Portfolio Diversification :
Alive and well in Euroland !

Kpate Adjaouté
HSBC Republic Bank (Suisse) SA

and

Jean-Pierre Danthine
University of Lausanne, CEPR and FAME

July 2001

Abstract.

Diversification opportunities in Euroland appear to have improved significantly since the advent of the euro, thus invalidating the prospects identified in the last years of the convergence-to-EMU period. We identify low frequency movements in the time series of return dispersions suggestive of cycles and long swings in return correlations. The most recent post-euro period is clearly associated with an important upswing with return dispersions exceeding for the first time their peaks of the early nineties.

JEL codes: F30;G11;G15 Key words: portfolio diversification, return dispersion, euro

1. Introduction

In a study building on the first few months of the euro (Adjaouté and Danthine, 2000), we found that the conditions under which portfolio investors diversify across the Euro-area equity markets had changed materially in the 1990's. In particular, we identified a significant increase in the degree of correlation between national stock indices implying that diversification opportunities had been significantly reduced over that period. We proposed that the process of economic and monetary integration at work in Euroland since at least the mid-90's and culminating with the advent of the euro on January 1, 1999 was the likely culprit. Within this process, however, the disappearance of currency risk appeared less important for investors than the convergence of economic structures and/or the homogenisation of economic shocks (across the Euro-15 member states). That is, the increased stock return correlation was as manifest when we abstracted from currency fluctuations than when they were computed using effective monetary returns.

We observed that this evolution should mark the end of pure country allocation strategies within Europe: the increased conformity of stock returns implied that international diversification across the Euro-area on the basis of a pure country allocation model had increasingly smaller benefits. We also argued that the changing economic structures within Europe and the disappearance of currency risks could have lowered the cost of the home bias within Euroland and confirmed this intuition if the alternative to staying at home was to diversify with the use of a pure country allocation model. Further analysis however showed that diversification across both countries and sectors remained the much superior investment strategy and that, in light of this option, the cost of the home bias continued to be significant in Europe.

In the present paper, we revisit these issues with the benefit of more than two years of data since the formal advent of the euro. In particular, we construct weekly returns for country and sectors indices, starting from October 7, 1988 to March 30, 2001 (652 observations); as in our first paper, we use Datastream total market indices and the full sample is partitioned in appropriate sub-samples to study the dynamics of the Euro-land investment opportunity set. Although the effective replicability and investibility of these indices can be questioned, they nevertheless represent the theoretical ideal benchmarks to assess portfolio diversification opportunities.

2. The long sample

We start by taking full advantage of our sample data to revisit some of the questions addressed in our previous study. We define a pre-convergence period extending from October 7, 1988 to December 31, 1994, and a convergence period going from the signature of the Maastricht treaty, January 1, 1995, to the limit of our data sample, March 30, 2001. We concentrate on the variance-covariance matrix of returns within Euroland. Building on the results of our previous research, we exclusively take the viewpoint of Euro investors. That is, we abstract from currency risk and focus on the changes in the correlation of returns expressed at constant (December 31, 1998) conversion rates.

As mentioned earlier, the full sample consists of weekly index returns from October 7, 1988 to March 30, 2001, for the ten early entrants in EMU (Luxembourg has been ignored from the analysis; note that data for Portugal are not available before February 1990). For each country, the Datastream total market country index returns and sector indices returns are collected. Datastream defines 10 sector groups by country, leading in theory to 10 country indices and 100 sector indices for the consolidated data sample. However, some sectors do not exist in certain countries or do not have a sufficient data history to be considered in the study. This is the case for the utilities sector, which is not constructed for Ireland, or the information technology sector which is formally in existence in Portugal since July 1999 only. The consolidated data sample, comprised of 10 country indices and 86 sector indices is summarized in Table 1 below. Table 2 provides summary statistics on annualized weekly returns using country index returns. As Table 2 shows, there is a noticeable dispersion of risks and returns both within each sub-sample and across sub-samples. In fact, in the pre-convergence period, the minimum average return is –2.37% (Portugal) versus a maximum return of +12.91% (Austria) while the comparable statistics are +1.78% (Austria) and 25.36% (Finland), respectively, during the convergence sub-sample. The strict euro period shows a minimum country return of –9.13% (Belgium) and a maximum of 18.12% (Finland).

