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Abstract

We investigate the linkage between business cycle convergence and financial portfolio choice for a panel of 18 EU countries. We construct an index of similarity of financial portfolios which we then put into context with the view that "the financial world" has an impact on business cycles and contributes to business cycle convergence via the consumption-wealth linkage. The model which guides our analysis is the International Asset Pricing Model (IAPM). Portfolios of the 18 EU countries investigated by us turn out to become more similar over time. According to our fixed effects GMM TSLS estimations, similar portfolios contribute to a convergence of business cycles - via a convergence of consumption cycles. This turns out to be especially true for country-pairs that include euro area non-member countries and, thus, have quite different income and wealth structures.

JEL-Classification: E21, F36, G11, O47

Keywords: business cycle convergence, consumption-wealth linkage, International Asset Pricing Model, portfolio choice, panel methods, specialisation index

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1. Motivation

Motivated by the optimum currency area theory (Mundell, 1961) business cycle convergence is an important topic for members of such a union and also for member candidates. Only if all countries taking part in the monetary union behave as an economic unit and react similarly to asymmetric shocks a common monetary policy can act in a coherent and sustainable fashion. Otherwise, contradictory signals for the interest setting of the central bank might be a consequence and might make membership of a monetary union quite costly.

Hence, business cycle convergence should be seen as a way to remedy the non-existing business cycle synchronisation. If business cycle convergence would happen then business cycle synchronisation would occur. Therefore business cycle convergence is vital if the EMU would ever be an optimal currency area.

Most economists agree that, so far, the countries participating in the EMU do not have synchronised business cycles (as earlier sources, see, for instance, Artis, 2003; Gros and Hefeker, 2004). Business cycle convergence of the participating countries would compensate for the stability loss of giving away autonomy of monetary policy, because consequently the empirical realisations of the indicator variables for European monetary policy decision makers would converge as well and setting a common interest rate for uncommon regions would be less of a problem.

But which factors contribute to business cycle convergence? Besides well known factors such as trade integration or factor mobility, one further factor could be the degree of synchronicity of consumption of private households in euro area member countries. Synchronized consumption can in turn be engendered by similar private (financial) investment strategies, leading to similar returns and consumption out of financial wealth. Financial wealth of private households has grown substantially in the recent years before the financial crisis. In Western Europe, financial wealth amounts to over 150 % of GDP, and the

estimation of the annual growth rate of financial wealth is 4.2 % (2002 – 2006) (Uni Credit Group, 2007). Further growth has been expected before the financial crisis set in.

The growing importance of financial wealth implies that investment decisions have a growing influence on income, the standard of living - and therefore also on consumption. Investment strategies are usually assumed to be met in a “rational” fashion. Rationality in this context implies that investors would reach similar investment decisions.

In this direction, a plausible "common" investment strategy could be derived from the International Asset Pricing Model (IAPM) introduced by Solnik (1974) which, in turn, is based on the Capital Asset Pricing Model (CAPM) by Sharpe (1964). According to the IAPM, a portfolio should reflect the relative world market weights of all countries to achieve the best risk-return-ratio (de Santis and Gérard, 2006). Its basic idea is that there is a national systematic risk that can be further reduced by investing internationally. It starts from the premise that the country markets themselves (i.e., the country proportions in the portfolios) are already diversified with regard to unsystematic risk. Analogously to the CAPM, risk premia in the IAPM are assumed to be proportional to their international systematic risk. Exchange rate risk is considered to be either hedged or, in the case of bonds, the correlation between exchange rate risk and return is explicitly modelled in Solnik‘s model. The logic of the IAPM implies that all investors in the world hold the same (world) market portfolio[1] and a risk free asset.

The IAPM has recently gained much attention in popular finance media which addressed the widely observed phenomenon of the so-called *home bias*. Basically, the notion of a home bias in our context addresses the pattern that an investor is typically investing mainly in her home country instead of benefitting from international diversification. For

[1] Solnik (1974) in his inter-temporal model differentiates between a hedged stock market portfolio and a risk free bond portfolio. The bond portfolio is only riskless with regard to its beta, not with regard to exchange rate risk. These two risky assets are summarized in this paper to the world market portfolio. The risk free asset is our usual risk free asset with a beta of 0 and no exchange rate risk.

instance, about 83 percent of German investors invest in German companies although the finance literature has been recommending diversification across different countries, asset categories, etc. for years (Zydra, 2008).

So far, the link among the overall investor position and the macroeconomic dimension of business cycle convergence has not been discussed extensively in the literature yet. It is one of our aims in this study to link the microeconomic advantages derived from rational investment strategies on the micro level to business cycle convergence on the macro level and, for this purpose, to investigate empirically whether the theoretical link empirically holds for the euro area member countries. It is important to note in this context that rationality of investment decisions is not the driving force of business cycle convergence itself. Instead, the decisive determinant of the latter is the *similarity of portfolios* which result in *similar income effects* – independent on whether portfolio strategies follow the IAPM or not. The mechanism we have in mind is that if all investors follow the same strategy the portfolios necessarily reflect the similarity of investment and create similar income effects.

Just to summarize: the main challenge is to investigate the *linkage between business cycle convergence and portfolio choice*. Our focus in this context is on private investors due to the rising importance of private financial wealth. Our main prior is that similar portfolios contribute to a convergence of business cycles – via a convergence of consumption cycles.

Important pre-conditions for the empirical validity of our main prior are numbered below - as a chain of testable hypotheses.

1. There is a linkage between financial wealth and income effects, - or put differently - "wealth influences consumption". Otherwise, investment strategies would have no influence and our empirical investigation would not be appropriate. This crucial issue is usually discussed under the term of the *consumption-wealth linkage* and has been positively confirmed in several studies for the connection of financial wealth and consumption (Ludwig and Sløk, 2002; Slacalek, 2006; Kishor, 2007, Sousa 2009).

Ludwig and and Sløk (2002) investigate how consumption responds to changes in financial and housing wealth in 16 OECD-countries. Using panel data techniques they report marginal propensities to consume out of stock market wealth of two till five per cent.

The sample of 16 countries used by Slacalek (2006) covers most countries of our sample as well. The results suggest that first, a rise in wealth raises consumption on average by 5 per cents, second, that the individual country changes are dependent on the financial system (market based economies exhibit a higher responsiveness) and third, that financial wealth has a higher effect on consumption as housing wealth in the EMU countries of the sample.

Kishor (2007) comes to different results for the US economy concerning the effect of financial wealth: The marginal propensity to consume is three per cent opposed to ten per cent in the case of house price changes. The author attributes the differences to the transitory shock effects that affect financial wealth and more permanent shocks affecting housing wealth.

However, Sousa (2009) finds out that housing wealth has almost no influence in the euro area and is not significant. His contribution uses data from 1980 till the end of 2007 for the aggregate euro area and confirms the consumption-wealth linkage, although the empirical marginal propensity to consume is only 1.4 per cent.

