INTERNATIONAL EQUITY RISK PREMIUM CONVERGENCE

Rafik ABDESSELAM*
Sylvie LECARPENTIER-MOYAL**
Patricia RENOU-MAISSANT***

1. Introduction

A large body of literature based on the formation of financial asset prices has for many years emphasized the strategic role of the equity premium in financial allocation portfolios. Investors are willing to hold risky assets, as long as they know they may receive a bonus in return, i.e. an equity premium, in addition to the risk-free return. In that case, the equity premium measures the difference between the return on equities and the return on risk-free assets.

The literature on equity premiums has typically focused on the overall equity premium. Mehra and Prescott (1985) found that the observed average value of risk premiums has far exceeded its theoretical value. This constitutes the "equity premium puzzle". The literature later extended this basic model in many ways (capital asset pricing model, arbitrage pricing model, etc.). Besides, many researchers have shown that estimates of the equity premium based on historical data could vary widely, depending on the methodology and the sample period used (Schwert (1990), Siegel (1992), etc.).

This paper uses an ex-post observed measure of the equity premium. The aim of this study is not to explore several measures of the equity premium but to analyze the components of the equity premium and to investigate empirically the convergence of these equity premiums in the main financial markets. With growing financial deregulation in international stock markets, one may assume that the links between national stock markets have been strengthened. Moreover, over the last forty years, financial markets throughout the world have steadily become more open to foreign investors. As far as European markets are concerned, the implementation of the EMU has made these markets substantially more self-determined and less driven by other global markets. In addition to being one of the largest areas of economic activity, the Euro zone also represents one of the largest stock markets in the world;

* Université de Caen – GEMMA. Abdesselam@econ.unicaen.fr
** Université de Rennes I – CREREG (Rennes), MODEM (Paris X – Nanterre). sylvie.moyal@wanadoo.fr
*** Université de Caen – GEMMA (Caen), MODEM (Paris X – Nanterre). PatriciaMaissant@aol.com

in terms of market capitalization, it is the second largest after the United States and ahead of Japan.

The degree to which national markets have become integrated is an important consideration. So it is interesting to establish whether there is a tendency for equity premiums to converge. Indeed, if international stock markets share common trends, this would imply that equity premiums tend to be closer to each other in world capital markets and that there is nothing to be gained from international portfolio diversification. Thus, we have studied the evolution of equity premiums in eleven stock markets (those of Belgium, France, Germany, Italy, the Netherlands, Spain, the United Kingdom, Switzerland, Canada, Japan and the United States) using monthly data from 1984 to 2001. These stock markets are among the largest in the world in terms of market capitalization[1].

An analysis of the evolution of equity premiums and of possible convergence in the eleven largest stock markets in the world requires a study of equity premium components in various countries. Furthermore, in order to get more information about the evolution of equity risk premiums, we conducted data analysis on the equity risk premium's components: stock price growth rate, dividend yield and risk-free interest rate. This meets a dual objective:

- to give a general description of the main components of the equity premium according to the period and to stock markets,

- to analyze the location of and the link between the European stock markets and the American and Japanese stock markets in relation to the equity premium components, both spatially and historically.

The paper describes structural analyses, based on a methodological chain of exploratory methods of analysis of classic and evolutionary data, in other words of multidimensional exploratory statistics.

We then analyze the convergence of equity risk premiums. We consider convergence as a gradual and on-going process and we measure the degree of convergence of these markets using the time-varying parameter methodology suggested by Haldane and Hall (1991).

The paper is organized as follows. Equity premium measurement and data are briefly introduced in section 2. Section 3 presents data analysis of the components of equity risk premiums. Section 4 investigates convergence of equity risk premiums. Section 5 reviews the conclusions.