Table 1: Consolidated sample information

Sample	Range	Max. # observations per series	Min. # observations per series
Whole	**07/10/88 - 30/03/01**	**652**	**402**
Pre convergence	**07/10/88 - 30/12/94**	**326**	**76**
Convergence	**06/01/95 - 30/03/01**	**326**	**326**
Pre euro	**10/11/96 – 01/01/99**	**117**	**117**
Euro	**08/01/99 - 30/03/01**	**117**	**117**

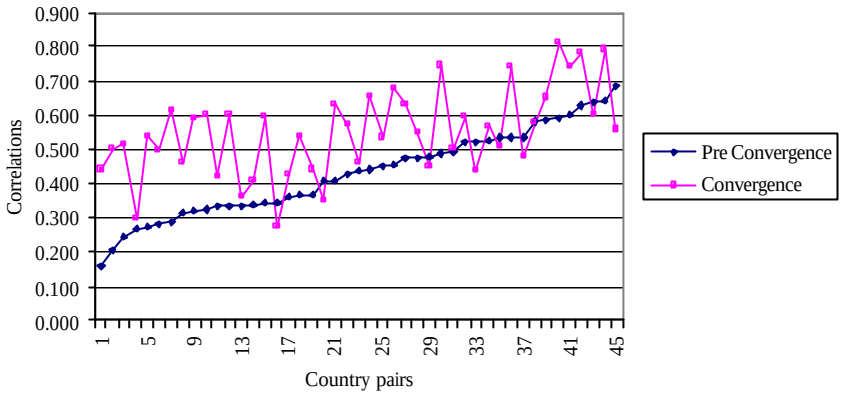
Table 2: Summary statistics on annualized weekly country returns

	Austria	Belgium	Germany	Spain	Finland	France	Ireland	Italy	Netherlands	Portugal
PANEL A: PRE CONVERGENCE										
Mean	12.91	2.03	7.24	2.26	3.77	5.78	7.27	1.60	8.48	-2.37
Median	9.82	2.96	8.81	-1.13	-4.26	12.87	-0.92	7.70	11.26	-2.61
Std. Dev.	22.62	11.71	14.69	16.63	21.96	14.88	16.94	20.47	10.19	14.00
Jarque-Bera	408.39	27.41	23.75	10.17	21.76	7.16	3.38	12.36	15.27	17.91
Probability	0.00	0.00	0.00	0.01	0.00	0.03	0.18	0.00	0.00	0.00
Observations	326	326	326	326	326	326	326	326	326	260
PANELB: CONVERGENCE										
Mean	1.78	12.13	12.77	17.45	25.36	16.89	17.11	14.77	16.83	12.39
Median	5.49	19.52	17.97	25.75	45.71	14.38	22.02	9.76	26.32	10.25
Std. Dev.	14.33	15.60	18.52	18.94	34.21	18.27	17.66	21.15	16.85	18.14
Jarque-Bera	34.20	51.39	62.79	73.05	79.09	2.64	153.12	20.31	90.70	313.51
Probability	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00
Observations	326	326	326	326	326	326	326	326	326	326
PANEL C: STRICT EURO										
Mean	0.16	-9.13	4.08	-1.16	18.12	13.24	1.68	5.27	4.91	-4.06
Median	11.09	6.17	13.76	12.25	32.02	15.73	-2.28	17.72	20.53	-5.19
Std. Dev.	14.03	17.02	21.03	18.19	45.40	19.62	18.81	19.18	15.76	16.79
Jarque-Bera	16.67	2.74	0.66	1.09	5.71	1.31	1.18	0.81	3.28	5.44
Probability	0.00	0.25	0.72	0.58	0.06	0.52	0.55	0.67	0.19	0.07
Observations	117	117	117	117	117	117	117	117	117	117

We start by using country index returns to compute the 10x10 unconditional correlation matrix for the pre convergence period, which runs from October 7, 1988 to December 30, 1994 (326 observations). These correlation pairs are sorted in ascending order and plotted against the country pairs. The correlation pairs for the convergence period, covering January 6, 1995 to March 30, 2001 are then computed and plotted along the pre-convergence correlation pairs.