2. The IAPM forms the basis of a plausible investment strategy. If it is likely that investors behave according to it, the optimal portfolio weights derived by the IAPM can act as a benchmark to measure the degree of the home bias. The advantage of the aforementioned investment strategy for investors is empirically confirmed by several studies (Brooks and Del Negro, 2004; von Nietzsch and Stotz, 2006; Bluethgen et al., 2008; Schneider, 2011).

Brooks and Del Negro (2004) conclude from stock data of more than 9600 companies from more than 42 countries that diversification across countries is still an effective strategy although recent literature emphasizes the role of diversification across industries. They argue that stock market return correlations that can be observed from mid-1990s on might be only temporal because it was partly driven by a stock market bubble.

If the IAPM is considered as a long-term investment strategy, von Nietzsch and Stotz (2006, p. 107) judge it as plausible direction for investors to take. Their approach is to oppose the Sharpe ratio of a pure home country portfolio compared to an international portfolio. They find out that return increases in their sample of the G-7 countries from 1979 to 2005 by about one per cent if the IAPM is the investment strategy, if the same time the exchange rate risk is hedged.

Bluethgen et al. (2008) calculate a disadvantage of 2.4 % for German investors if the actual portfolio choice is compared to the optimal portfolio choice of the IAPM. They argue that there are signs that a rising attention towards this topic induces private investors to change their investment behaviour.

3. Portfolios in the sample have become more similar (Schneider, 2011).
4. “Similar investment” contributes to consumption cycle convergence.
5. Convergence of consumption cycles contributes to business cycle convergence.

The Figure 1 below serves to illustrate the transmission channel behind this “chain”. It runs from similar portfolios over similar financial returns and over similar consumption to converged cycles.

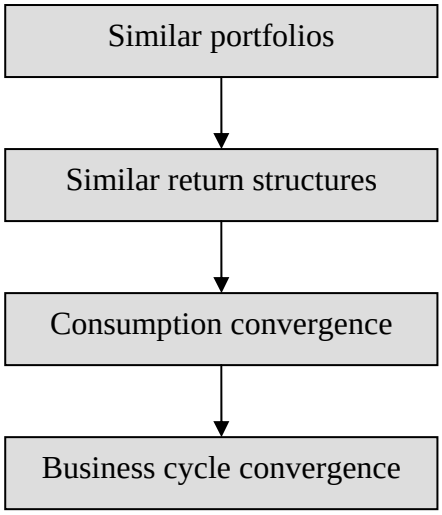

Figure 1 - *Transmission channels from similar portfolios to business cycle convergence*

The remainder of the paper is organized as follows. The preconditions one and two are considered to stand on a solid empirical ground and are not pursued further. In Section 2, we go more deeply into issues of measuring portfolio similarity and come up with an empirical measure of portfolio similarity for European countries. In Section 3, we carefully derive the other variable definitions and specifications, enact some pre-tests, develop the empirical panel model and put hypotheses four and five under econometric scrutiny; i.e., we check whether "similar financial investment" contributes to consumption cycle convergence and whether convergence of consumption cycles contributes to business cycle convergence. Section 4 finally concludes.

2. Issues in portfolio similarity

To measure portfolio similarity, we adopt an index which has been used in the context of industry patterns before (Belke and Heine, 2006, 2007; Clark and van Wincoop, 2001). We construct it as a pairwise specialisation index and call it SPEC. Accordingly, the empirical realisation of the index of a country-pair with *less similar* portfolios turns out to be *higher* than the respective index of countries with more similar portfolios. The criterion for similarity

is that country shares in the investment portfolio are similar with the assumption in mind that country shares represent on average the whole country: This implies that a country share incorporates all diversification possibilities to completely diversify unsystematic risk (intra-national risks are "diversified away" within each country). Country shares are represented by country indices; in addition, a country index represents the profit per country.

Finally, the specialisation index SPEC is calculated as follows:

$$\mathbf{SPEC} = \sum_{i=1}^{n} \left| a_i - b_i \right|, \tag{1}$$

with n = number of countries and i = country index. The parameter *a* represents the share of country i in country i and b is the share of country B in country i. Empirical realisations of SPEC range from 0 (complete similarity/same portfolio) to 2 (complete dissimilarity). With regard to the high degree of economic and financial integration, we consider the euro area as one country for our purposes.

The data used for constructing SPEC basically originate from two sources: the Coordinated Portfolio Investment Survey (CPIS) coordinated by the IMF and Eurostat. To be more concrete, we use data delivered by Eurostat on the national financial accounts broken down according to the kind of investment (bond, shares, other). From the IMF data we infer portfolio proportions of each country and empirical realisations of foreign (portfolio) wealth.

As national accounts do not reveal the relation of foreign wealth to domestic wealth to calculate the relative amount that is invested in the respective home country, we calculate the *domestic proportion* by adding bonds, shares and insurance accruals to the total wealth of a country i and subtracting foreign wealth of the same country.

The CPIS data is not limited to private investors. However, there are arguments in favour of using SPEC as a proxy for private investment as well: A growing coverage of popular media of the diversification topic draws the attention of private investors to their own

investment and might induce investment changes. For private investors that are not interested in financial theory it is plausible to assume that they hold funds that are managed by institutional investors. A further argument is an earlier study by Lapp who concludes that estimated banking investment is comparable to private investment (Lapp, 2001, p. 68).

Due to data limitations, we finally consider 18 European countries - most of them euro area members and some of them "core countries" of EMU: Austria, Belgium, Bulgaria, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Portugal, Romania, Slovak Republic, Spain and Sweden. The time range of our panel is 1999 to 2006[2], although data cannot be provided for all countries and for all the years.[3]

The overall development of the specialisation index SPEC over time meets our expectations. The SPEC variable exhibits a downward trend across the covered time period 2001 to 2007. That means portfolios indeed have become more similar with respect to country proportions. Figure 2 displays the development over time of our specialisation index averaged over all country-pairs per year.

