary, the correlations of national cycles within Europe seem to be increasing significantly according to several studies.

In order to get some stylised facts with respect to the within- and across-country correlation between regional business cycles, we calculate correlations between bilateral annual percentage growth rates of the regional total employment, which are displayed graphically in the figures 1 to 3. For every possible pair of regions, we generate **rolling correlations** by a stepwise procedure[5], **as depicted detailed by our estimation *algorithm* in the appendix I**. We let the sample grow in annual steps, each time calculating

3 The data of regional employment for 1970 until 1992 were kindly provided by *Clark*, for the years 1993 to 1997 from EUROSTAT.

4 Using alternative filter methods in order to induce stationarity properties of the variables lead to similar results which are available on request by the authors

5 In this final version of the paper, we dispense with using ten-years windows for constructing the rolling correlation coefficient (as, e.g., ECB 1999) in order to avoid loosing ten degrees of freedom of our sample. Nevertheless we calculated these coefficients, but there were no differences in the results.

the corresponding correlation coefficient (beginning with regional correlations for the sample from 1971 to 1975 and then continuing with calculations for 1971 to 1976, 1971 to 1977 and so on).[6] However, we finally refused to use some alternative procedures which could have been potentially applicable, too. Neither splitting the total sample in two or more subsamples, nor creating a rolling window is favoured by us. The reasons to proceed in that way have been (1) that we only have annual data available and thus suffer from low degrees of freedom[7], and (2) that the choice of the **window** (for example letting consecutive 10-year subsamples cover an additional one-year period minus the first one, see *Caporale* et al. (1999) would appear to be rather arbitrary.

A broad brush visual inspection of figures 2 to 4 reveals that many **correlation functions** seem to incorporate a **negative trend**. Interestingly enough, our findings corroborate the results by *Fatás* and *Clark* and *Wincoop* (see above). However, a puzzle emerges in view of the strong evidence in favour of increasing co-movements between national business cycles found in the literature. Note that a statistical artefact (i.e., the degree of correlation decreasing with the length of the sample) is excluded per construction of our correlation measure. It seems to us more promising to try to solve this puzzle explicitly by searching for possible impact factors (i.e., the several specialisation indices) behind this negative trend. This will be done in the next chapter via regression analysis.

6 The t-value of the estimated correlation coefficient might increase with the share of the available sample range used as expressed by the following relation: $t_\rho = \frac{\rho \cdot}{\sqrt{1-\rho^2}} \cdot \sqrt{n-2}$. In order to be able to reject the possibility that the identified correlations are a statistical artefact, we put in several simulated random number time series. The latter are not correlated with each other by construction. When we estimated the resulting sequence of bilateral correlation coefficients, no correlation turned out independent on the number of used observations. In other words, we do not enact spurious intertemporal comparisons.

7 This would not be the case if monthly or higher frequency data were available.

Figure 2: Within-France region pair correlations

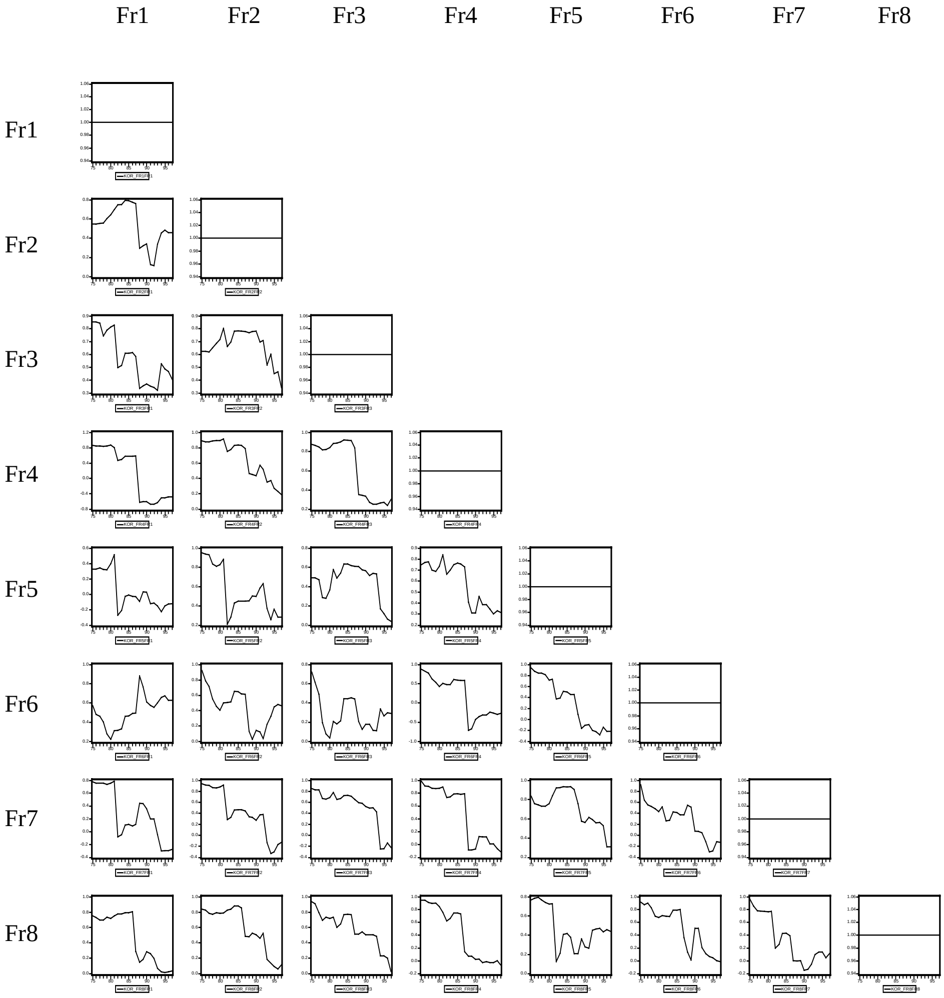


Figure 3: Within-Germany region pair correlations

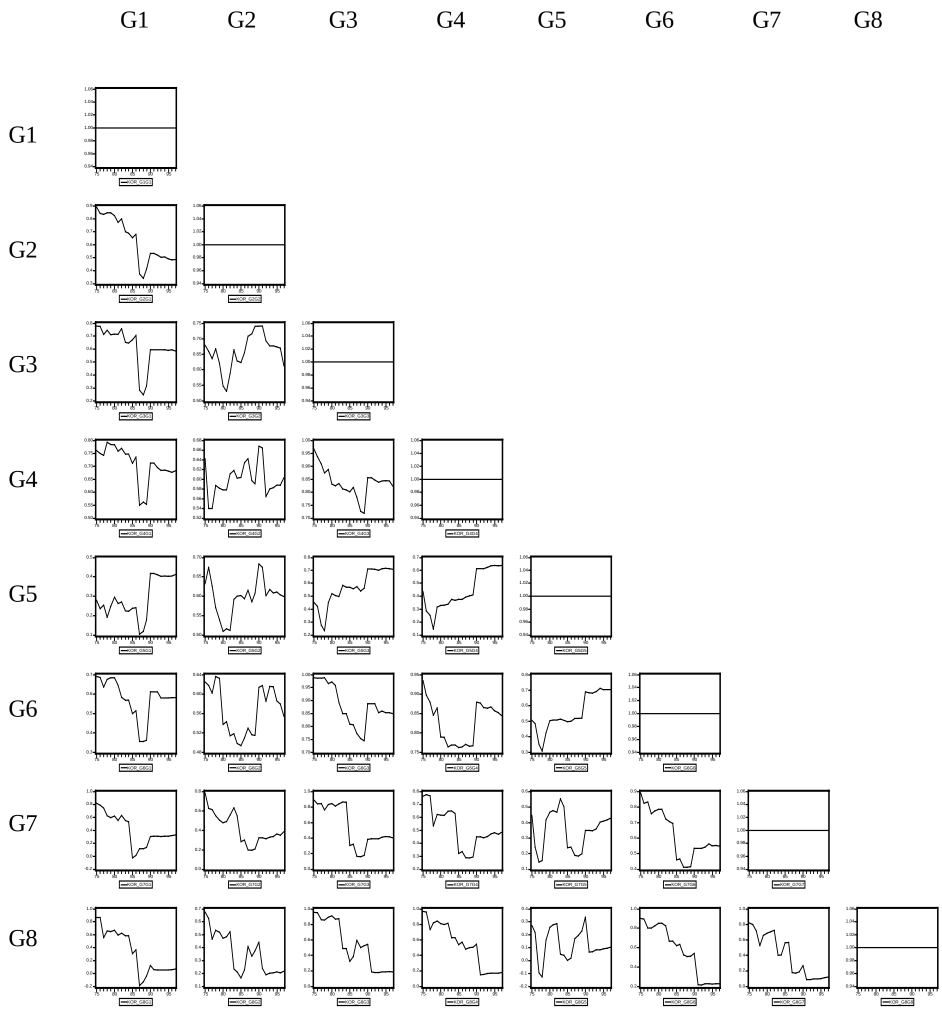
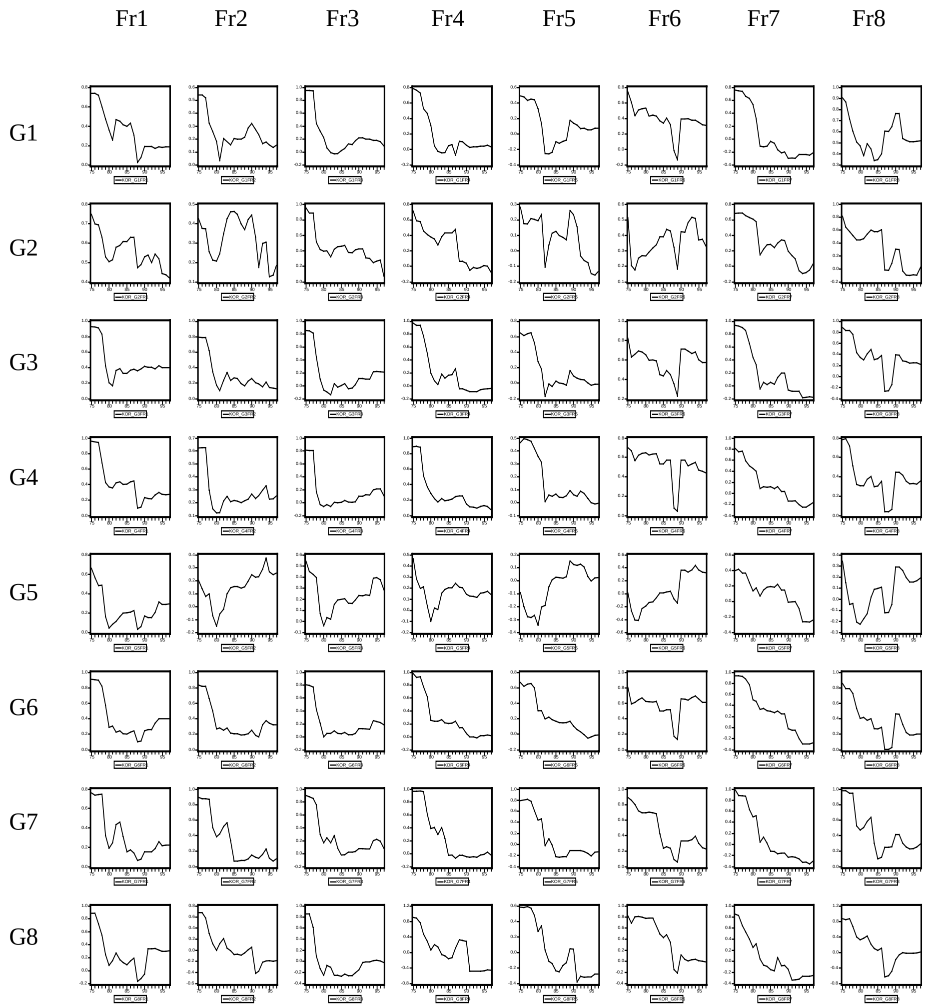