Our results are illustrated in Figure 1. They are entirely in accordance with what was found in our previous study. Return correlations are significantly and almost uniformly larger in the second period than in the first. This supports, for an appropriately long sample of post-January 1, 1999 observations, the views expressed before and summarized in our introduction.

Figure 1: Evolution of country pair correlations: before and during convergence



We next perform a similar exercise at the sector level. To have a sense of the sector level dynamics, we focus on all the available sectors within the EMU countries. For each of the selected sectors, we construct the m x m correlation matrix, where m is the number of countries in which the sector is available, and conduct the same analysis as the country level correlation. For example, for the "General industrials" sector, we have used the weekly returns of that sector in Austria, Belgium and the other eight countries to build our correlation matrix. In the absence of any country specific dimension, this correlation will be close to 1, because one is asking what is the correlation of the "General industrial" sector in France with the same sector in Belgium and so on.

Results from this exercise are fully in line with those obtained above at the country level and in our previous study at the sector level. They are not reproduced here to preserve space. When the angle of view is more than 12 years of data and convergence is identified with the advent of the Maastricht treaty, the evolution of return correlations is unambiguous.

Table 3 displays the result of a formal Jenrich stability test indicating unequivocally that the matrices of returns differ significantly over the two sub-samples. This is true at the aggregate as well as the sector levels. At this stage we are led to conclude that the adjunction of more recent data does not invalidate the results of our previous study.

Table 3: Jenrich test of stability of correlation matrices : Large Sample

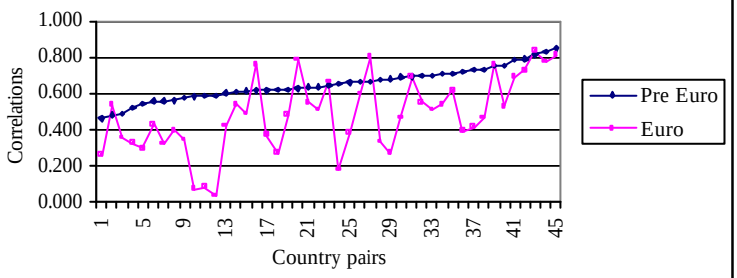
	Countries (DF=45)	Sectors(DF = 3655)
Larger Sample	172.844	10486.155
	(0.0000)	(0.0000)

The pre convergence sample goes from7/10/88 to 30/12/1994, while the convergence sample runs from 06/01/1995 to 30/03/2001
The degrees of freedom are computed as n(n-1)/2 where n =10 for countries and n=86 for sectors
p-values are given in parentheses

3. The euro sample

We now look more closely and in isolation at the post-January 1, 1999 data. This effectively means that we replace the broader concept of convergence, associated with the notion of economic integration, with a narrower definition of the EMU process strictly identified with the advent of the euro. We define a pre-euro period as corresponding to the same length (as our euro sample) period prior to January 1999, that is, starting from October 11, 1996. That is, we use returns from January 8, 1999 to March 30, 2001 (117 observations) for the euro period and the 117 returns preceding January 8, 1999 as the pre-euro period. Again we abstract from currency fluctuations (before January '99). Figure 2 displays the results obtained at the aggregate (country indices) level.

Figure 2: Evolution of country pair correlations: pre euro and euro periods



Somewhat to our surprise, the picture is now radically different. Out of 45 pairwise correlations, 36 are lower in the euro period than in the immediately preceding period. This picture is representative of what we obtain at the sector level for 7 out of 10 sectors. The only clear exception is the sector labelled "non cyclical services" where correlations have continued to increase, while the picture is more blurred in the case of the "cyclical services" and "utilities" sectors. Details are provided in the appendix.