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[1]Source : International Federation of Stock Exchanges. NYSE 11534612,9 thousand US dollars as per end 2000, Japan 3193934,4 ; London 2612230,2 ; Deutsche Boïse 1270243,2 ; Euronext Paris 1446631,1 ; Switzerland 792316,4 ; Toronto 770116,3 ; Italy 768363,4 ; Euronext Amsterdam 640456,3 ; Spain 504221,9 and Euronext Brussels 182481,0.

2. Equity premium : measurement and data

2.1 Measurement

The equity premium measures the difference between the expected return on a portfolio of common stocks and the return on risk free assets. Its value at time t ($\rho(\tau)_t$) can be expressed by:

$$\rho(\tau)_t = E_t(R_{t+\tau}) - rf(\tau)_t \qquad (1)$$

where $R_{t+\tau}$ is the stock return between time t and t + τ, $rf(\tau)_t$ is the risk-free interest rate in which τ is the residual maturity and E_t is the expectation operator conditional on information available at time t.

The expected stock return includes two components: the expected growth rate of prices and the dividend yield expected from stocks between time t and t + τ. It can be written:

$$E_t(R_{t+\tau}) = \frac{E_t(P_{t+\tau}) - P_t}{P_t} + \frac{E_t(D_{t+\tau})}{P_t} \qquad (2)$$

where P_t is the stock price at the end of year t, $D_{t+\tau}$ are the dividends distributed during periods t and t + τ.

The expected stock return can be approximated using:

$$E_t(R_{t+\tau}) = \log \frac{E_t(P_{t+\tau})}{P_t} + \frac{E_t(D_{t+\tau})}{P_t} \qquad (3)$$

and the equity premium is therefore expressed by:

$$\rho(\tau)_t = \log \frac{E_t(P_{t+\tau})}{P_t} + \frac{E_t(D_{t+\tau})}{P_t} - rf(\tau)_t \qquad (4)$$

If we consider a world without uncertainty, we obtain the formula:

$$\rho(\tau)_t = \log \frac{P_{t+\tau}}{P_t} + \frac{D_{t+\tau}}{P_t} - rf(\tau)_t \qquad (5)$$

2.2 Data

We used monthly data over the 1984-2001 period[2] obtained from Datastream. Series are individually described below:

- The stock price series P_t are global indices calculated with a homogeneous method. The indices are calculated using a representative list of stocks for each market. The number of stocks for each market is determined by the size of the market capitalization.

[2] For Belgium and Spain data are not available for the whole period. For Belgium, data begins in June 1989 and for Spain in April 1991.

- The dividend yield DY_t expresses the dividend associated to market stock index as a percentage of the share prices ($DY_t = \frac{D_{t+1}}{P_t} \times 100$).

- The risk-free interest rate RF_t expressed in percentage terms is a 10-year government bond yield for most countries[3]. In Belgium, Spain and the Netherlands data are not available for the whole period, so we used the 10-year benchmark bond for Belgium and Spain and the long CBS government bond for the Netherlands.

Finally, the risk premium expressed in percentage terms (Π_t) is calculated on an annual basis using the following formula:

$$\Pi_t = 1200 \times \log\left(\frac{P_{t+1}}{P_t}\right) + DY_t - RF_t \tag{6}$$

The statistics and the graphs relative to three components of equity premium are presented in the appendix.

If we consider stock price growth rates, strong disparities between countries can be observed. The mean value of the stock price growth rate is particularly weak in Japan at 3.1%, while its median value is actually negative. We find strong values, above 10%, in the United Kingdom (10.7%), in Belgium (10.9%), in the Netherlands (11.7%), in the United States (11.7%), in Italy (12.1%), in Switzerland (12.8%) and in France (13.1%). We notice a strong volatility of the stock price growth rate: standard deviations and coefficients of variation are very high. Standard deviations range from 51 (in the United States) to 86 (in Italy). The coefficient of variation is particularly high in Japan, where it reaches 2228%. For other countries it ranges from 436% in the United States to 770% in Spain. Figure A1 shows large fluctuations around zero and points in all countries to a dramatic drop caused by the financial crash of October 1987. Many professionals agree that the rises in 1986 and in the first semester of 1987 corresponded to a stock market bubble. In most countries, stock prices recovered sharply after the downturn of the fall of 1987, even though gains were smaller in Germany and in Switzerland.