Figure 4: Cross-country region pair correlations



4 ESTIMATION

What do we intend to explain with our estimations? According to the preceding sections, our main (three step) argument would be anyway that intra-industrial trade increases in those regions which display a similar degree of specialisation caused by agglomeration tendencies (centripetal and centrifugal forces). As a consequence, an increasing correlation of regional cycles should be observed between them. Evidently, the contrary, i.e. a decreasing cycle correlation in the wake of deglomeration, should be valid as well.

In order to be able to test for a significant relationship between the relative business cycle performance of two selected regions and the relative **bilateral specialisation index**, we have applied **several methods**:

1. estimations for single **individual** pairs of regions instead of pooling regions in order to avoid too rigid (OCA) assumptions (see point 2),
2. regressions of the correlation coefficient between two regional business cycles on a certain measure of relative concentration via a **pooled** analysis (under the relatively rigid (OCA) assumption that all region pairs in the pool react in the same manner on changes in the concentration measure), and
3. augmentation of the benchmark estimations by dummies for common borders, German reunification and relative differences between regional income.[8]

4.1 Procedure

Since our variables are stationary by definition, we run our regressions **in levels**. For example, realisations of the correlation coefficient KOR by definition fall into a range of –1 to +1. table 1 clearly demonstrates the existence of finite upper and lower bounds for the realisations of the specialisation indices. The same is valid with respect to the common border, reunification dummies (both between zero and one) and the relative income variable (RELINC) which essentially represents a share and therefore takes values between zero and one.[9] In the following, one representative regression is displayed for the case of the specialisation measure SPEC in order to convey an impression of our proceedings. The equations estimated by us have the following structure. The correlation coefficient (KOR) of unemployment growth rates between two regions is regressed on a constant (C), on its own past (KOR(-1)), on the specific specialisation index (SSI) and, if necessary, on a deterministic trend (TREND) and/or a dummy (DUMMY) for a special year:

8 Regressions of the change of the annual correlation coefficient on the change of relative concentration did not lead to significant results in both individual and pooled estimations. The same was the case with respect to considering EMS membership explicitly in our estimation via sample splits.

9 The only possible exception could be the Balassa-Aquino index. However, a visual inspection of the series reveals that its realisations fall in a relatively narrow band.

(1) KOR = c(1) + c(2)*KOR(-1) + c(3)*SSI + c(4)*TREND+ c(5)*DUMMY.

We estimated these kind of regressions for all region pairs and all four different specialisation indices via individual equation and pooled equation estimation techniques. The latter are based on equation 1 as well. However, the only difference consists of the fact that variables in our second step refer to a pool of region pairs. **Lagged endogenous variables** (i.e. lagged realisations of KOR) should be no problem in our context because estimates are still consistent as long as the absence of residual autocorrelation is – as in our case – not rejected (see above all *Wasmer* and *Weil* (2000). The final specification of the underlying regression equations is based on the usual diagnostics combined with the **Schwarz Bayesian Information Criterion** (SCH). The latter is chosen as our primary model selection criterion since it asymptotically leads to the correct model choice (if the true model is among the models under investigation, Lütkepohl 1991). The regression which reveals the lowest SCH-value and at the same time fulfils the usual diagnostic residual criteria is selected and finally tabulated by us. However, one important precondition for their application we take into account is the same number of observations for the alternative specifications (*Banerjee* et al. 1993, p. 286, *Mills* 1990, p. 139, *Schwarz* 1978).

The **sample** has been chosen to be 1971 to 1997 (if available) in order to exploit all available information. The procedure is exactly the same for each region pair such that we never intervene to exercise a discretionary judgment. As usual, we add country specific dummies from time to time in order to account for possible breaks in the bi-regional relations. Significant dummies are added only if they are economically meaningful, if they improve the SCH statistics (higher informational contents even if a penalty for the extra dummy is taken into account) and lead to a non-rejection of the normality assumption of the residuals (*Jarque* and *Bera* 1987). At the same time they should contribute to fulfil the criteria on the residuals, especially those on normality. However, none of our results is essentially due to the implementation of these dummies.

With respect to the coefficients of the explaining "specialisation indices" in our regressions we expect the following conditions to hold:

(2)
$$\frac{\partial KOR}{\partial CON} > 0\,; \qquad \frac{\partial KOR}{\partial FIN} > 0\,; \qquad \frac{\partial KOR}{\partial SPEC} < 0\,; \qquad \frac{\partial KOR}{\partial BAL} < 0\,;$$
$$0 \leq CON \leq 1 \qquad 0 \leq FIN \leq 1 \qquad 0 \leq SPEC \leq 6 \qquad 0 \leq BAL \leq \infty$$

Note that the numbers of necessary regressions depends on the chosen specialisation index (BAL: 240 relevant region pairs; CON, FIN, SPEC: 120 relevant region pairs) and on the specific pair of regions (France-France, Germany-Germany, France-Germany, Germany-France (our estimations are based on EViews)). With these facts in mind, we would now like to turn to an introduction to our results.

4.2 Results

4.2.1 Individual Equation Estimations

In the following tables 3a to 3d, for each region pair the coefficient estimate of our specialisation index (*/**/*** corresponding to α=0.1/0.05/0.01), the R-squared and the empirical realisation of the α-probability of the LM-autocorrelation F-test (2 lags) are displayed. The dark-shaded fields denote significant coefficient estimates of our indicators, if the sign corresponds to our theoretical expectations expressed in eq. 2. The grey-shaded areas represent significant estimates of the same variable, if their sign is **contrary to** intuition. As a consequence of our method of constructing the specialisation indices, tables 3a to 3c are symmetric. For this reason, we only display the relevant part of the matrix of results. However, symmetry is not valid with respect to table 3d where the reference region now matters (see the different results for, e.g., FR3FR4 versus FR4FR3) and the whole matrix is displayed.

According to our results, in case of CON and SPEC around one quarter (but just one sixth in case of FIN) of the region pair-specific regressions lead to the theoretically expected signs of significant coefficient estimates of the "specialisation index". In the case of the asymmetric matrix for the Balassa-Aquino index, this valid for 51 region pairs out of a maximum possible 240.

Let us now turn to a more detailed analysis of the results gained on the basis of the first three indices CON, FIN and SPEC. It appears to be useful in a first step to take a look at the share of theoretically correct signs in all significant relationships. The latter amounts to 70 percent in the case of CON and SPEC and 60 percent for FIN. Second, it seems to be worthwhile to examine potential regional cumulations of corroborations of our theoretical priors derived in sections 3 and 4.1 before. A certain **clustering** of significant results with the expected sign can above all be observed within France. Especially for the regions Nord-Pas-De-Calais (FR3) and less so for the regions Ouest (FR5) and Sud-Ouest (FR6) we are able to reject the null hypothesis that the specialisation index does not have an impact on the degree of synchronisation of regional business (employment) cycles. A considerable number of seven region pairs proves to be significant with the expected sign, independent of the chosen index.

Table 3a: Regression results based on the conformity index CON (Appendix II)

Table 3b: Regression results based on the Finger-Kreinin index FIN (Appendix II)

Table 3c: Regression results based on the specialisation index SPEC (Appendix II)

Table 3d: Regression results based on the Balassa-Aquino index BAL (Appendix II)

However, the corresponding pattern of results is less clear within Germany where the absolute number of black-shaded fields is much lower. Moreover, in the case of Germany only two region pairs are significant throughout, independent of the chosen index (Rheinland-Pfalz/Saarland and Bayern (G5G7) and Niedersachsen/Bremen with Baden-Württemberg (G2G6)).