Table 4 confirms that the matrices of correlation are significantly different in the two periods whether at the aggregate or the sector level.

Table 4: Jenrich test of stability of correlation matrices : Euro sample

	Countries (DF=45)	**Sectors(DF = 3655)**
Strict euro	121.229	3940.508
	(0.0000)	(0.0000)

The pre euro sample goes from 11/10/96 to 1/1/99, while the euro sample runs from 08/01/99 to 30/03/2001
The degrees of freedom are computed as n(n-1)/2 where n =10 for countries and n=86 for sectors

p-values are given in parentheses

These results indeed raise a challenge since they are in direct contradiction with those obtained up to now. Of course, we are now dealing with two relatively short sub-periods, possibly affected by specific events. A long and slow structural evolution, such as the one associated with economic and monetary integration we thought we had identified when looking at the long sample, may be temporarily concealed by one-time shocks that could colour a period as short as two years. An alternative explanation may also come from the existing literature on world market integration. Bekaert and Harvey (1995) substantiate the time-varying nature of market integration and if correlations are to be used as quantitative indicators in that sense, then the evidence presented here thus far conforms to this view. This observation is also in line with the fact that return correlations are known to have cyclical characteristics. In view of testing this hypothesis, we now turn our attention to the time evolution of the cross-sectional dispersion of equity returns for our entire sample.

4. Cross-sectional dispersion of returns

The evidence stemming from the above analysis suggests a possible cyclical behavior of country and sector correlations. Traditional time series analysis does not however allow to test the cyclicality of the correlation matrix. A test based on a rolling correlation matrix would make little sense, since virtually no change would be observed based on conventional testing procedures, because of overlapping data. On the other hand, the approach based on two adjacent samples does not provide any insight into cycles. The strategy we follow to shed light on the existence of cycles is based on the notion of cross-sectional dispersion introduced by Roulet and Solnik (2000). The idea behind cross-sectional dispersion is very intuitive and works as follows.

Consider n financial assets over a particular investment period; the more dispersed their returns turn out to be, the more scope there is for portfolio diversification. If on the other hand, the dispersion of returns is small, the more similar these asset returns are and the less room there is for diversification. Given that this dispersion is defined in terms of the n assets existing at time t, a time series of cross-section dispersion of returns can be generated and its properties analyzed in the standard time series framework. In particular, in the case of country indices with weekly observations, a standard deviation across the ten index returns can be calculated each week, so that using the whole sample data at hand we have a sample of 652 weekly dispersions. Similarly, the 86 sector returns can be used each week to generate a sector cross-sectional standard deviation. Table 5 below gives a summary of the computed dispersions while Figure 3 displays the results of this computation by country and sectors. As discussed by Roulet and Solnik (2000), there is a direct and inverse relation between dispersion and global correlation. Higher dispersion implies lower correlation and higher diversification gains and conversely so in the presence of lower dispersion (and higher correlation).

Table 5: Summary statistics on cross-sectional dispersion

	Country	Sector
Mean	**1.670**	**2.943**
Median	**1.525**	**2.725**
Maximum	**5.070**	**7.938**
Minimum	**0.441**	**1.415**
Observations	**652**	**652**