The Japanese market behaves differently, with a strong rise in the first half of 1987, a loss relative to its lowest maximum and a spectacular recovery after the crash. The Japanese market is concerned -by the impact of fiscal tightening on growth prospects and uncertainty over the impact of prospective financial deregulation. In August and September 1990, stock markets suffered price falls. These losses reflected the oil price supply shock following Iraq's

[3] We use long -term bonds because we study the convergence in financial markets.

invasion of Kuwait. During the 1990s, equity prices continued to rise and reached new heights by April 1998. The only notable exception to this trend was Japan. In the autumn of 1997, stocks fell sharply in response to the unfolding crisis in south-east Asia. Between the end of 1997 and March 2000, all stock markets set new record highs. From April 2000 to the first quarter of 2001, world-wide stock prices declined sharply. The losses seem to reflect the deflation of a world-wide equity price bubble rather than a collapse primarily driven by macroeconomic developments.

At least, if we consider the linear correlations between stock price growth rates, we observe a strong correlation between the French, German and Dutch markets as well as between the Swiss and Dutch markets.

With regard to the dividend yields, the dispersion is very weak everywhere, with standard deviations lower than 1.1. The coefficients of variation are close for all countries and are inferior to 34%. The mean value of dividend yields is low in Japan (0.8%), moderate in Switzerland (1.8%) and in Germany (2%) and above 2% in the other countries. The dividend yield is the highest on average in the United Kingdom (3.9%), followed by the Netherlands (3.5%), Spain (3.3%) and France (3%). Figure A2 shows a drop in dividend yields over the period in all the countries, a regular fall in the United States and in Canada but a much more erratic behaviour in the other countries. We note particularly low dividend yields in Japan during the 1987-1990 period. Dividend yields are strongly correlated, most of the linear coefficients of correlation are superior to 0.8; however the correlations are weaker for Italy - all the coefficients are lower than 0.8 - and for Japan, where the coefficients are lower than 0.5.

The long interest rates show significant disparities between countries and are particularly low in Japan (4.3%) and in Switzerland (4.5%) and very high in Italy (10.1%). For the other countries, the mean values range from 6.5% in Germany to 8.62% in Canada. The standard deviations indicate a weak volatility of the interest rates, which are everywhere lower than 3.1. The coefficients of variation range from 18% in the Netherlands to 43.4% in Japan. Figure A3 reveals a very similar evolution of long interest rates over the whole study period: a marked bear tendency. We observe a very strong correlation of the long interest rates between the various countries, the weakest coefficient being equal to 0.794 in both Italy and the United States. As regards the European countries, the coefficients are well above 0.9.

Figure 1 plots the equity risk premium stock markets. Equity premiums seem similar in all countries, i.e. they are erratic and vary around zero. The strong volatility of equity premiums can be explained by the large fluctuations in the stock price growth rates. The long interest rates and the dividend yields do not vary much. All different peaks observed during the period correspond to months of strong variations in portfolio equities. Table 1 provides some summary statistics for monthly equity risk premiums. Over the period, a negative equity risk premium observed in Japan shows that government bonds yield more than stocks on average. In the other countries, the average equity risk premium is positive and ranges from 2.2% in Belgium to 10% in Switzerland. Over the study period, Switzerland is the country with the highest yield on stocks. The highest equity risk premium was in Japan in August 1992 where it reached 235% and the lowest was recorded in Switzerland, -429%, in October 1987. If we measure volatility by standard deviation, the highest volatility is to be found in Italy and Japan and the lowest volatility is observed in the United States. The coefficients of variation confirm this result as regards the volatility of equity premium. In most series, the Jarque-Bera statistics point to significant deviations from normality, except for Belgium, Italy and Japan. This result can be largely explained by the financial crash of October 1987. The Dickey Fuller statistics show evidence of stationary equity risk premiums in all countries.