Concerning the relationship between German and French regions, more significant coefficients with the expected sign emerge as compared to the within-German region pairs. The numbers for France are exceeded by three in case of SPEC. However, in the cases of FIN and SPEC the respective numbers fall below the French numbers by two. Four region pairs (Schleswig-Holstein/Hamburg vis-à-vis Bassin Parisien (G1FR2), Schleswig-Holstein/Hamburg vis-à-vis Nord-Pas-de-Calais (G1FR3), Bayern vis-à-vis Bassin Parisien (G7FR2) and Bayern vis-à-vis Sud-Ouest (G7FR6)) come out as significant with the expected sign, independent of the respective index.

We conclude our analysis of the single regression results with a closer investigation of the results for the Balassa-Aquino index BAL. First, within Germany we find twice as much significant correlation pairs with the expected signs than within France (20 compared to 10). Second, across both countries, i.e. with respect to correlations between German and French regions, 21 significant correct specifications can be identified. Seen on the whole, 82 of the total of 240 regressions lead to significant estimated coefficients for the specialisation indices. Even more important, 51 of those 82 regressions, i.e. nearly 65 percent, lead to theoretically consistent estimates. This leads us to conclude also in the case of the Balassa-Aquino index that there is some evidence in favour of a significant impact of ‘ specialisation indices’ on the extent of correlation between regional business cycles in two core countries of EMU.

However, one important caveat with respect to our estimations of individual pairs of regions may be constituted by the fact that only a limited sample (consisting of a maximum of 27 annual observations) is available for single European regions from EUROSTAT. In the light of the recent debate on the extent to which Euroland represents an optimum currency area, another potential extension of our above cross-section specific regressions deserves attention as well. It might be useful to test empirically whether region pairs can be treated as identical cross-section identifiers in the sense that one can impose the same characteristics/parameters on each cross-section unit of the sample. This sample is represented in our investigations by a large part of core EMU, i.e. France and Germany. In other more concrete terms, it would be an interesting exercise to test whether consistent and reasonable regression results hold with respect to the impact of specialisation indices on the synchronisation of business cycles if one ignores all cross-section specific features. By this one would assume regions respectively region pairs to be homogenous entities (as is implicitly done so far by some proponents of EMU). This can also be interpreted as an effort to test whether a certain common impact of specialisation on the synchronisation of regional business cycles is valid **on average**. An empirical non-rejection of this view would point to a similar pattern of endogeneity of synchronisation and, thus, towards a non-increasing probability of asymmetric shocks under EMU.

These aspects motivated us to pool our data and to do some **pooled estimation** exercises in the next section in order to enhance our available degrees of freedom and in order to test the degree. Another purpose is to test the degree of **homogeneity of endogeneity** of the OCA-criterion **business cycle synchronisation** in a straightforward way.

4.2.2 Pooled Estimations

In our case, a relatively **large** number of cross-section units (pairs of regions) are observed over a fairly **average** number of periods. However, authors like *Imbs* (1999) completely dispense with time periods and confine themselves to a large number of cross-sections, i.e. countries. Since the average number of periods used in our estimations is by far not as large as the number of cross-section units, the possibility of an application of a feasible Generalised Least Squares correcting **for both** cross-section heteroskedasticity and contemporaneous correlation is possible here.

In the following, we perform some Pooled Least Squares estimations, taking the region pairs as cross sectional identifiers. Referring to eq. (2), we again expect the coefficients for CON and FIN to be significantly larger than zero and the coefficients for SPEC and BAL to be smaller than zero. We start with pooled estimations which assume the same **common coefficients** for the explanatory variables across all cross-section members of our pool (consisting of all possible region pairs). We give up this assumption later on in the robustness section. A deterministic trend and a dummy for German reunification are again included as a standard throughout the regressions. In the following tables (4a to 4d) the results of these regressions are displayed.

Table 4a: Pooled Least Squares (conformity index CON)

Dependent Variable: KOR_?
Method: Pooled Least Squares
Sample(adjusted): 1975 1997
Included observations: 23 after adjusting endpoints
Number of cross-sections used: 92
Total panel (unbalanced) observations: 2011

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.023285	0.156091	-0.149174	0.8814
KOR_?(-1)	0.823726	0.010145	81.19833	0.0000
CON_?	0.233370	0.159970	1.458833	0.1448
TREND	-0.010469	0.000851	-12.30850	0.0000
DUMGER	0.102018	0.011384	8.961888	0.0000

R-squared	0.817611	Mean dependent var	0.416860
Adjusted R-squared	0.817247	S.D. dependent var	0.322340
S.E. of regression	0.137799	Sum squared resid	38.09114
F-statistic	2248.115	Durbin-Watson stat	1.544667
Prob(F-statistic)	0.000000		

Table 4b: Pooled Least Squares (Finger-Kreinin index FIN)

Dependent Variable: KOR_?				
Sample(adjusted): 1973 1997				
Included observations: 25 after adjusting endpoints				
Number of cross-sections used: 92				
Total panel (unbalanced) observations: 2013				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.125333	0.062186	2.015452	0.0440
KOR_?(-1)	0.822603	0.010215	80.52909	0.0000
FIN_?	0.084749	0.068035	1.245681	0.2130
TREND	-0.010215	0.000853	-11.96916	0.0000
DUMGER	0.100126	0.011453	8.742600	0.0000
R-squared	0.814857	Mean dependent var		0.416723
Adjusted R-squared	0.814488	S.D. dependent var		0.322213
S.E. of regression	0.138781	Sum squared resid		38.67435
F-statistic	2209.414	Durbin-Watson stat		1.534122
Prob(F-statistic)	0.000000			

Table 4c: Pooled Least Squares (specialisation index SPEC)

Dependent Variable: KOR_?				
Sample(adjusted): 1975 1997				
Included observations: 23 after adjusting endpoints				
Number of cross-sections used: 92				
Total panel (unbalanced) observations: 2011				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.207003	0.014464	14.31165	0.0000
KOR_?(-1)	0.824009	0.010146	81.21199	0.0000
SPEC_?	-0.002074	0.002207	-0.939821	0.3474
TREND	-0.010407	0.000850	-12.24866	0.0000
DUMGER	0.102271	0.011388	8.980800	0.0000
R-squared	0.817498	Mean dependent var		0.416860
Adjusted R-squared	0.817134	S.D. dependent var		0.322340
S.E. of regression	0.137842	Sum squared resid		38.11477
F-statistic	2246.411	Durbin-Watson stat		1.544183
Prob(F-statistic)	0.000000			

Unfortunately, three of our four specialisation indices prove to be insignificant although rejection of insignificance is only barely missed by the conformity index CON. However, the Balassa-Aquino index of specialisation BAL is highly significant across all region pairs. Thus, all further conclusions which refer to a significant impact of speciali-

Table 4d: Pooled Least Squares (Balassa-Aquino index BAL)

Dependent Variable: KOR_?				
Sample(adjusted): 1973 1997				
Included observations: 25 after adjusting endpoints				
Number of cross-sections used: 240				
Total panel (unbalanced) observations: 5042				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.228461	0.009802	23.30813	0.0000
KOR_?(-1)	0.804392	0.006631	121.3124	0.0000
BAL_?	-0.031971	0.009266	-3.450190	0.0006
TREND	-0.011285	0.000551	-20.47050	0.0000
DUMGER	0.099155	0.007145	13.87737	0.0000
R-squared	0.814137	Mean dependent var		0.382852
Adjusted R-squared	0.813990	S.D. dependent var		0.323911
S.E. of regression	0.139699	Sum squared resid		98.30129
F-statistic	5515.916	Durbin-Watson stat		1.531790
Prob(F-statistic)	0.000000			

sation on cycle synchronisation have to be based solely on this index. Lagging the independent variables, shortening the sample period according to some criteria (e.g., pre- and within-EMS period) did not lead to better results with respect to our central hypothesis either.

Note that the impact of the deterministic **trend** is estimated to be rather small albeit highly significant and **negative** across all pooled estimations. This points to significant desynchronisation of regional cycles in core EMU and clearly corroborates our findings from a visual inspection of the correlation coefficients in section 3.3. At the same time this result casts some doubts on our solution to the above mentioned puzzle (see section 3.3) because the negative trend is identified independently of the investigated index. Thus, the indices (especially BAL) can only be partly made responsible for the observed desynchronisation of the bilateral business cycles. In the following, it is examined whether our quite provocative results are robust.

4.2.3 *Testing for robustness of the pooled estimation results*

In order to avoid an omitted-variable bias we conduct several test for robustness, each considering different aspects and including additional explaining variables.[10] First, we follow *Clark* and *Wincoop* (1999) including dummies for **common regional borders** (see our algorithm in the appendix for the identification of common borders). Like *Imbs* (1999), we also implement the **relative income** variable in order to grasp the income effect on regional trade and co-movement. We include these variables separately (a) and (b) and jointly (c).

Second, we test – as usual in such kind of studies - for robustness with respect to **changes in the sample**. Here we follow two approaches: (d) in order to limit our analysis to the available, i.e. not estimated (see section 3.2), data we confine ourselves to a sample ranging from 1975 to 1994. This can be interpreted as another test for robustness of our results. (e) in order to conclude observations only if data on all variables are available for all cross-sections in the same period, we employ data from a balanced sample ranging from 1975 to 1990.

Third, we use **alternative specifications of the constant** in the pooled regression estimation. By this, we dispense with our initial assumption of common coefficients (identical intercepts for all pool members). Here we consider the case of no intercepts (f) and a case of fixed effects, i.e. specific (and possibly different) intercepts for each region pair as a pool member (g).