Figure 3: Country and Sector Cross-sectional Dispersions

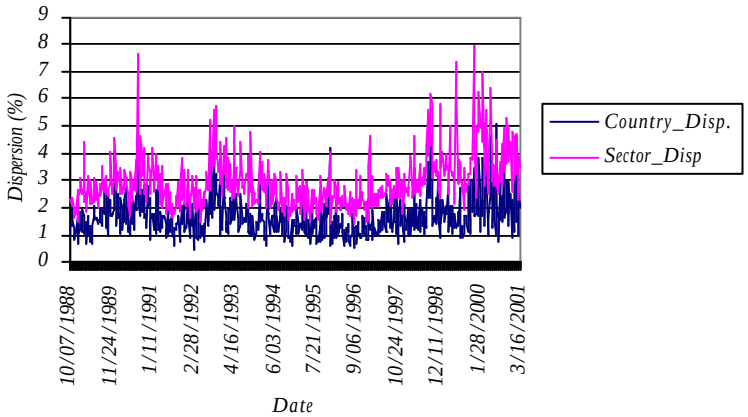


Figure 3 displays the impressive high frequency variability of the weekly dispersion of returns. While the variability of weekly dispersion dwarfs lower frequency movements, periods of high dispersion followed by periods of low dispersion can be identified as well. This pattern is suggestive of cycles in the time series behaviour of cross-sectional dispersions. Observe that the sector cross-sectional dispersions are almost systematically above the country dispersions (there is a total of 5 exceptions altogether): as far as risk diversification is concerned, diversification across countries and sectors remain the much superior alternative.

In order to enlighten the cyclicity issue, a trend has to be extracted from this very volatile data. We apply the Hodrick-Prescott methodology with smoothing parameters of 270 000 and 28 800. Results, displayed in Figures 4 and 5, provide a consistent message. The following observations can be made.

1. There are significant low frequency movements in return dispersions, both at the sector and the country level.
2. The earlier part of our sample, corresponding with the pre-convergence periods, was marked by two peaks in both country and sector dispersions, leading to a high average dispersion level.
3. Return dispersions were below average in the middle of the nineties reaching a trough in late 1996. They have been mostly increasing ever since.
4. In 2000 and 2001, thus for the bulk of the euro-period, return dispersions have been above their previous peak levels reached in 1990 and 1993.
5. The post-1996 upswing in return dispersions may not have reached its summit at the country level; it appears to have peaked in mid-2000 at the sector level.
6. Dispersions, once smoothed out, are always higher at the sector level; the difference between sector dispersions and country dispersions appears to have increased in the latter part of our sample.

All in all, the more discriminating approach used in this section permits shedding light on our previous and current results. When we use sample data terminating in April 1999, the correlation comparisons are conditioned by the two peaks in the early part of the sample and the long downswing of the mid-nineties, leading to a diagnosis of decreasing dispersions and thus increasing correlations (from the pre-convergence to the convergence period). This explains our earlier results. The short euro sample, on the other hand, clearly places the stress on the above average dispersions of the last few years and thus supports the opposite diagnosis obtained in Section 3. Table 6 formally documents that the median country dispersion slightly decreased

between the pre-convergence to the convergence period while there was a much more significant upward jump from the pre-euro to the euro period. The dispersion approach illustrated in Figures 4 and 5 invalidates the hypothesis that diversification opportunities in the Euro-area have been permanently impaired as a result of the process of economic and monetary integration. In view of the low frequency movements in the dispersion of returns, two conclusions are equally plausible: increased economic and monetary integration is the cause of a permanent increase in the average dispersion level auguring well of diversification opportunities in the new Euro-area; alternatively and equally likely, the recent upswing in dispersions is a purely cyclical event, unrelated to the underlying process of integration, and likely to give way to future phases of lower return dispersions.