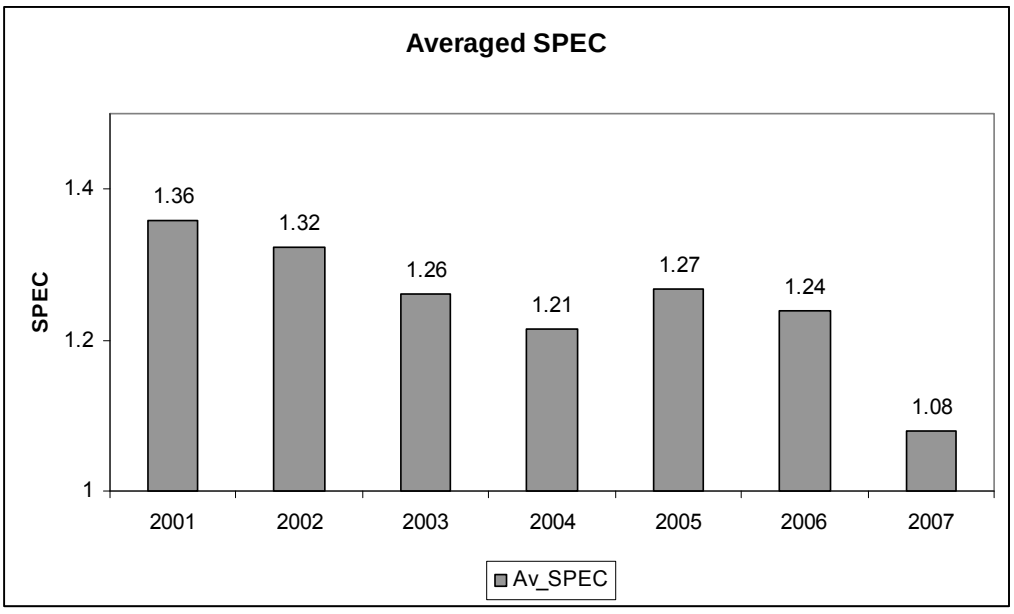

Figure 2 - *Averaged specialisation index SPEC – development over time*
Database: Eurostat; IMF; own calculations

[2] Our final sample ranges from 2001 to 2006 although in same cases lagged variables, the latest from the year 2000, are used.
[3] Exact data availability is mentioned in the text on a case-by-case basis in the respective sections.

To explain the development of SPEC, the main drivers of it need to be analysed first. First of all, the general development of SPEC was not dominated in the past by the trend development of single specific countries as Figure 3 clearly indicates.

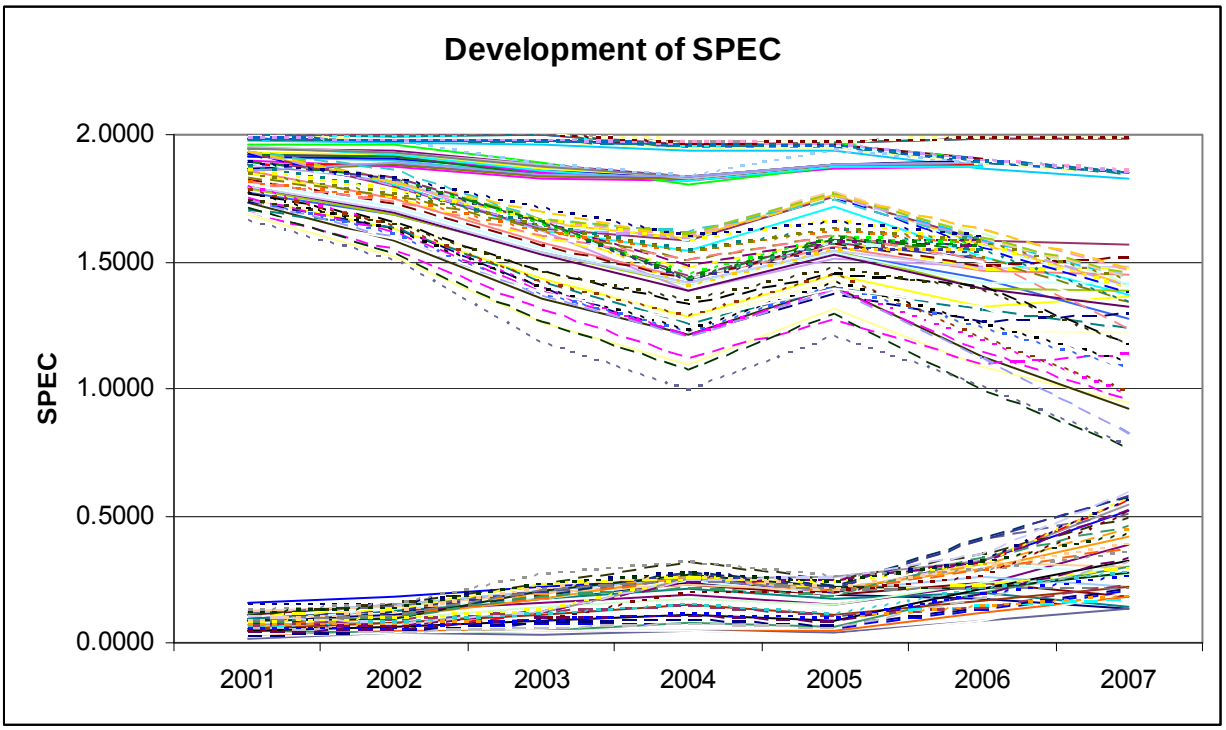

Figure 3 - *Development of the specialisation index over time for all country-pairs*
Database: Eurostat; IMF; own calculations

Clearly, *two groups* of EU countries can be distinguished: one group emanating from a rather high level of dissimilarity, heading towards more similarity, and another group with very similar portfolios with dissimilarity slightly growing.

The first group consists mainly of country-pairs that combine one EMU member with one Non-EMU member (called EMU1, with the 1 indicating that there is just one EMU member), or two countries that are both not part of the EMU. This means that countries that are still outside the EMU increasingly invest inside the EMU with the exemption of the year 2005. If countries outside the EMU invest in the EMU, the difference between foreign investment of these countries and the "home zone" investment of EMU countries becomes smaller and the empirical realisation of SPEC declines. There are a few exceptions that show

strong dissimilarity over the whole time range; mainly, the Eastern European countries like Rumania or Bulgaria with rather narrow financial markets, as is traditional in their history.

The other group consists of country-pairs in which both countries are euro area members (called EMU2). Interestingly, the investment pattern within the EMU seems to exhibit a different trend. The reason why the portfolios of these countries become dissimilar is that *the EMU bias* (investment in EMU-countries) *is declining*, and that countries increasingly tend to invest abroad. As not all countries share the same foreign investment strategy outside the EMU, the portfolios become more dissimilar.

3. Empirical model

3.1 General outline, variables and preliminary evidence

We construct our econometric model to empirically assess the relationship between portfolio similarity and consumption correlation or GDP correlation, respectively. Data for consumption and GDP is taken from the Eurostat database. GDP of all 18 countries under investigation is available from 1998 on; for consumption, the same is valid from the year 2000 on. We deflate consumption and GDP data with the harmonized consumer price index (derived from Eurostat) and de-trend both series employing a Hodrick-Prescott filter (Hodrick and Prescott, 1997).

Strictly according to Belke and Heine (2006 and 2007) who applied this procedure for an only slightly smaller sample period than ours, we apply the HP filter to the original series and – as usual - subtract the smoothed series from the original ones GDP and CPT. The advantages of this standard practice are, first, that it is easy to implement and, second, that the resulting cyclical residuals are similar to those produces by the bandpass-filter introduced by Baxter and King (1999).