Fourth, we estimate a feasible **Generalized Least Squares** (instead of an OLS) specification (h) assuming the presence of cross-section heteroskedasticity but the absence of contemporaneous correlation of the residuals (inclusion of lagged dependent variable!). Finally, we omit the **German unification dummy** (i). The following table displays the coefficient estimates of our four specialisation indices together with the realisation of the α-probability (*/**/*** corresponding to α=0.1/0.05/0.01) and the corresponding R-squared for each of the robustness test specifications.

10 With this testing up-strategy we exactly follow, e.g., *Belke* and *Gros* (1998a). One objection might be that exactly this procedure possibly leads to an omitted-variable bias. However, the empirical realisations of the relevant test statistics do not reveal - as already discussed above – any misspecification like, e.g. serial, correlation of the residuals.

Interestingly, only in the case of a limited sample length ((d) and (e)) the results of all regression coefficients turn to significance and have the expected sign.[11] Further, the BAL variable is the only significant one in the other robustness tests and the trend throughout remains negative and significant (a clear corroboration of our "stylised

Table 5: The impact of specialisation on the synchronisation of cycles: Testing for robustness

	CON	FIN	SPEC	BAL
Original estimation	0,23 0,81	0,08 0,81	-0,002 0,81	-0,03*** 0,81
(a) Including variable for common borders	0,21 0,81	0,08 0,81	-0,002 0,81	-0,03*** 0,81
(b) Including variable for relative income	0,19 0,84	0,06 0,84	-0,001 0,84	-0,02* 0,83
(c) Including variable for relative income and common borders	0,18 0,84	0,06 0,84	-0,0017 0,84	-0,01* 0,83
(d) Estimation with a limited sample (1975 to 1994)	0,29* 0,79	0,11** 0,79	-0,003 0,79	-0,03*** 0,79
(e) Balanced sample (1975 to 1990)	0,36* 0,77	0,15** 0,77	-0,004 0,77	-0,04*** 0,77
(f) Estimation without intercept	0,20*** 0,81	0,21*** 0,81	0,006*** 0,79	0,05*** 0,79
(g) Pooled Estimation with Fixed Effects	-0,56 0,85	-0,23 0,84	0,01* 0,84	0,06** 0,84
(h) Estimation with Generalised Least Squares	0,06 0,9	-0,002 0,9	-0,002 0,81	-0,02*** 0,88
(i) Omitting the German Reunification Dummy	0,24 0,81	0,08 0,8	-0,0018 0,81	-0,03*** 0,8

Note: Each field of the table contains first the estimated coefficients of the specialisation index together with its significance level (denoted in stars as explained in section 4.2 and second below the realisation of the R-squared.

11 Note that the limited sample includes only those realisations of the specialisation indices which are not estimated by us for the reason of non-availability.

facts", but not shown in table 5). If we estimate the pool regression without intercept (f), the coefficients of the variables CON and FIN reveal the expected sign significantly larger than zero, but the coefficients of FIN and BAL are now positive and not significant. For the relative income variable we clearly cannot reject the hypothesis that this variable does not have an impact on the co-movement of bilateral regional business cycles. Seen on the whole, the results of the robustness tests do not change our conclusions on the relationship between specialisation and synchronisation of regional business cycles significantly.[12]

5 CONCLUSIONS

In the preceding chapters we were able to derive some tentative answers to the question of the impact of specialisation on the synchronisation of regional business cycles in Europe. We list the most important ones below:

1) In the case of regions whose sectoral composition has changed into the same direction because of increasing specialisation, we expected higher synchronisation of the regional cycles. This lets regions turning into "high-tech" or "developing" ones. However, a necessary condition for this, a positive impact of increasing similarity of sectoral composition on synchronisation could be corroborated only partly. Only for some regions and some indicators we were able to detect that kind of impact which is expected from theory.

   At the same time, some regions have to be considered which will develop **differently**. This can also be traced back to agglomeration, i.e. the emigration of industries and labour. In this case, we forecasted a decreasing degree of correlation. Again, the corresponding negative impact of increasing similarity of sectoral composition on synchronisation could only be observed for **some** regions and **some** indicators.

2) Relying on those of our results which correspond the most closely to theory, one forecast would be that core-EMU will tend to change into **two-class** pairs of regions.

12 Constructing a rolling window as a second method of mapping the correlation function and using this variable to test for a relationship between this variable and the specialisation indices proved to be fruitless efforts in the case of the individual region pair regressions as well as with respect to the pooled estimation procedure.

On the one hand, there will be regions which converge to each other and display increasingly synchronous business cycles and enhance their regional income by intra-industrial trade. On the other hand, there will be regions which will lose by agglomeration. Seen on the whole, this could lead to a more uneven distribution of regions with respect to their business cycle stance (regional GDP).

3) Our section 3.3 on stylised facts revealed that the degree of **synchronisation of regional** business cycles has **decreased** in the past for a majority of region pairs. This result stands in contrast to many studies indicating an increasingly closer correlation of business cycles **between countries** which are now members of EMU (e.g. *Artis* and *Zhang* 1997, *Christodoulakis* et al. 1995). However, our evidence in favour of a decreasing synchronisation of regional cycles is implicitly backed by other studies with a regional focus (*Fatás* 1997, *Clark* and *Wincoop* 1999). Moreover, already *Belke* and *Gros* (1998) detailedly worked out that regional asymmetries do not necessarily constitute a strong argument against the OCA-property of Euroland. Instead, one could argue (and this can be clearly read off the data in chapter 3) that regional asymmetries caused, e.g., by an increasing desynchronisation of regional cycles have already been a problem of existing currency unions like France and Germany in the past.

4) What kind of impact should our results have on the design of monetary and fiscal policy? The general concern about the cost of having a common policy for a heterogeneous area like EMU is corroborated by our results in a very subtle sense. Let us first base our arguments on those of our empirical results which confirm the standard theoretical considerations. Since those results indicate a negative impact of less specialisation on the synchronisation of regional cycles, the common monetary policy stance in Euroland might not be optimal for many regions because they might find themselves at increasingly different stages of their business cycle (**common monetary policy for uncommon regions**). However, since the common monetary policy might at the same time have benefits for some regions with a high degree of intra-industrial trade and therefore high business cycle synchronisation, the overall result is not unambiguously negative. Instead, our estimates even allow a guess - or better a founded speculation - **which** regions will **loose** and **which** regions will **benefit** from increasing specialisation. Insofar as the speed of specialisation is enhanced by EMU, a forecast of the regional distribution of some real gains and some losses from EMU appears feasible as well.

These conclusions might be disputed on technical grounds, because by far not all empirical results corresponded to our theoretical expectations. A lot of regressions for certain region pairs and specific specialisation indices revealed a negative or even an insignificant impact of specialisation on the synchronisation of cycles. Moreover, future research should try to investigate why the results on the four specialisation indices are so different. However, even if one abstracts from the **regression** results in chapter 4, one can still stick to the main stylised fact found in chapter 3, namely that of an on average decreasing degree of cycle correlation between important core EMU regions. This finding underlines the problem of a common monetary policy for uncommon regions which, however, has already existed in the DM- and in the Franc-zone before.

Seen on the whole, thus, our empirical results indicate that regionally asymmetric shocks cannot be excluded for EMU in the future. This might raise the claim for stabilising insurance mechanisms (Belke and Gros (1998)). On the regional level, however, the performance of weaker regions should be strengthened by tax incentives and by measures to promote the establishing of certain industries.

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APPENDIX I

```
                    'ESTIMATION PROCEDURE'

SMPL 1971 1997

FOR !1=1 TO 26
    SMPL 1971 1971+!1

    'Defining a Group of Variables'
    group corr growth_fr1 growth_fr2 growth_fr3 growth_fr4 growth_fr5 growth_fr6 growth_fr7
    growth_fr8 growth_g1 growth_g2 growth_g3 growth_g4 growth_g5 growth_g6    growth_g7
    growth_g8

    'Matrix Representation of this Group'
    stom(corr,m1)

    'Matrix of Correlations between Columns of Matrix'
    matrix m2 = @cor(m1)

    'Generate 'Rolling' Correlations for every possible Pair of Regions'

    SMPL 1971+!1 1971+!1

        FOR !2=1 TO 8
            FOR !3=1 TO 8

                'France-France'
                genr kor_fr!2fr!3=0

                'Germany-France'
                genr kor_g!2fr!3=0

                'France-Germany'
                genr kor_fr!2g!3=0
```

```
            'Germany-Germany'

            genr kor_g!2g!3=0


            'France-France'

            genr kor_fr!2fr!3=m2(!2,!3)


            'Germany-France'
            genr kor_g!2fr!3=m2(8+!2,!3)


            'France-Germany'

            genr kor_fr!2g!3=m2(!2,8+!3)


            'Germany-Germany'

            genr kor_g!2g!3=m2(8+!2,8+!3)


        NEXT

    NEXT

NEXT
```