Figure 4: Filtered country and sector global dispersions: HP filter = 270000

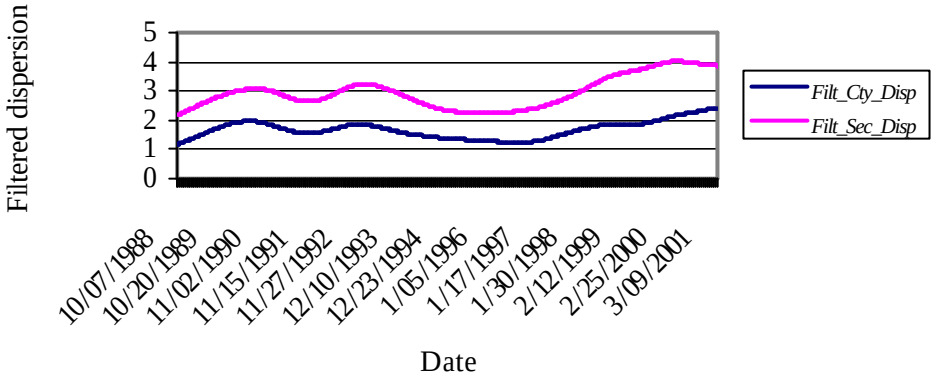


Figure 5: Filtered country and sector global dispersions: HP Filter = 28800

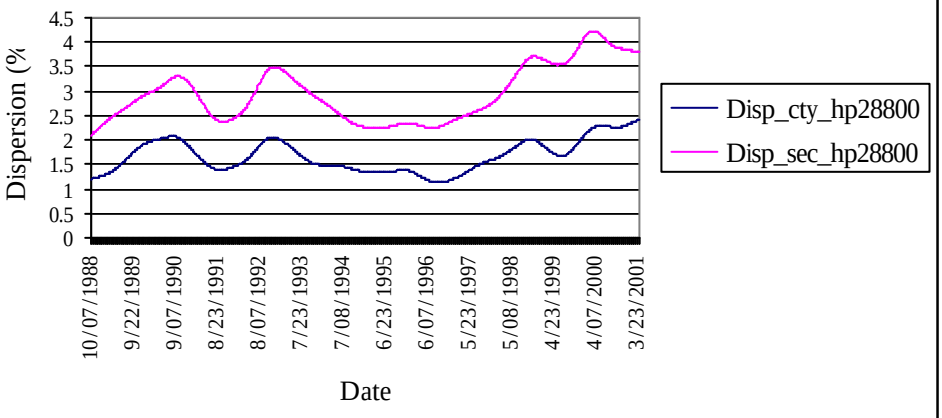


Table 6: Statistics on country and sector dispersions by sub-sample period

	Pre convergence		Convergence		Pre euro		Euro	
	Country	Sector	Country	Sector	Country	Sector	Country	Sector
Median	1.573	2.661	1.488	2.828	1.456	2.758	1.806	3.592
Maximum	4.410	7.625	5.070	7.938	4.687	6.169	5.070	7.938
Minimum	0.441	1.504	0.557	1.416	0.684	1.442	0.749	1.923

5. Conclusions

What are the implications for financial returns and diversification opportunities in Europe of the all important process of economic and monetary integration at work since the beginning of the nineties? This fascinating question had lead us to look at the time evolution of the matrix of return correlations a few months only after the birth of the euro. With little choice at the time, we had defined two post-convergence to the euro periods, one defined with the onset of the Maastricht Treaty in January 1995, the other one beginning in August 1997. The latter was motivated by poll results indicating that by that date the overwhelming majority of 200 financial and economic forecasters predicted that all 10 of the first euro countries would indeed join EMU, with the remaining uncertainty essentially resolved by January 1998. With this limited post-convergence and post-euro data, we consistently obtained results showing that return correlations had been higher in the later "convergence" period than in the pre-convergence one. The picture was unambiguous: the convergence (cum beginning of the euro) period appeared less favorable to portfolio diversification. We speculated on the causes of this phenomenon and its implications for the home bias and the country allocation paradigm.

In the present paper, we have revisited this important issue at the light of more recent data containing almost two and a half years of post-euro return observations. The more recent data convey a radically different message. Indeed the pure euro sample is characterized by lower return correlations than those obtained for the immediately preceding period of the same length, whether these correlations are computed at the country or at the sector level. These conflicting results have lead us to adopt an alternative, more discriminating, methodology. Focusing on the time series of return dispersions, we identified interesting low frequency movements in dispersions suggestive of cycles and long swings in return correlations. The most recent post-euro period is clearly associated with a significant upswing with dispersions exceeding for the first time their peaks of the early nineties. In the absence of the later data, the peaks of the early nineties were conditioning our previous results. Whether the recent increase in dispersions (decrease in

correlations) is indicative of a trend shift, possibly associated with the advent of the euro, or constitutes a purely cyclical phenomenon, only the future will tell. The fact of the matter is, however, that our results clearly invalidate the hypothesis, previously entertained, that diversification opportunities in the Euro-area have been permanently impaired as a consequence of the process of economic and monetary integration. They strongly confirm, on the other hand, the superiority of a model where diversification is sought after simultaneously across country and sector dimensions over the traditional country allocation model. In fact our analysis tend to suggest that the superiority of the former model may have increased over the very recent past, too recent however to make much of this tantalizing observation.