As recommended by Ravn and Uhlig (2002) we choose a value of 6.25 as the parameter for de-trending, to avoid the overly large smoothing effect that derives from a

parameter of 100 that is often used for annual data. The result after de-trending is a smoothed time series that approximates the cyclical component without the trend component. Hence, we have transformed the non-stationary variables consumption and GDP into stationary variables.

As far as the correlation coefficient is concerned, we calculate the commonly used Bravais-Pearson coefficient over a 5 year rolling time window. We use moving time windows to smooth short-term variations in the data in order to avoid any misinterpretation of exceptional years. In a sense, however, the window should be used in a way to reflect the real situation in the data. In the empirical model, the correlation coefficients are confronted with the specialization index SPEC. Therefore, it is reasonable to assign the rolling time windows of consumption according to the effect of the specialisation index on consumption. Our "economic model" actually claims that consumption correlation effects follow after portfolio-wealth-effects have come into force; or, to put it differently, with portfolio similarity being followed by consumption correlation.

However, reverse causation, i.e. anteceding years of consumption correlation do have an effect on portfolio choice, cannot be precluded. This situation might occur if cycles are at different levels in the years before, and the weaker country receives, for instance, transfer payments from a European fund. Consumption cycles assimilate, and people start to participate in foreign investment because financial barriers are lowered and additional "money" pours into the country. The result would be a growing consumption correlation, decreasing home bias and a lower SPEC. With an eye on the very limited data availability of SPEC, we feel legitimized to follow a *compromise* which consists of choosing a centered time window with the corresponding year for which our specialisation index is calculated as the center.

What is more, we try to avoid autocorrelation of the data because it might in the end lead to an inefficient estimation. In a rolling time window of, say, 10 years, 9 years of consecutive realisations are the same and the resulting variable is highly serially correlated in

our case. To reduce the degree of artificial correlation, we follow Belke and Heine (2006, 2007) and finally choose a window of 5 years with the additional advantage that five years represent a reasonable approximation of the time span of one business cycle.

We include *financial wealth* and *income* as additional control variables. Private financial wealth is implemented in order to investigate the consumption-wealth linkage more deeply. In accordance with theory, we expect a direct positive link from changes in relative financial wealth to changes in consumption (correlation). The corresponding variable measuring the similarity of financial wealth, RELFW, is calculated by taking the net financial wealth of private households as reported by the financial accounts of Eurostat. Financial wealth consists of cash, deposits, bonds, shares, insurance accruals and miscellaneous positions. We deflate the data with the consumer price index of each country and calculate it per capita. Taking the differences of the logarithms of the country-specific financial wealth variables per country-pair results in the variable that in our case expresses the similarity of private financial wealth between these two countries. The lower the empirical realisation of the variable RELFW is, the more similar are the countries with regard to their endowment with financial wealth.

Finally, the variable RELINC stands for “relative income” and is formed by the logarithm of the absolute deflated differences of disposable income per head of the respective country-pair. Net savings are deducted from disposable income because net savings are already included in the financial wealth variable and we would like to avoid double-counting. The inclusion of income is motivated both by the specification of the traditional consumption function and the insight that consumption out of wealth might be endogenous because consumption and wealth are determined simultaneously through income (Slacalek, 2006, p. 3).Table 1 summarizes our denominations and definitions of the variables which we will use throughout the paper.

Variable	Description
SPEC	Specialisation index: **SPEC =** $\sum_{i=1}^{n} \lvert a_i - b_i \rvert$ with n = number of countries i = country index a is the share of portfolio-country A in country i and b is the share of portfolio-country B in country i SPEC ranges from 0 (complete similarity/same portfolio) to 2 (complete dissimilarity)
RELFW	Logarithm of the absolute difference of private financial wealth per country-pair. Financial wealth was deflated by the consumer price indices of the corresponding country.
RELINC	Logarithm of the absolute difference of disposable income less net savings per country-pair. Disposable income was deflated by the consumer price indices of the corresponding country.
CPT	Statistical (Bravais-Pearson) correlation coefficient of consumption; range: -1 to 1. A moving average window of 5 years, centred, was chosen. Consumption per head was deflated by the consumer price indices of the corresponding country.
GDP	Statistical (Bravais-Pearson) correlation coefficient of GDP; range: -1 to 1. A moving average window of 5 years, centred, was chosen. GDP per head was deflated by the consumer price indices of the corresponding country.

Table 1 - *List and explanation of variables*

Before starting with our explicit empirical model, we present some scatter plots which correlate consumption correlation coefficients with empirical realisations of SPEC. This should serve as a quick overview and a first indication as to whether our priors from theory tend to hold. All values have been averaged over the time period of 2001 to 2006 as far as data is available and are complemented with a regression line.

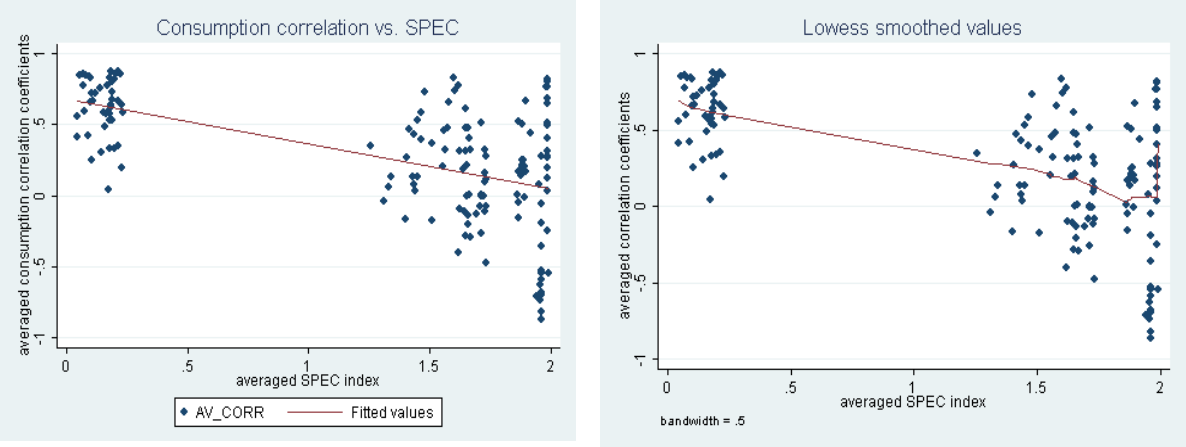

Figure 4 - *Consumption correlation and the specialisation index*

Database: Eurostat; IMF; own calculations

The scatter plots in fact illustrate the expected interdependence: a lower realisation of the specialisation coefficient (i.e. a higher portfolio similarity) leads to higher consumption correlation. In the Figure on the right we employ the less outlier-sensitive Lowess-smoother to visually emphasize the connection between SPEC and the respective correlation coefficients.[4] The higher the smoothing parameter is, the smoother the fitted values are. Following the recommendation of Cleveland (1979) for visualizing data, we decided to use a smoothing parameter (bandwidth) of 0.5. However, general evidence of the supposed relationship seems to be clear cut, though not very strong and is, thus, more deeply analyzed in the econometrics section.