'Starting Estimations'

```
SMPL 1971 1997
```

'Ordinary Least Squares for Single Pairs of Regions and Several Agglomeration Indices'

```
    FOR !2=1 TO 8

        FOR !3=1 TO 8

            IF !2 > !3 THEN


                'France-France'


                    'OLS for CON'

                    equation eqfr!2fr!3con

                    eqfr!2fr!3con.LS kor_fr!2fr!3 = c(1)+c(2)*con_fr!2fr!3+c(3)*TREND+

                    c(4)*kor_fr!2fr!3(-1)+c(5)*d82+c(6)*d88
```

```
            'OLS for SPEC'
            equation eqfr!2fr!3spec
            eqfr!2fr!3spec.LS kor_fr!2fr!3 = c(1)+c(2)*spec_fr!2fr!3+c(3)*TREND+
            c(4)*kor_fr!2fr!3(-1)+c(5)*d82+c(6)*d88

            'OLS for FIN'
            equation eqfr!2fr!3FIN
            eqfr!2fr!3fin.LS kor_fr!2fr!3 = c(1)+c(2)*FIN_fr!2fr!3+C(3)*TREND+
            c(4)*kor_fr!2fr!3(-1)+c(5)*d82+c(6)*d88



        'Germany-Germany'

            'OLS for CON'
            equation eqg!2g!3con
            eqg!2g!3con.LS kor_g!2g!3 = c(1)+c(2)*con_g!2g!3+c(3)*DUMGER+
            C(4)*TREND+ c(5)*kor_g!2g!3(-1)

            'OLS for SPEC'
            equation eqg!2g!3spec
            eqg!2g!3spec.LS kor_g!2g!3 = c(1)+c(2)*spec_g!2g!3+c(3)*DUMGER+
            C(4)*TREND+c(5)*kor_g!2g!3(-1)

            'OLS for FIN'
            equation eqg!2g!3FIN
            eqg!2g!3fin.LS kor_g!2g!3 = c(1)+c(2)*FIN_g!2g!3+c(3)*DUMGER+
            C(4)*TREND+ c(5)*kor_g!2g!3(-1)

    ENDIF

        'Germany-France'

            'OLS for CON'
            equation eqg!2fr!3con
            eqg!2fr!3con.LS kor_g!2fr!3 = c(1)+c(2)*con_g!2fr!3+ c(3)*kor_g!2fr!3(-1)
```

```
'OLS for SPEC'
equation eqg!2fr!3spec
eqg!2fr!3spec.LS kor_g!2fr!3 = c(1)+c(2)*spec_g!2fr!3+
 c(3)*kor_g!2fr!3(-1)+c(4)*trend

'OLS for FIN'
equation eqg!2fr!3FIN
eqg!2fr!3fin.LS kor_g!2fr!3 = c(1)+c(2)*FIN_g!2fr!3+c(3)*kor_g!2fr!3(-1)

'OLS for BAL'
   IF !2 <> !3 THEN

      'for France-France'
      equation eqfr!2fr!3BAL
      eqfr!2fr!3BAL.LS kor_fr!2fr!3 = c(1)+c(2)*BAL_fr!2fr!3+C(3)*TREND+
       c(4)*kor_fr!2fr!3(-1)+c(5)*d82+c(6)*d88

      'for Germany-Germany'
      equation eqg!2g!3BAL
       eqg!2g!3BAL.LS kor_g!2g!3 = c(1)+c(2)*BAL_g!2g!3+c(3)*TREND+
      c(4)*kor_g!2g!3(-1)

   ENDIF

      'for Germany-France'

      equation eqg!2fr!3BAL
      eqg!2fr!3BAL.LS kor_g!2fr!3 = c(1)+c(2)*BAL_g!2fr!3+c(3)*DUMGER+
      C(4)*TREND+c(5)*kor_g!2fr!3(-1)

      'for France-Germany'

      equation eqfr!2g!3BAL
      eqfr!2g!3BAL.LS kor_fr!2g!3 = c(1)+c(2)*BAL_fr!2g!3+C(3)*TREND+
      c(4)*kor_fr!2g!3(-1)+c(5)*D81+c(6)*D88
```

```
            NEXT
        NEXT



    'Identification of Several Dummies'


    SMPL 1971 1997


    'German Unification'
       GENR DUMGER=0
        SMPL 1990 1997
        DUMGER =1


    'Dummies for Country-Specific Shocks'
        SMPL 1971 1997
        genr d79=0
        genr d81=0
        genr d82=0
        genr d88=0
        SMPL 1979 1979
        genr d79=1
        smpl 1981 1981
        genr d81=1
        smpl 1982 1982
        genr d82=1
        smpl 1988 1988
        genr d88=1


    'Regressions for Pool of Region Pairs'


SMPL 1971 1997


    'Pool Regressions for CON'


        DELETE EMUCORECON
        POOL EMUCORECON
```

```
        FOR !2=1 TO 8
            FOR !3=1 TO 8

                IF !2 > !3 THEN
                    EMUCORECON.ADD fr!2fr!3 g!2g!3
                ENDIF

                IF !2 >= !3 THEN
                    EMUCORECON.ADD g!2fr!3
                ENDIF

                EMUCORECON.LS KOR_? C KOR_?(-1) CON_? TREND DUMGER

            NEXT
        NEXT
```

'Pool Regressions for FIN'

```
    DELETE EMUCOREFIN
    POOL EMUCOREFIN

        FOR !2=1 TO 8
            FOR !3=1 TO 8

                IF !2 > !3 THEN
                    EMUCOREFIN.ADD fr!2fr!3 g!2g!3
                ENDIF

                IF !2 >= !3 THEN
                    EMUCOREFIN.ADD g!2fr!3
                ENDIF

                    EMUCOREFIN.LS KOR_? C KOR_?(-1) FIN_? TREND DUMGER
```

```
            NEXT
        NEXT



'Pool Regressions for SPEC'

    DELETE EMUCORESPEC
    POOL EMUCORESPEC

        FOR !2=1 TO 8
            FOR !3=1 TO 8

                IF !2 > !3 THEN
                    EMUCORESPEC.ADD fr!2fr!3 g!2g!3
                ENDIF

                IF !2 >= !3 THEN
                    EMUCORESPEC.ADD g!2fr!3
                ENDIF

                    EMUCORESPEC.LS KOR_? C KOR_?(-1) SPEC_? TREND DUMGER

            NEXT
        NEXT



'Pool Regressions for BAL'

DELETE EMUCOREBAL
POOL EMUCOREBAL

        FOR !2=1 TO 8
            FOR !3=1 TO 8
```

```
                IF !2 <> !3 THEN
                    EMUCOREBAL.ADD fr!2fr!3 g!2g!3
                ENDIF

                    EMUCOREBAL.ADD g!2fr!3 fr!2g!3
                    EMUCOREBAL.LS KOR_?  C KOR_?(-1) BAL_? TREND  DUMGER

            NEXT
        NEXT
```

'Testing for Robustness'

'Limiting the Cross Sections'

'Only French Regions'

```
'pool regressions for CON'

DELETE EMUCORECONFR
POOL EMUCORECONFR

FOR !2=1 TO 8
  FOR !3=1 TO 8

 IF !2 > !3 THEN
 EMUCORECONFR.ADD fr!2fr!3
 ENDIF

 EMUCORECONFR.LS KOR_? C KOR_?(-1) CON_? TREND DUMGER
```

```
'Only German Regions'

        'pool regressions for CON'

DELETE EMUCORECONG
POOL EMUCORECONG

FOR !2=1 TO 8
 FOR !3=1 TO 8

 IF !2 > !3 THEN
 EMUCORECON.ADD g!2g!3
 ENDIF


 EMUCORECONG.LS KOR_? C KOR_?(-1) CON_? TREND DUMGER


   'Specification of Robustness Variables'

   'Dummies for Common Borders'

      FOR !2=1 TO 8
        FOR !3=1 TO 8

           GENR DUM_fr!2fr!3=0
           GENR DUM_g!2g!3=0
           GENR DUM_g!2fr!3=0
           GENR DUM_fr!2g!3=0

        NEXT
      NEXT
```

'Common Borders in Germany'

```
GENR dum_g1g2=1
GENR dum_g2g3=1
GENR dum_g2g4=1
GENR dum_g3g2=1
GENR dum_g3g4=1
GENR dum_g3g5=1
GENR dum_g4g2=1
GENR dum_g4g3=1
GENR dum_g4g5=1
GENR dum_g4g6=1
GENR dum_g4g7=1
GENR dum_g5g3=1
GENR dum_g5g4=1
GENR dum_g5g6=1
GENR dum_g6g4=1
GENR dum_g6g5=1
GENR dum_g6g7=1
GENR dum_g7g6=1
GENR dum_g7g4=1
```

'Common Borders in France'

```
GENR dum_fr5fr3=1
GENR dum_fr3fr5=1
GENR dum_fr5fr6=1
GENR dum_fr6fr5=1
GENR dum_fr3fr4=1
GENR dum_fr4fr3=1
GENR dum_fr4fr7=1
GENR dum_fr7fr4=1
GENR dum_fr4fr8=1
GENR dum_fr8fr4=1
GENR dum_fr6fr7=1
GENR dum_fr7fr6=1
```

```
        GENR dum_fr1fr2=1
        GENR dum_fr2fr1=1
        GENR dum_fr1fr5=1
        GENR dum_fr1fr3=1
        GENR dum_fr1fr4=1
        GENR dum_fr1fr6=1
        GENR dum_fr1fr7=1
        GENR dum_fr5fr1=1
        GENR dum_fr3fr1=1
        GENR dum_fr4fr1=1
        GENR dum_fr6fr1=1
        GENR dum_fr7fr1=1
```

'Common Borders Germany France / France-Germany'

```
        GENR dum_fr4g5=1
        GENR dum_g5fr4=1
        GENR dum_fr4g6=1
        GENR dum_g6fr4=1
```