References

Adjaoute, Kpate, and Jean-Pierre Danthine, (2000), "EMU and Portfolio Diversification Opportunities", FAME Research Paper # 31, International Center FAME, Geneva

Bekaert, Geert, and Campbell R. Harvey, (1997), "Time-varying World Market Integration", *Journal of Finance*, 50, 403-444.

Solnik, Bruno, and Jacque Roulet, (2000), "Dispersion as Cross-Sectional Correlation", *Financial Analysts Journal*, January/February 54-61.

Appendix

In this appendix we present the evolution of sector pair correlations for the pre-euro and the euro periods. Our results apply for a sector decomposition across 10 broad and non-overlapping sectors. With the exception of the "Non-cyclical services" sector, and to a lesser extent "Cyclical services" and "Utilities", pairwise correlations appear to have decreased from the pre-euro to the euro period.

Figure A1: Evolution of sector pair correlations, basic industries: pre Euro and Euro periods

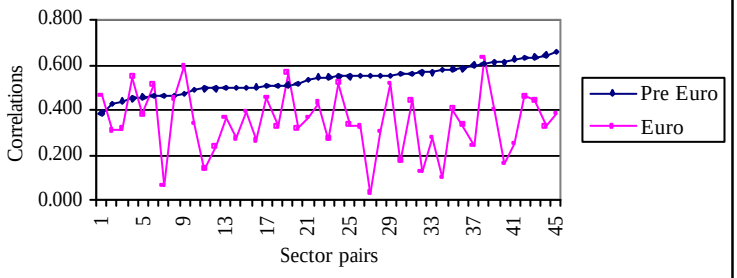


Figure A2: Evolution of pair correlations, cyclical consumer goods: pre Euro and Euro periods

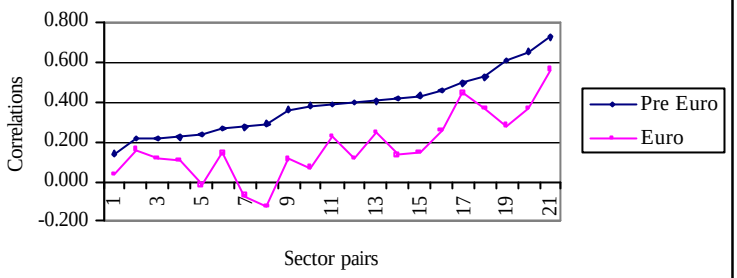


Figure A3: Evolution of pair correlations, cyclical services: pre Euro and Euro periods

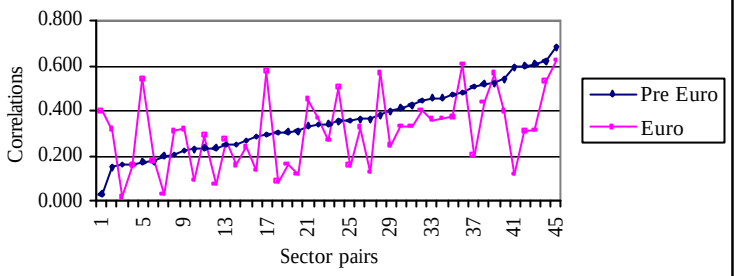


Figure A4: Evolution of pair correlations, general industrials: pre Euro and Euro periods

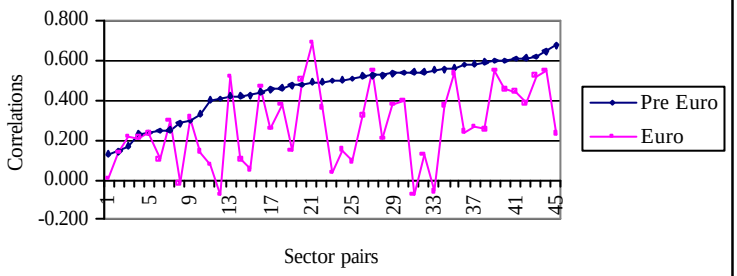


Figure A5: Evolution of pair correlations, information technology: pre Euro and Euro periods