The contemporaneous correlations of the various markets are reported in Table 2. We note that the Dutch, German and French markets are more closely correlated between themselves than they are with other markets, (the correlation coefficients are above 0.8). We notice a low correlation between the Japanese equity risk premium and those of other markets.

The study of the various components of equity risk premium provides further information about the formation of equity premiums. Indeed, we notice that the weakness of equity risk premium in Japan is not explained by the weakness of the return rates on stocks or by high long interest rates, but combine three particularly low level components. In fact, it is Japan which has the weakest stock price growth rates, dividend yields and long-term interest rates. Switzerland is characterised by a low dividend yield, a low long-term interest rate and a high growth rate of stock prices (second to France). It is also the country which shows the strongest equity premium on average. After all, the stock prices growth rate is the fundamental component explaining the variations of the equity premium because of the strong volatility that affects this series. We find it interesting not to limit the analysis to the convergence of the equity risk premium and to also study the three components of the equity premium. Similar levels of equity premium hide very heterogeneous realities concerning the components of equity premium. We shall therefore undertake a multivariate analysis of the data.

Fig. 1: Equity Risk Premium Stock Markets

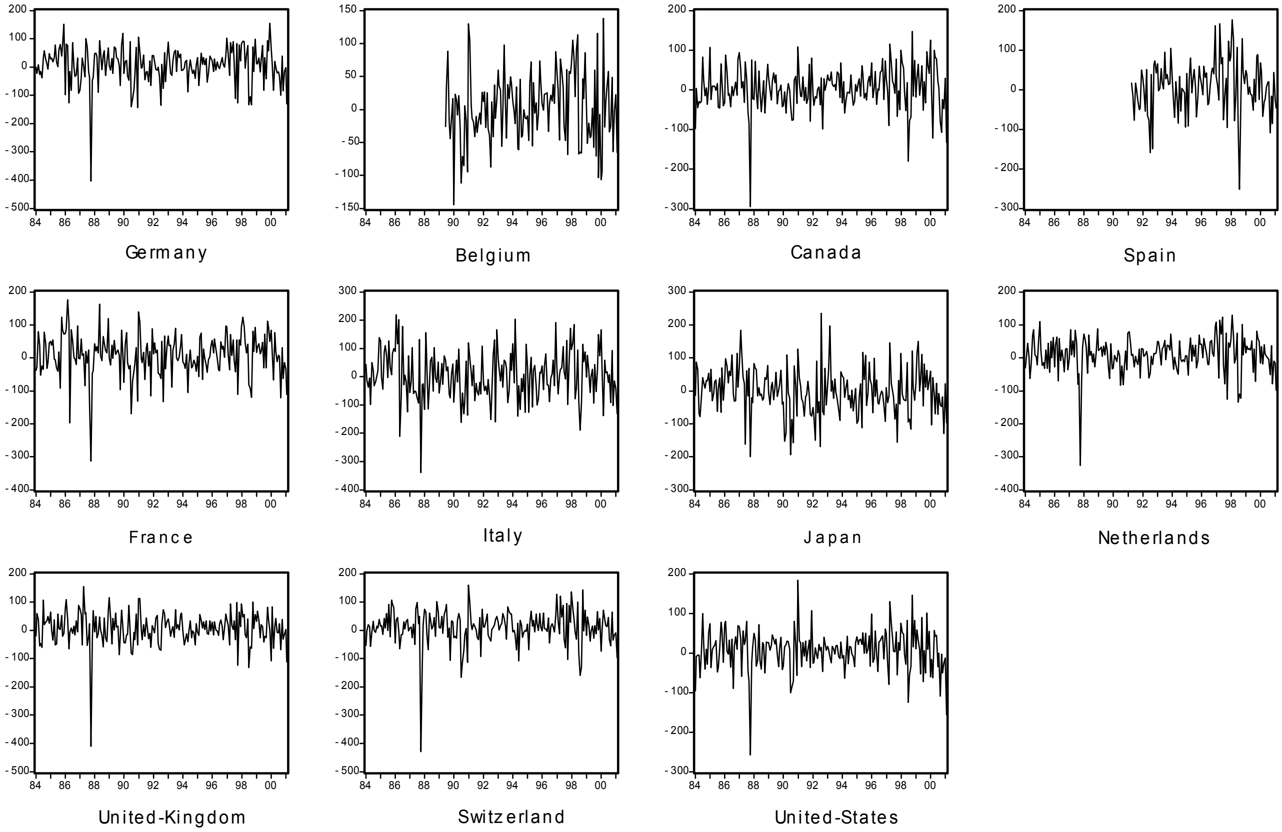


Table 1: Summary statistics for monthly equity risk premium stock markets

	Mean	Median	Maximum	Minimum	Standard Deviation	CV (%)	Jarque-Bera	Proba	ADF
Belgium	2.253	1.647	137.843	-144.787	53.030	2353.75	0.134	0.935	-11.169
Canada	2.438	1.243	147.431	-295.373	54.141	2220.71	173.412	0.000	-13.697
France	8.234	13.297	175.209	-312.414	64.368	781.73	93.299	0.000	-12.363
Germany	5.053	11.014	154.948	-403.069	64.494	1166.26	480.068	0.000	-13.130