'Relative Income between the Regions'

```
  FOR !2=1 TO 8
    FOR !3=1 TO 8

        genr relinc_fr!2fr!3=0
        genr relinc_g!2g!3=0
        genr relinc_fr!2g!3=0
        genr relinc_g!2fr!3=0

        genr relinc_fr!2fr!3=@abs(ry_fr!2-ry_fr!3)
        genr relinc_g!2g!3=@abs(ry_g!2-ry_g!3)
        genr relinc_fr!2g!3=@abs(ry_fr!2-ry_g!3)
        genr relinc_g!2fr!3=@abs(ry_g!2-ry_fr!3)
```

```
        NEXT
    NEXT



'Implementing the Robustness Variables in Pool Regressions'


'Robustness of Pool Regressions for CON'


    DELETE EMUCORECON1
    POOL EMUCORECON1

        FOR !2=1 TO 8
            FOR !3=1 TO 8

                IF !2 > !3 THEN
                    EMUCORECON1.ADD fr!2fr!3 g!2g!3
                ENDIF

                IF !2 >= !3 THEN
                    EMUCORECON1.ADD g!2fr!3
                ENDIF

                    EMUCORECON1.LS KOR_? C KOR_?(-1) CON_? TREND
                    DUMGER RELINC_?

            NEXT
        NEXT



    DELETE EMUCORECON2
    POOL EMUCORECON2

        FOR !2=1 TO 8
            FOR !3=1 TO 8
```

```
            IF !2 > !3 THEN
                EMUCORECON2.ADD fr!2fr!3 g!2g!3
            ENDIF

            IF !2 >= !3 THEN
                EMUCORECON2.ADD g!2fr!3
            ENDIF

                EMUCORECON2.LS KOR_? C KOR_?(-1) CON_? TREND DUMGER DUM_?

        NEXT
    NEXT

DELETE EMUCORECON3
POOL EMUCORECON3

    FOR !2=1 TO 8
        FOR !3=1 TO 8

            IF !2 > !3 THEN
                EMUCORECON2.ADD fr!2fr!3 g!2g!3
            ENDIF

            IF !2 >= !3 THEN
                EMUCORECON3.ADD g!2fr!3
            ENDIF

                EMUCORECON3.LS KOR_? C KOR_?(-1) CON_? TREND DUMGER
                RELINC_? DUM_?

        NEXT
    NEXT
```

'Robustness of Pool Regressions for FIN'

```
DELETE EMUCOREFIN1
POOL EMUCOREFIN1

    FOR !2=1 TO 8
        FOR !3=1 TO 8

            IF !2 > !3 THEN
                EMUCOREFIN1.ADD fr!2fr!3 g!2g!3
            ENDIF

            IF !2 >= !3 THEN
                EMUCOREFIN1.ADD g!2fr!3
            ENDIF

                EMUCOREFIN1.LS KOR_? C KOR_?(-1) FIN_? TREND DUMGER RELINC_?

        NEXT
    NEXT



DELETE EMUCOREFIN2
POOL EMUCOREFIN2

    FOR !2=1 TO 8
        FOR !3=1 TO 8

            IF !2 > !3 THEN
                EMUCOREFIN2.ADD fr!2fr!3 g!2g!3
            ENDIF

            IF !2 >= !3 THEN
                EMUCOREFIN2.ADD g!2fr!3
            ENDIF
```

```
                    EMUCOREFIN2.LS KOR_? C KOR_?(-1) FIN_? TREND DUMGER DUM_?

                NEXT
            NEXT

        DELETE EMUCOREFIN3
        POOL EMUCOREFIN3

            FOR !2=1 TO 8
                FOR !3=1 TO 8

                    IF !2 > !3 THEN
                        EMUCOREFIN3.ADD fr!2fr!3 g!2g!3
                    ENDIF

                    IF !2 >= !3 THEN
                        EMUCOREFIN3.ADD g!2fr!3
                    ENDIF

                        EMUCOREFIN3.LS KOR_? C KOR_?(-1) FIN_? TREND DUMGER
                        RELINC_? DUM_?

                NEXT
            NEXT
```

'Robustness of Pool Regressions for SPEC'

```
        DELETE EMUCORESPEC1
        POOL EMUCORESPEC1

            FOR !2=1 TO 8
            FOR !3=1 TO 8

                    IF !2 > !3 THEN
                        EMUCORESPEC1.ADD fr!2fr!3 g!2g!3
                    ENDIF
```

```
            IF !2 >= !3 THEN
                  EMUCORESPEC1.ADD g!2fr!3
            ENDIF

                  EMUCORESPEC1.LS KOR_? C KOR_?(-1) SPEC_? TREND DUMGER
                  RELINC_?

      NEXT
NEXT


DELETE EMUCORESPEC2
POOL EMUCORESPEC2

      FOR !2=1 TO 8
            FOR !3=1 TO 8

                  IF !2 > !3 THEN
                        EMUCORESPEC2.ADD fr!2fr!3 g!2g!3
                  ENDIF

                  IF !2 >= !3 THEN
                        EMUCORESPEC2.ADD g!2fr!3
                  ENDIF

                        EMUCORESPEC2.LS KOR_? C KOR_?(-1) SPEC_? TREND DUMGER
                        DUM_?

            NEXT
      NEXT


DELETE EMUCORESPEC3
POOL EMUCORESPEC3
```

```
        FOR !2=1 TO 8
            FOR !3=1 TO 8

                IF !2 > !3 THEN
                    EMUCORESPEC1.ADD fr!2fr!3 g!2g!3
                ENDIF

                IF !2 >= !3 THEN
                    EMUCORESPEC3.ADD g!2fr!3
                ENDIF

                    EMUCORESPEC3.LS KOR_? C KOR_?(-1) SPEC_? TREND DUMGER
                    RELINC_? DUM_?

            NEXT
        NEXT


'Robustness of Pool Regressions for BAL'

    DELETE EMUCOREBAL1
    POOL EMUCOREBAL1

        FOR !2=1 TO 8
            FOR !3=1 TO 8

                IF !2 <> !3 THEN
                    EMUCOREBAL1.ADD fr!2fr!3 g!2g!3
                ENDIF

                    EMUCOREBAL1.ADD g!2fr!3 fr!2g!3
                    EMUCOREBAL1.LS KOR_?  C KOR_?(-1) BAL_? RELINC_? TREND
                    DUMGER


            NEXT
```

```
NEXT

DELETE EMUCOREBAL2
POOL EMUCOREBAL2

FOR !2=1 TO 8
FOR !3=1 TO 8

IF !2 <> !3 THEN
EMUCOREBAL2.ADD fr!2fr!3 g!2g!3
ENDIF

EMUCOREBAL2.ADD g!2fr!3 fr!2g!3
EMUCOREBAL2.LS KOR_?  C KOR_?(-1) BAL_? DUM_? TREND

NEXT
NEXT

DELETE EMUCOREBAL3
POOL EMUCOREBAL3

FOR !2=1 TO 8
FOR !3=1 TO 8

IF !2 <> !3 THEN
EMUCOREBAL3.ADD fr!2fr!3 g!2g!3
ENDIF

EMUCOREBAL3.ADD g!2fr!3 fr!2g!3
EMUCOREBAL3.LS KOR_?  C KOR_?(-1) BAL_? RELINC_? DUM_? TREND
DUMGER

NEXT
NEXT
```

APPENDIX II

Tab. 3a: Regression results based on the conformity index CON

	FR 1	FR 2	FR 3	FR 4	FR 5	FR 6	FR 7	FR 8	G 1	G 2	G 3	G 4	G 5	G 6	G 7	G 8
FR 1																
FR 2	0,73															
	0,72															
	0,35															
FR 3	-0,44	20.98*														
	0,96	0,85														
	0,88	0,61														
FR 4	1.89*	-8,78	9.36***													
	1,00	0,96	0,99													
	0,26	0,41	0,33													
FR 5	-3,49	10,93	11.36*	7.19*												
	0,91	0,95	0,76	0,94												
	0,52	0,43	0,86	0,20												
FR 6	-1.65**	10.57*	9.32*	3.44*	-4,42											
	0,87	0,95	0,79	0,99	0,97											
	0,79	0,89	0,12	0,62	0,42											
FR 7	-1,82	-28,26	12,78	-13,61	14.77***	24,17										
	0,95	0,98	0,96	0,99	0,96	0,93										
	0,64	0,43	0,88	0,84	0,51	0,54										
FR 8	-8,05	3,14	5.96***	10.47**	-9.55*	-14,24	-1,17									
	0,95	0,98	0,93	0,94	0,90	0,92	0,91									
	0,34	0,38	0,97	0,51	0,30	0,50	0,60									
G 1	-8,25	5.66**	5.20***	8.55*	18.12***	-2,90	6.27*	-2,01								
	0,92	0,78	0,98	0,93	0,84	0,87	0,98	0,83								
	0,15	0,82	0,38	0,15	0,66	0,13	0,64	0,36								
G 2	0,71	0.02**	-1,33	2,71	16.66**	1,03	-25.89***	-0,83	-0,92							
	0,83	0,78	0,92	0,96	0,75	0,64	0,93	0,88	0,96							
	0,63	0,15	0,24	0,88	0,67	0,62	0,38	0,34	0,09							
G 3	-0,26	-13.26*	-5,73	-6,99	-6.41**	4,24	-26,37	0,10	10,69	-34.85**						
	0,94	0,88	0,93	0,95	0,93	0,40	0,95	0,86	0,72	0,50						
	0,31	0,95	0,50	0,88	0,78	0,70	0,63	0,12	0,27	0,96						
G 4	-9,48	-1,05	-0,36	-1,05	-1,60	0,73	1,02	2,02	0,16	-14.43***	-4,19					
	0,94	0,86	0,94	0,97	0,97	0,54	0,95	0,60	0,71	0,59	0,90					
	0,52	0,36	0,98	0,81	0,69	0,19	0,75	0,65	0,90	0,53	0,70					
G 5	0,66	-7,03	0,26	-12,96	0,99	3.83**	-8,55	0,99	2.97*	-13.71**	-88.36***	0,97				
	0,90	0,78	0,95	0,73	0,90	0,97	0,91	0,86	0,92	0,48	0,92	0,99				
	0,54	0,18	0,38	0,74	0,97	0,70	0,84	0,11	0,19	0,36	0,98	0,78				
G 6	0,29	4.43*	-0,02	-2,22	-0,24	0,67	-6.06**	-1,50	-0,85	5.94**	2,06	-0,91	-13,73			
	0,93	0,93	0,93	0,98	0,98	0,88	0,98	0,92	0,92	0,84	0,96	0,94	0,95			
	0,61	0,50	0,43	0,98	0,48	0,33	0,36	0,97	0,47	0,39	0,67	0,58	0,12			
G 7	-0,09	15.62*	-0,85	-0,71	1,06	5.03*	1,60	-4,01	-5.52**	-11,79	-144.47**	4,72	82.64***	15.20*		
	0,91	0,93	0,94	0,94	0,96	0,92	0,98	0,94	0,98	0,85	0,82	0,83	0,41	0,94		
	0,64	0,19	0,45	0,97	0,22	0,50	0,44	0,13	0,24	0,40	0,87	0,81	0,61	0,14		
G 8	-1,54	-1,14	-5,42	2,24	-17.17***	9.17**	-17.40**	29.75***	-5,83	-78.75**	-42,57	-11,44	0,02	3,69	-52,19	
	0,94	0,90	0,94	0,87	0,96	0,93	0,96	0,89	0,93	0,76	0,89	0,95	0,37	0,97	0,82	
	0,52	0,41	0,58	0,75	0,49	0,10	1,00	0,50	0,18	0,60	0,15	0,95	0,12	0,88	0,20	