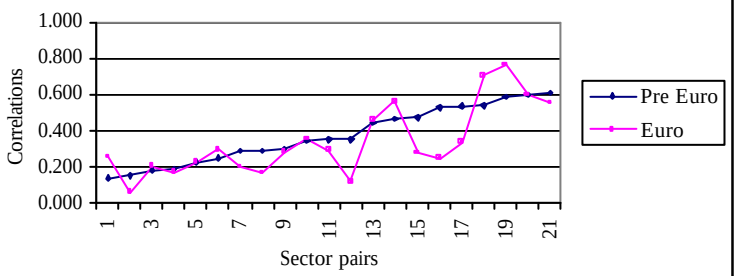


Figure A6: Evolution of pair correlations, non-cyclical services: pre Euro and Euro periods

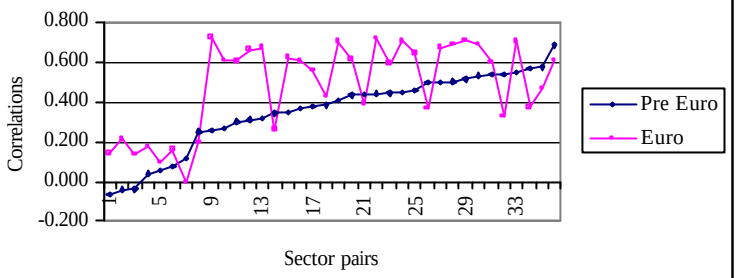


Figure A7: Evolution of pair correlations, non-cyclical consumer goods: pre Euro and Euro periods

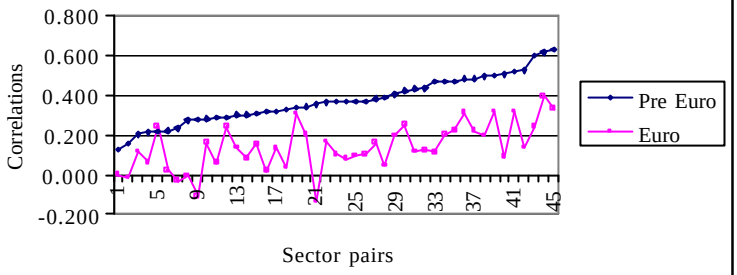


Figure A8: Evolution of pair correlations, resources: pre Euro and Euro periods

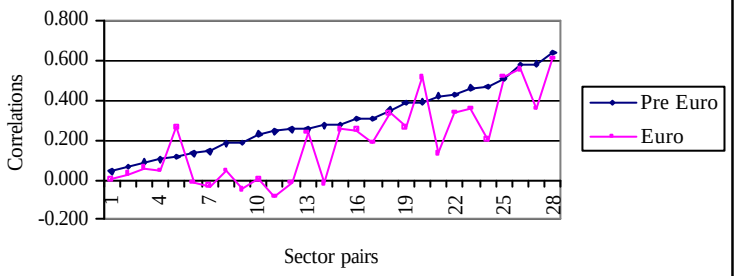


Figure A9: Evolution of pair correlations, financials: pre Euro and Euro periods

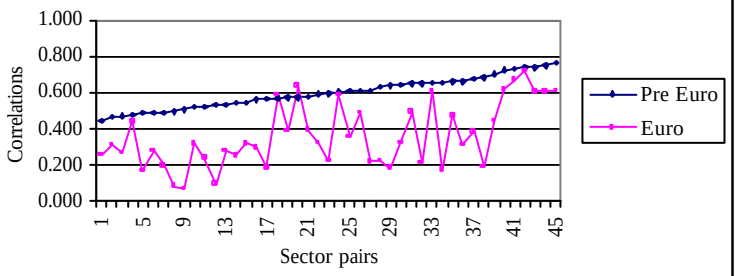


Figure A10: Evolution of pair correlations, utilities: pre Euro and Euro periods