What is more, the plots in Figure 4 provide additional insights into the characteristics *of the country-pairs*: we are able to differentiate between a highly correlated group of countries that exhibit similar portfolio structures (i.e., a low realisation of SPEC) and another group with a less distinct picture. The second group in some cases features highly correlated cycles, but is characterized by less similar portfolios (i.e., a high realisation of SPEC) on average.

The first group *on the LHS* of the scatter plots in Figure 4 with similar portfolios and high correlation consists mainly of the pure EMU country-pairs (both countries are member of the EMU). About 64 % of the country-pairs with an average correlation coefficient above 0.5 share the common currency. On the other hand, there are a few countries with a low SPEC that are not very well correlated. Their amount is limited. Most often a lower SPEC with little correlation corresponds to Norway and the Netherlands which seem to invest abroad, but are still not taken along with the situation of those countries they invested in. The reasons

[4] This technique is based on a polynomial fit to the data with a weighted Least-squares method, according to which large residuals have less weight as small residuals to achieve higher variations not distorting the results. This is the main advantage of this visualization as opposed to the OLS procedure which is quite sensitive to outliers.

underlying this pattern might, for instance, be simply the limited time series, individual investment strategies, or other determinants of the consumption correlation such as the relative development of income.

Typical representatives of the second group *on the* upper *RHS* of the two plots in Figure 4 with a high correlation but a high specialisation index, are in most of the cases Denmark or Estonia. Both countries take part in the Exchange Rate Mechanism II of the EMU. The respective country pairs, however, often do not have a similar portfolio structure because their investment in the EMU is not as pronounced as their home bias.

To convey a richer picture of the relationship of SPEC to macroeconomic variables, we provide another plot including the comparison of averaged SPEC and GDP correlation values. Here, the connection is expected to be weaker because the SPEC index is supposed to have a direct "causal" relationship only with consumption and in an indirect way, via consumption as a component of GDP, also with GDP itself.

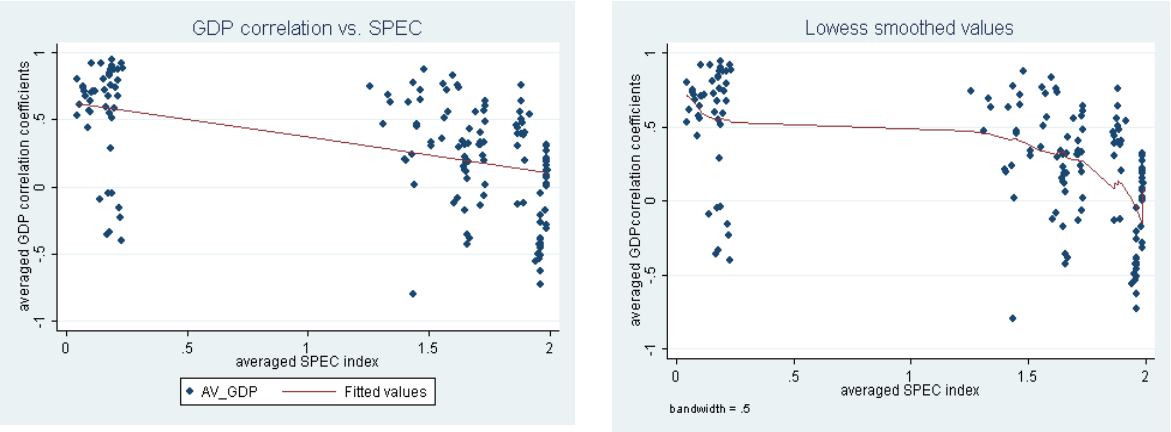

Figure 5 - *GDP correlation vs. SPEC index*
Database: Eurostat; IMF; own calculations

As expected, in the case of GDP correlation the relationship seems to be slightly less steep and less clear as far as the overall picture is concerned than in case of consumption correlation (see Figure 5).

Taking this first visual inspection as a starting point, we assess the data more formally and analyse whether our preliminary empirical findings are confirmed by a more full-fledged econometric model in the next section.

3.2 Econometric model

3.2.1 Formal analysis and model specification

We start our formal analysis with tests of non-stationarity of our variables. Estimates are in levels instead of differences because due to the use of the de-trending technique, only GDP synchronicity (GDP) and consumption correlation (CPT) are expected to be stationary. The latter has additionally been confirmed by a separate unit root test which is available on request.

For all other cases, we apply the Pesaran (2007) panel unit root test which is based on the standard Augmented Dickey-Fuller test but is augmented with the cross-section averages of lagged levels and first-differences of the individual series. This test has several advantages in our context. First, cross-section dependence is taken into account. Although the time span is quite low which should by itself lead to a smaller exhibition of temporal persistence (Wooldridge, 2002, p. 175 and pp. 250ff.), cross-sectional dependence within the framework of the EMU should not be excluded a priori. Second, it can be applied to unbalanced panels as ours. Third, (fractional) serial correlation is accounted for as well. Fourth, it is consistent for quite small samples as in our case. As expected, the null hypothesis of the unit-root test, the non-stationarity of data, is rejected for all variables, even if a lag is included.[5]

[5] Results are available on request.

Further formal tests are necessary before the final econometric model can be applied: The panel data with the 153 country-pairs should not be characterized by serial correlation or heteroskedasticity without consideration of these possible data attributes. We apply the the Wooldridge test for serial correlation (Wooldridge, 2002, pp. 282ff.). Our test results suggest that serial correlation is indeed a data attribute and heteroskedasticity cannot be excluded either. If not corrected, the presence of heteroskedasticity and/or serial correlation might lead to an inefficient Least-squares estimator (Baum, 2006, p. 133). However, as the final sample period of six years is rather small and the moving time window of the variables CPT and GDP has a span of only five years, the serial correlation problem should be less severe (Wooldridge, 2002, p. 274). Following Greene (2003, pp. 314ff.), one could nevertheless account for the issue of non-i.i.d. errors by two measures. First, one could conduct fixed effects estimations and correct their standard errors for both autocorrelation and heteroskedasticity. We take recourse to this option in the following. Second, feasible Generalized Least-squares (*FGLS*) estimations would allow for both data attributes but cannot be used here as the number of periods is higher as the number of panels (country-pairs). The same applies to a seemingly unrelated regression (Baum, 2006, p. 236).