Note: Sample 1975 to 1997, dummies implemented if necessary to fulfil LM autocorrection criterion (LM-test, F-test-version, with 2 lags)

Tab. 3b: Regression results based on the Finger-Kreinin index FIN

	FR 1	FR 2	FR 3	FR 4	FR 5	FR 6	FR 7	FR 8	G 1	G 2	G 3	G 4	G 5	G 6	G 7	G 8
FR 1																
FR 2	3,91															
	0,87															
	0,92															
FR 3	-1,12	6.66**														
	0,91	0,81														
	0,85	0,24														
FR 4	0,24	-1,19	3.35***													
	0,99	0,96	0,98													
	0,97	0,49	0,96													
FR 5	2.95**	5.08**	4.22*	3.09**												
	0,95	0,97	0,88	0,96												
	0,22	0,50	0,57	0,22												
FR 6	-0,87	3,61	9.11***	1,67	1,08											
	0,94	0,95	0,87	0,99	0,97											
	0,93	0,87	0,98	0,89	0,41											
FR 7	-0,25	-0,29	1,18	-2,85	5.46***	10.01**										
	0,95	0,97	0,96	0,99	0,95	0,95										
	0,64	0,40	0,88	0,86	0,54	0,95										
FR 8	3,25	0,74	3.35**	0,90	-4.00*	-1,65	0,48									
	0,97	0,98	0,93	0,99	0,93	0,94	0,96									
	0,30	0,36	0,80	0,69	0,11	0,65	0,45									
G 1	1.49*	3.61**	3.21***	-0,11	1.65*	-0,32	-0,60	-2,08								
	0,95	0,78	0,98	0,95	0,96	0,87	0,99	0,83								
	0,43	0,90	0,29	0,84	0,90	0,79	0,94	0,94								
G 2	0,59	0,95	0,47	0,91	-2,14	-0,17	-4.61***	-3,59	-0,76							
	0,87	0,79	0,95	0,95	0,82	0,66	0,96	0,93	0,88							
	1,00	0,18	0,22	0,93	0,74	0,43	0,97	0,86	0,38							
G 3	-0,35	-2.93*	-2,15	-2,47	-2.96***	0,68	-4.52*	-3,97	7.24***	1,19						
	0,95	0,90	0,94	0,96	0,94	0,84	0,97	0,92	0,77	0,43						
	0,46	0,42	0,64	0,93	0,53	0,28	0,44	0,49	0,19	0,16						
G 4	-2,01	-0,61	-0,60	-0,39	-1.43*	0,20	1.81***	-1.49*	-0,40	-0,57	-1,43					
	0,95	0,90	0,96	0,97	0,98	0,94	0,99	0,91	0,86	0,54	0,91					
	0,53	0,34	0,42	0,82	0,68	0,13	0,27	0,06	0,35	0,16	0,69					
G 5	0,26	-6.04***	-0,18	-9.38***	1,27	-1,56	-9.17***	-3.33**	0,84	-2.89*	-11.19**	0,00				
	0,90	0,74	0,83	0,63	0,90	0,92	0,90	0,87	0,94	0,57	0,92	0,99				
	0,54	0,74	0,98	0,31	0,17	0,35	0,59	0,55	0,72	0,41	0,85	0,72				
G 6	1,27	0,02	-0,85	-0,46	-0,16	0,50	0,05	-1,45	-0,76	1.51*	-0,52	-2,42	-5.77**			
	0,94	0,92	0,92	0,98	0,99	0,88	0,98	0,92	0,92	0,86	0,94	0,87	0,91			
	0,44	0,71	0,28	0,97	0,65	0,36	0,86	0,99	0,46	0,06	0,59	0,48	0,10			
G 7	0,87	3.26**	-0,08	-0,44	-0,57	2.32**	1,13	-2,16	-2,12	-4,46	-3,14	-6.01**	19.21***	4,75		
	0,91	0,94	0,94	0,95	0,97	0,95	0,99	0,94	0,82	0,76	0,95	0,95	0,45	0,94		
	0,56	0,27	0,49	0,99	0,82	0,11	0,47	0,10	0,87	0,65	0,97	0,80	0,74	0,39		
G 8	-0,31	5,89	0,52	-0,12	-9.41***	-2,03	-8.77**	-1,12	-2,12	-1,23	1,52	-1,12	0,31	0,91	-9,04	
	0,94	0,86	0,93	0,91	0,94	0,95	0,94	0,96	0,80	0,72	0,93	0,94	0,37	0,94	0,79	
	0,53	0,49	0,17	0,71	0,11	0,54	0,52	0,28	0,99	0,55	0,11	0,82	0,12	0,86	0,05	

Note: Sample 1975 to 1997, dummies implemented if necessary to fulfil LM autocorrection criterion (LM-test, F-test-version, with 2 lags)

Tab. 3c: Regression results based on the specialisation index SPEC

	FR 1	FR 2	FR 3	FR 4	FR 5	FR 6	FR 7	FR 8	G 1	G 2	G 3	G 4	G 5	G 6	G 7	G 8
FR 1																
FR 2	-0,05															
	0,87															
	0,93															
FR 3	0,03	-0.61**														
	0,91	0,77														
	0,78	0,11														
FR 4	-0,01	0,01	-0.24**													
	0,99	0,96	0,98													
	1,00	0,43	0,98													
FR 5	0,04	0,02	-0.19*	-0.12*												
	0,91	0,92	0,82	0,94												
	0,52	0,17	0,56	0,18												
FR 6	0.14**	-0.11*	-0.29***	-0.06*	0,00											
	0,89	0,95	0,86	0,99	0,97											
	0,57	0,83	0,61	0,72	0,61											
FR 7	0,02	0,32	-0.82**	0,21	-0.26***	-0.38***										
	0,95	0,97	0,85	0,99	0,97	0,96										
	0,64	0,41	0,35	0,82	0,46	0,50										
FR 8	-0.25**	-0,06	-0.07*	-0.07**	0,07	0,19	-0,08									
	0,99	0,99	0,91	0,99	0,33	0,86	0,97									
	0,33	0,66	0,64	0,39	0,12	0,53	0,35									
G 1	-0.32***	-0.03*	-0.06**	0,02	-0,01	0,03	0,01	0,07								
	0,93	0,85	0,98	0,93	0,93	0,87	0,99	0,84								
	0,67	0,97	0,29	0,96	0,69	0,11	0,93	0,34								
G 2	-0.02*	-0,27	-0,04	-0,06	0,20	-0,05	0,11	0,12	-0,05							
	0,90	0,53	0,91	0,84	0,60	0,41	0,95	0,89	0,88							
	0,64	0,32	0,19	0,11	0,80	0,43	0,18	0,34	0,63							
G 3	0,03	0.26*	0,50	0,14	0.10*	-0,07	0,51	0,04	-0.19*	0.67**						
	0,93	0,89	0,89	0,95	0,93	0,41	0,97	0,92	0,74	0,44						
	0,57	0,86	0,88	0,84	0,83	0,76	0,73	0,62	0,17	0,34						
G 4	0,06	0,04	0,00	0,91	0.04*	0,02	0,03	0,04	0,00	-0,04	0,04					
	0,95	0,75	0,94	0,96	0,96	0,55	0,96	0,73	0,71	0,22	0,90					
	0,61	0,84	0,97	0,51	0,48	0,30	0,66	0,44	0,91	0,15	0,67					
G 5	0,00	-0,05	-0.13**	1.48***	0,06	-0.08**	0.50***	0,03	-0.06***	0.23*	1.26**	0,00				
	0,90	0,93	0,93	0,43	0,92	0,94	0,94	0,69	0,93	0,48	0,91	0,99				
	0,45	0,25	0,41	0,14	0,26	0,15	0,76	0,56	0,30	0,33	0,89	0,74				
G 6	0,01	-0.07*	0,00	0,04	0,00	-0,01	0,06	0,02	0,01	-0.17***	0,02	0,03	0,20			
	0,90	0,93	0,84	0,98	0,98	0,88	0,97	0,92	0,87	0,51	0,94	0,86	0,95			
	0,66	0,59	0,75	0,98	0,45	0,40	0,17	0,97	0,69	0,37	0,59	0,43	0,17			
G 7	0,01	-0.19*	0,12	0,07	0,01	-0.11**	-0,08	0,03	0,08	-0,01	-0,24	0,14	-1.55***	-0.37***		
	0,77	0,94	0,85	0,93	0,97	0,91	0,98	0,81	0,81	0,75	0,83	0,76	0,46	0,96		
	0,43	0,23	0,55	0,68	0,85	0,26	0,48	0,32	0,85	0,69	0,88	0,84	0,85	0,74		
G 8	0,02	-0.48**	0,10	-0,11	0.19*	-0.17***	0.48***	-0.31**	-0.19**	1.12**	0,58	0,20	0,00	-0,14	-0,13	
	0,94	0,94	0,94	0,89	0,94	0,97	0,96	0,86	0,84	0,72	0,89	0,89	0,37	0,96	0,82	
	0,52	0,46	0,32	0,99	0,57	0,49	0,99	0,27	0,87	0,65	0,16	0,95	0,12	0,27	0,22	