We decided to use the fixed effects estimation for several reasons. The fixed effects model is a panel data model designed for a small time period and a clearly bigger number of unities; i.e. country-pairs, as in our case (Baum, 2006, p. 219). In addition, the preconditions for the application of fixed effects models are quite moderate (StataCorp., 2007, pp. 396ff.) and require that the unit-specific residuals (i.e. the residuals of the different country-pairs) vary within units and not over time. The variations around the mean are explained, and the panel average itself is removed from the data. This is the reason why time invariant variables cannot be included. They do not change within the unit and do not contribute to the explanation of the variance around the mean (Baum, 2006, pp. 220ff.). On the other hand, applying pooled regression would assume that consumption behavior is the same in all

countries and initiates from the same level (common constants are assumed). What is more, fixed effects models allow for heterogeneity across units. This means that different intercepts for different country-pairs are estimated and that the individual (i.e. country-pair; panel) effect is correlated with the regressors. Applied to our context, this means that it is admitted that the countries start from different levels of consumption or GDP correlation respectively since country-pair specific constants are assumed.

The specialization index, SPEC, and/or the similarity of financial wealth, RELFW, and/or relative income, RELINC, could be correlated with unobserved effects. These unobserved effects are considered to have a roughly time-constant effect on the regressors (Wooldridge, 2002, p. 248) and could be, among others, trade variables, common language, investment, or government expenditures. These aspects probably contribute to consumption and business cycle correlation, but are not explicitly included in the equation in our case. The different intercepts are a plausible assumption because different levels of correlation probably prevail in the sample, especially if countries inside and outside the rather homogenous EMU are compared.

Fixed effect estimation requires the assumption that the slope coefficients are the same across units. This means that the correlation coefficients of the different country-pairs are assumed to react in the same way with regard to changes in the regressors, SPEC, RELFW and RELINC. This assumption is a backbone of our study because we assume implicitly that the propensity to consume is the same across countries. The consequence is that the only way to consider different responses between country-pairs and over the time period of the analysis is the intercept (Hill; Griffiths et al., 2008, p. 391).

The corresponding model for our fixed effects estimation is represented by the following equation:

$$y_{it} = \alpha_i + x_{it}^{'}\beta + v_i + \varepsilon_{it} \tag{2}$$

with y_{it} as the dependent variable (consumption correlation; variable CPT) and $x_{it}^{'}$ and β as the vectors of the regressors SPEC, RELFW and RELINC. The term v_i represents the unit specific disturbance term and ε_{it} the normal residual. The subscript i in each case stands for country-pairs (i = 1,2,...,N) and the index t reports the time dimension (t = 1,2,...,T). The vector β does not incorporate any indication for time or countries because, as explained above, *the slope coefficients are expected not to vary over time* and units. The country-pair specific disturbance term v_i does not bear any time index because it is assumed to be constant over time.

A more detailed illustration of the corresponding model equation is:

$$CPT = cons(1) * SPEC + cons(2) * RELFW + cons(3) * RELINC. \quad (3)$$

The expression "cons" stands for the constant.

The alternative to a fixed effects model is a random effects model. Random effects assume that the panel effects are uncorrelated with the other modeled influence factors; therefore, the panel effects, plus the normal error term, are treated as random disturbances (Baum, 2006, p. 220). Another precondition for the application of random effects models is that the sample is drawn randomly from the population. It is more efficient than the fixed effects model if the assumption of uncorrelated panel effects holds (StataCorp., 2007, p. 185). Hence, we explicitly tested for the choice of the correct model – fixed versus random effects.

For each of our regressions we verified the assumption of fixed effects by means of the Hausman test. The results are either displayed in the tables of regression results or again available on request. Let us now turn to our final econometric approach taken.

3.2.2 Econometric approach

In the following, we apply a *Two-tage Least-squares technique* exactly because it uses the information of the variables SPEC, RELFW and RELINC by estimating the impact of these variables on GDP correlation via their "causal" relation with consumption.

We do not expect that the similarity of portfolios and private financial wealth exert a dominating impact on consumption correlation, but our prior is that we should be able to identify non-negligible effects - in strict accordance with the consumption-wealth linkage literature.

According to theory, more pronounced (private) financial interdependences should lead to more synchronized consumption. Expressed differently, a more similar endowment with financial wealth and income should lead to a higher correlation of consumption between countries. As a consequence, the latter should finally also lead to a closer GDP co-movement. Hence, we expect negative signs of the estimated coefficients of SPEC, RELFW and RELINC. A negative sign means that the more similar the countries are in terms of financial wealth, the more likely their consumption and GDP variables tend to correlate as well. Table 2 conveys a first overview of the empirical characteristics of the variables used.

Variable	Mean, all country- pairs	Mean of EMU1	Mean of EMU2
CPT	.2457479 (.5826107)	.0538718 (.5778479)	.6722831 (.3442252)
GDP	.2727054 (.551297)	.1843981 (.5501075)	.5636564 (.4329154)
SPEC	1.254481 (.7433009)	1.690632 (.2639865)	.1820124 (.1173527)
RELFW	.5926015 (.4688719)	.7757079 (.4928413)	.2417455 (.1627629)
RELINC	.3722123 (.319188)	.4716529 (.2927319)	.1020557 (.0862881)

Standard errors in brackets

Table 2 – *Variables: descriptive statistics*
Database: Eurostat; IMF; own calculations

A quick look at the data reveals that EMU members are much more correlated in terms of consumption and GDP as compared to country-pairs where one country is not part of the EMU. The country-pairs including only euro area member countries display a smaller standard deviation as well. This result does not come as a surprise because EMU countries have strong interdependences among each other and, in addition, obey to a similar institutional framework, as for instance, the Maastricht criteria. Stronger financial involvement is indicated by a lower SPEC index of EMU country-pairs; closer financial links are indicated by a smaller difference of financial wealth of EMU-2 country-pairs (variable RELFW). The same pattern is valid in case of the variable RELINC: income per head is more similar (the differences are smaller) in the EMU2-group as compared to the EMU1-group. The pure EMU group is much more homogenous with regard to the economic circumstances "that form the background for the variables" than the other group.

3.2.3 Two-stage Least-squares and General Method of Moments

As said, our approach uses the impact of the variables SPEC, RELFW and RELINC on GDP correlation which works via consumption. Hence, GDP correlation is regressed only on those effects on consumption that can be directly traced back to the three variables. Other determinants of consumption that are not explicitly modelled (e.g., the propensity to consume) are *filtered out* when regressing GDP correlation on them.