Note: Sample 1975 to 1997, dummies implemented if necessary to fulfil LM autocorrection criterion (LM-test, F-test-version, with 2 lags)

Tab. 3d: Regression results based on the Balassa-Aquino-Index BAL

	FR 1	FR 2	FR 3	FR 4	FR 5	FR 6	FR 7	FR 8	G 1	G 2	G 3	G 4	G 5	G 6	G 7	G 8
FR 1		-0,07	0,68	-0,01	0,11	0,06	-0,55	-0,44	0,38	0,09	1,55	2.07**	1,47	1,02	1,33	0,58
		0,78	0,91	0,99	0,91	0,83	0,96	0,90	0,92	0,70	0,83	0,93	0,37	0,88	0,64	0,94
		0,49	0,86	0,99	0,46	0,80	0,68	0,97	0,41	0,24	0,26	0,40	0,02	0,19	0,53	0,42
FR 2	-2,70		0,12	0,90	-0,80	0,66	3.52**	-0,33	-1.69**	-0,73	1.76*	2.04**	0,55	-0.86*	-1.71**	-2.44**
	0,87		0,66	0,97	0,93	0,90	0,94	0,93	0,70	0,33	0,89	0,86	0,67	0,93	0,93	0,97
	0,90		0,20	0,32	0,11	0,46	0,18	0,94	0,57	0,10	0,87	0,27	0,09	0,45	0,01	0,08
FR 3	0,56	0,02		-1.20*	-0,46	-1.72*	-2.20**	-1.72**	-0.83*	-0,27	3.25***	3.24*	2.75***	0,42	1,24	0,82
	0,91	0,66		0,97	0,90	0,79	0,88	0,92	0,98	0,92	0,89	0,77	0,54	0,84	0,93	0,94
	0,88	0,19		0,76	0,11	0,92	0,53	0,57	0,05	0,13	0,94	0,55	0,23	0,83	0,92	0,26
FR 4	-0,55	0,68	-0,57		-0,83	0,47	1,02	-5.55**	-0,82	-0,63	0,98	0,21	1.89**	0,17	-1,05	1,67
	0,99	0,96	0,98		0,93	0,99	0,99	0,94	0,95	0,88	0,93	0,97	0,53	0,98	0,95	0,90
	1,00	0,24	0,96		0,47	0,97	0,71	0,55	0,49	0,22	0,20	0,82	0,15	0,84	0,88	0,07
FR 5	-0,38	-0,42	-1,72	-1,02		0,32	-1.92**	0,76	-2.44***	0,12	0,47	1.11**	1.49***	0,40	0,04	6.37***
	0,90	0,93	0,81	0,93		0,97	0,90	0,93	0,85	0,77	0,95	0,97	0,75	0,94	0,96	0,94
	0,61	0,12	0,68	0,35		0,12	0,30	0,11	0,96	0,44	0,27	0,81	0,12	0,74	0,28	0,59
FR 6	1,75	0,23	-3.36***	-0.31	0,47		-0.04	1,10	0,20	-0,31	-0,92	-0,24	-0,81	-0.84**	-1.06**	-1,32
	0,85	0,89	0,77	0,99	0,97		0,90	0,86	0,87	0,53	0,41	0,59	0,86	0,87	0,92	0,97
	0,97	0,98	0,68	0,69	0,27		0,99	0,55	0,14	0,34	0,70	0,79	0,02	0,94	0,40	0,79
FR 7	-0,20	2.13**	-1.82*	1,26	-1.26**	0,25		0,19	-1.78***	0,21	-1.99*	0,72	1.48**	0,50	0,40	3.62***
	0,95	0,95	0,87	0,99	0,92	0,90		0,14	0,95	0,95	0,94	0,96	0,92	0,97	0,98	0,96
	0,66	0,21	0,46	0,80	0,92	0,96		0,62	0,44	0,23	0,19	0,80	0,22	0,15	0,44	0,90
FR 8	1,48	-0,14	-1,02	-3.19*	1,40	0,64	0,14		1,38	4.21**	1,05	-0,49	1.03*	0,30	-0,04	0,48
	0,95	0,93	0,75	0,93	0,89	0,85	0,91		0,80	0,85	0,92	0,61	0,80	0,92	0,88	0,89
	0,39	0,94	0,97	0,48	0,44	0,58	0,61		0,24	0,42	0,61	0,37	0,73	0,91	0,04	0,16
G 1	-3.36***	-1.40***	-1.13***	-1.76*	-0,16	1.57**	-1.65**	1.67*		-0,34	-3.46***	-0.49*	-3.02***	-1.36***	0,15	0,29
	0,89	0,81	0,98	0,94	0,93	0,84	0,95	0,81		0,95	0,84	0,51	0,75	0,69	0,96	0,92
	0,99	0,48	0,40	0,23	0,76	0,76	0,43	0,47		0,47	0,23	0,74	0,44	0,62	0,37	0,10
G 2	0,06	0,70	-0,22	-0,56	0,68	0,41	0,30	3,08	-1.31*		-1.13**	1,11	0,27	-2.28***	-4.77**	-0,92
	0,53	0,44	0,93	0,87	0,35	0,58	0,95	0,88	0,86		0,66	0,44	0,45	0,66	0,73	0,69
	0,27	0,16	0,39	0,00	0,72	0,77	0,55	0,34	0,66		0,39	0,79	0,43	0,35	0,74	0,38
G 3	0,07	0,11	3.32***	-0,51	0,38	0,35	-5.30***	1,82	-0,04	-0.91**		0,61	0,97	-0.82***	-0,80	-8.15**
	0,89	0,86	0,91	0,95	0,92	0,96	0,94	0,84	0,84	0,62		0,89	0,89	0,97	0,93	0,87
	0,27	0,88	0,94	0,71	0,78	0,14	0,54	0,49	0,08	0,13		0,03	0,67	0,07	0,92	0,90
G 4	1,49	-0,42	3.37*	0,10	-0,14	0.99**	0,12	0,98	-0.30*	0,19	-0,08		2.82***	2.22***	6.10**	5.41**
	0,87	0,78	0,80	0,96	0,86	0,84	0,94	0,83	0,59	0,31	0,90		0,95	0,79	0,75	0,90
	0,47	0,81	0,76	0,59	0,57	0,13	0,25	0,38	0,77	0,43	0,27		0,45	0,77	0,76	0,84
G 5	1,09	-0.86*	1.89*	3.95***	1.38***	0,50	2.32***	2.61**	-3.14***	-0,01	1.02*	3.11***		2,40	-1,29	0,50
	0,63	0,82	0,64	0,56	0,86	0,93	0,89	0,66	0,77	0,48	0,80	0,94		0,82	0,18	0,49
	0,07	0,86	0,40	0,48	0,96	0,96	0,23	0,18	0,71	0,49	0,09	0,70		0,07	0,12	0,04
G 6	0,21	-0.77**	0,96	-0.18	-0,10	0,78	-0,55	0,99	-1.57***	-1.79***	-0.68***	1.96**	2,16		-1,57	0,33
	0,93	0,94	0,86	0,97	0,93	0,90	0,98	0,94	0,70	0,68	0,67	0,77	0,81		0,89	0,93
	0,91	0,59	0,75	0,92	0,31	0,28	0,92	0,60	0,58	0,27	0,05	0,93	0,23		0,75	0,66
G 7	-1,44	-1.18**	0,44	-0,52	-1.86**	0,58	-0,27	0,16	0,13	-0,96	-0,42	5,28	-1,72	-0.06		-0,53
	0,92	0,94	0,93	0,94	0,94	0,95	0,98	0,85	0,97	0,81	0,93	0,93	0,26	0,88		0,75
	0,62	0,01	0,75	0,47	0,76	0,31	0,41	0,16	0,41	0,70	0,94	0,58	0,29	0,79		0,52
G 8	-0,60	-0.31*	0,53	-0,29	0,10	-0,16	0,16	-0,12	-1.23*	0,22	-1.31**	0,39	0,09	-0.49*	-0.46*	
	0,94	0,87	0,94	0,88	0,93	0,98	0,94	0,97	0,93	0,53	0,84	0,92	0,60	0,94	0,91	
	0,55	0,54	0,33	0,99	0,71	0,41	0,81	0,15	0,18	0,53	0,82	0,55	0,57	0,67	0,26	

Note: Sample 1975 to (1997) 1994, in case of Berlin (G8) only 1975 to 1990 (data limitations due to BAL and reunification), dummies implemented if necessary to fulfil LM autocorrelation criterion (LM-test with 2 lags), third row for each region pair represents then usual a-probability value