Two-stage Least-squares is generally used as an instrumental variable approach because some of the RHS regressors (here SPEC, RELFW, RELINC) are assumed to be endogenous with regard to the individual country-pair effects. Although instrumental variables estimation is not strictly necessary in our case[6], we apply this approach in order to be able to model the described filtered effects of the three exogenous variables on GDP

[6] We would like to stress that a correlation of the endogenous variables with the error term is not a necessary precondition to use instrumental variable approaches. Nevertheless, it is a sufficient precondition.

correlation. In the first-stage regression, consumption correlation, CPT, is regressed on the specialisation index, SPEC, on the differences in financial wealth in the country-pairs, RELFW, and finally on the differences in income in the country-pairs, RELINC, as their direct impact on consumption is of interest in our case. The results of this first regression are used directly in the second regression that estimates the influence of consumption correlation on GDP correlation on the background that only the effects derived from SPEC, RELFW and RELINC are used.

Correspondingly, our Two-stage Least-squares (2SLS) estimation equation has the following form (StataCorp., 2007, p. 184):

$$y_{it} = Y_{it}\gamma + X_{1it}\beta + \mu_i + v_{it} \tag{4}$$

with y_{it} as the dependent variable (GDP) and Y_{it} as the 1 x g_2 vector including the observations of the endogenous variable(s) (CPT). The latter may be correlated with the error term v_{it}. X_{1it} is the 1 x k_1 vector with the observations of the exogenous variables (no additional exogenous variable besides the instrumented CPT is used) and β represents the vectors of the coefficients g_2 and k_1 respectively

The variables SPEC, RELFW and RELINC are treated as instruments of CPT by combining them into one instrument. This combination builds upon the regression of CPT on these variables as a background and uses the predicted values of this first stage regression in the second stage. However, it uses the residuals *of the original regressor* in step two - instead of the residuals of the instruments (Baum, 2006, pp. 188ff.).

As we have found some indication in Section 3.2.1 that heteroskedasticity and serial correlation might well characterise the data, we feel legitimized to argue that a General Method of Moments (GMM) approach produces more efficient results than the usual 2SLS estimation (Baum, 2006, p. 199).

Preconditions to use 2SLS as a fixed effects model (StataCorp., 2007, pp. 180ff. and Baum, 2006, pp. 185ff.) are summarized in Table 3. We take up exactly these issues as individual steps in our second step estimation.

Issue	Description	Application / statistical test
Order condition	Are there at least as many instruments as endogenous variables?	Order condition is fulfilled with three instrumental variables (SPEC, RELFW, RELINC) and one endogenous variable (CPT)
Rank condition	Is there a correlation of the excluded instruments with the regressor?	Kleibergen-Paap test
Weakness of instruments	Is the correlation of the instruments with the regressor high enough?	Kleibergen-Paap Wald test
Correlation of the instruments with the error term (overidentification)	Instruments that are correlated with the error term produce inconsistent results.	Hansen-J-test

Table 3 - *Summary of preconditions for 2SLS*

For fixed effect models, the exogenous variables are allowed to be correlated with the individual level (country-pair) effects μ_i, but these effects are considered to be quite constant over time (as already mentioned above). Other preconditions are that the error term v_{it} has a zero mean and is uncorrelated with the exogenous variables and that no time-invariant variables can be included.

We set up our regression equation with GDP as the dependent variable, and CPT as the explaining variable, *instrumented* by the portfolio specialisation index SPEC, the differences in financial wealth of the country-pairs RELFW and the differences in income RELINC. We choose the GMM option; the standard errors are again corrected by a robust option, for serial correlation is accounted as well.

The results of our *first-stage regression* (presented in Table 4 without the formal analysis results) overall corresponds with our priors.

First stage estimation results (of CPT, (before adjustment) Fixed effects estimation	**Overall** x	**EMU1** x	**EMU2** x
SPEC	-.6156357***	-0.3279127*	-2.543656***
(t-value)	-3,79	-1,74	-6,3
RELFW	-1.206134***	-1.233496***	-
(t-value)	-5,07	-4,01	
RELINC	-1.548924**	-2.936724***	-
(t-value)	-2,13	-3,44	
R-squared	0,1180	0,1954	0,2985
F-Statistics	14,41	13,52	13,23
Hausman-test (χ-squared)	71,71	86,87	18,55
p-value	0,0000	0,0000	0,0003

Dependent variable: consumption correlation CPT
*, **, *** indicates significance at the 10, 5 and 1 % levels, respectively

Table 4 - *Consumption correlation with RELINC – regression results*
Database: Eurostat; IMF; own calculations

The empirical realisations of the F-statistics and Chi-squared statistics are displayed in Table 4 and confirm the validity of our empirical model. It was expected before that the model does not explain all variations because our analysis has a priori been constrained to financial variables, income, and private households. Other important variables that could potentially explain consumption correlation such as, for instance, (correlation of) housing wealth or (correlation of) government expenditures are left for the unobserved part of the model. Besides that, holding financial wealth in bonds and shares has different traditions in specific countries. However, all countries in Europe have in common that direct investment in shares is subordinate. This might even be due to pension systems because an investment into shares via pension plans might replace other direct investment (Bundesverband deutscher Banken, 2004).

In general, it appears rather clear how investment affects consumption behaviour. On the one hand, savings targets like retirement schemes indicate that consumption is postponed. On the other hand, behavioural finance suggests that "felt wealth", as could be recently

observed in the US with growing housing prices or in the "new economy era" with financial holdings, leads to the feeling of being richer, which, in turn, tends to support consumption.

We now present our *second-stage regression* results, this time including the test statistics mentioned above in Table 3. We started our estimations without considering the dynamics. The reason is that only bonds and shares are considered in SPEC; in RELFW, additionally cash, deposits and financial accruals are considered. All these components are rather liquid financial instruments with low transaction costs (maybe with a confinement on insurance accruals). Hence, there are little obstacles for a quick assignment of wealth for consumption, and no huge time lag can actually be motivated by transaction time. However, the test statistics indicate that some modification of our specification was necessary. Whereas the order and the rank condition are fulfilled and weakness of instruments is rejected, the empirical realisation of the Hansen-test indicated correlation of the instruments with the error term.

As a consequence, a re-specification of the equation with regard to the inclusion of all instrumental variables appeared adequate to us. However, before specifying the new and final estimation equation, one should not forget that applying an IV procedure, as indicated by the Hausman-test, is not categorical.

What are potentially suspicious variables which might be correlated with the error term? According to theory, *portfolio specialisation* and *financial wealth correlation* are related to each other. As financial wealth might be driven by factors such as government expenditures (one may think of government aid as, for instance, retirement schemes), a small fraction could be correlated with the error term and could be time-variant in case of changes of public financial support. Therefore, both variables are potential candidates for the correlation with the disturbance term - although only a small variation is expected.

As portfolio similarity, SPEC, is rather motivated by individual economic “thoughts and experiences” than by macroeconomic factors, a more plausible candidate would be

financial wealth. One potential argument in favour of SPEC would, however, be that the variable displayed some changes over the years of monitoring. A growing influence of closer relationships through trade or foreign direct investment, leading to more portfolio investment abroad, was observable. Still, we do not expect that the change of impact of macroeconomic variables on SPEC within the short time period is decisive because of the rather microeconomic and slow-moving character of the latter. *Differences in income* might be another candidate because GDP and income might well be determined simultaneously. The best fit with respect to the Hansen J-test results, is achieved if all variables are left in the equation and all variables are instrumented by their own lags.

Due to our small sample period, the maximum number of lags is limited to two which produces results that are nevertheless sufficient according to the usual criteria. Especially for the specialisation index (which unfortunately has the relatively shortest time dimension) and financial wealth, one could imagine that it takes some time until their variations result in changes of real consumption. Above all against the background of retirement plans, a much longer "time-till-spending" effect than could be modelled here due to the data limitations is reasonable. Income is supposed to have a much more immediate effect on consumption; therefore, income correlation is instrumented with a maximum of only one lag.

We achieve the best fit with SPEC and RELINC entering the equation with one lag, and RELFW with two lags. Regressions for the subgroup of countries that are both members of the EMU do not deliver significant results for RELFW. Exactly for this reason, the respective first-stage regression result is not reported.

According to Table 5, both regressions deliver estimation results which correspond to our priors. Higher consumption correlation leads to a higher business cycle correlation, and the variable CPT is significant. All tests meet our pre-defined statistical requirements: the rank condition is fulfilled, the instruments are sufficiently strong, and the null hypothesis of correlation with the error term is rejected.

In the first stage regression, SPEC enters with a negative sign, implying that a rectified broader geographic diversification of the portfolios leads to higher consumption correlation. Differences in financial wealth do not appear to be significant if all country-pairs are considered. However, in the group of EMU1 country-pairs a significant negative sign (on the 5 % level) of the estimated coefficient of RELFW is displayed. This leads us to suspect that the pure EMU group (EMU2) is responsible for the non-significance of the result of this variable. For the EMU2 subgroup, no significant results emerged because the results of the first-stage regressions are used. The reason for the less satisfactory performance of the variable might be either that financial wealth is too homogenous within the EMU to exert a measurable influence on consumption correlation. Another explanation might be that the influence of financial wealth is more immediate as expected or much more delayed. As a consequence, a lag of two years might just not represent the right lag order for this sub-sample. The correlation with the error term makes it necessary to use two lags, however. Income differences enter the equation with only one lag and their estimated coefficient is highly significant, i.e. more similar income leads to more similar consumption.

Second stage regression
(on GDP)

Fixed effects estimation		**Overall**	**EMU1**
CPT (z-value)		0.2913388 2.72***	0.2970682 3.70***
Rank condition (Kleibergen-Paap)	test-statistic p-value	31.176 0.0000	22.774 0.0000
Weakness of instruments (Kleibergen-Paap Wald test)	test-statistic critical value	13.058 9.08	18.883 9.08
Correlation of instruments with error term (Hansen J)	test-statistic p-value	3.671 0.1595	4.166 0.1245

First stage regression
(on CPT)

Fixed effects estimation	**Overall**	**EMU1**
SPEC (1 lag) (t-value)	-1.023339 -5.37***	-0.8005302 -4.16***
RELFW (2 lags) (t-value)	-	-1.551893 -2.27**
RELINC (1 lag) (t-value)	-3.537729 -3.58***	-4.181008 -3.47***
R-squared F-Statistics	0.1608 13.0800	0.3245 18.8800

*, **, *** indicates significance at the 10, 5 and 1 % level respectively
- not implemented / not significant

Overall	All countries in the panel are considered
EMU1	One country of the country-pair is a member of the EMU
EMU2	Both countries of the country-pair are members of the EMU

Table 2 - *Results of first and second stage estimation (after adjustment)*
Database: Eurostat; IMF; own calculations

The empirical realisations of the R-squared and of the F-statistic turn out to be higher in both cases than in the equation without lags, indicating that probably a time delay in consumption is the more adequate assumption as indicated by the lags of the variables. The basic results, the signs of the variables, remain unchanged.

4. Conclusion

The main contributions of the paper are twofold. First, it is the first time that a similarity index is applied on portfolios and then employed in a macroeconomic convergence analysis. Second, the similarity of portfolios is brought into context with the view that "the financial world" has an impact on business cycles and contributes to business cycle convergence via the consumption channel.

The paper has its starting point from a positive linkage between financial wealth and consumption. As an important factor of financial wealth it emphasizes portfolio composition which in turn is influenced by investment strategies. The model which guides our analysis is the International Asset Pricing Model (IAPM) which proved to be advantageous for investors in the past. The empirical question whether more investors within euro area countries follow this strategy and accordingly have more similar portfolios is analysed based on a specialisation index that measures portfolio similarity. And indeed, portfolios of the 18 EU countries investigated by us turn out to become more similar over time.

The two priors that form the main basis of the central hypothesis of this contribution are the influence of portfolio composition on consumption cycles and the impact of consumption cycle convergence on business cycle convergence. Their empirical corroboration leads us to conclude that *similar portfolios contribute via a convergence of consumption cycles to a convergence of business cycles.* Applying the TSLS method, we first model the influence of portfolio similarity and two additional variables, wealth and income, on consumption, and after that, as a second step, the impacts of the filtered results on business cycle convergence. All estimation results turned out as expected which means that our central hypothesis is empirically confirmed, especially for countries of the EMU1-group. This group consists of countries that have quite different income and wealth structures.

Our empirical results might well serve as a motivation for politicians, especially in EMU candidate countries, to support well-diversified foreign investment activities and gain two things in the medium term: advantages out of the investment strategy for “their” population and a contribution to business cycle convergence.

Admittedly, as also expressed in our paper, the savings rate in different countries are actually not the same. Of course, this implies that the impact (in percentage points) of revenues from financial wealth on consumption also differs. However, we feel legitimized to argue that income in the “poorer” countries within the sample income will successively increase which, in turn, should enhance their savings as well. One could even add that the „third factors“ have the potential to lead to a convergence in the consumption effect. Just to summarize, the effect of financial wealth is, as things stand, still different across but there is a high probability that this will change in the future.

A concluding remark considering the recent events of the financial crisis appears to be adequate in our context: will the results still hold in future studies which start from an approach similar to ours if the years from 2007 on are included in the sample? We argue that for our main conclusion, i.e. that financial investment influences business cycle convergence, to hold it is not important that markets have positive or negative effects on financial income. It is only important that financial income and its effect on consumption are not too different in different countries. As the financial crisis has basically hit most markets that are important for the countries in our sample its impact probably does not vary very much in the different portfolios. In the short run even a fallback on the home market would not change much due to similar market development, although for the distant future this could mean that portfolios diverge again.

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