Italy	4.336	2.369	219.365	-339.801	86.025	1983.97	4.034	0.133	-13.724
Japan	-0.400	-4.434	234.961	-199.523	70.172	-17543.0	4.422	0.109	-13.581
Netherlands	8.322	10.152	129.099	-325.765	52.677	632.98	496.861	0.000	-11.938
Spain	7.003	13.014	175.891	-252.369	66.163	944.78	15.176	0.000	-9.235
Switzerland	10.043	13.283	160.534	-429.399	61.646	613.82	1351.041	0.000	-12.785
United Kingdom	6.114	5.577	155.3919	-410.074	56.453	923.34	1612.542	0.000	-13.686
United States	6.114	9.967	182.953	-258.487	51.287	838.84	128.234	0.000	-13.725

Note : Unit root tests are conducted using the ADF test. The 95 % critical values for the ADF test statistics are -2.875 for the "with trend" version and –1.941 for the "without trend" version .

Table 2: Contemporaneous correlations between monthly equity risk premium stock markets

	Belgium	Canada	France	Germany	Italy	Japan	Netherlands	Spain	Switzerland	United Kingdom	United States
Belgium	1.000										
Canada	0.285	1.000									
France	0.565	0.645	1.000								
Germany	0.589	0.635	0.816	1.000							
Italy	0.356	0.438	0.626	0.658	1.000						
Japan	0.322	0.391	0.399	0.391	0.191	1.000					
Netherlands	0.661	0.643	0.809	0.853	0.591	0.443	1.000				
Spain	0.541	0.524	0.643	0.647	0.554	0.403	0.736	1.000			
Switzerland	0.647	0.518	0.605	0.677	0.423	0.337	0.803	0.598	1.000		
United-Kingdom	0.471	0.541	0.643	0.655	0.495	0.370	0.755	0.577	0.670	1.000	
United-States	0.467	0.770	0.605	0.610	0.407	0.364	0.693	0.514	0.618	0.668	1.000

3. Data Analysis of equity risk premium components

Average yearly data for the equity premium and its components on the eleven most important stock markets are used. The data cover a period of seventeen years, namely from 1984 till 2000. The data are of the "cubic" type: the same variables – (the equity premium and its components) were measured using the same unit for the same individuals – i.e. stock markets – at given dates between 1984 and 2000. Variables represent the equity Risk Premium (RP), Stock Price growth rate (GP), Dividend Yield (DY) and Risk-free Interest Rate (IR).

3.1 Mean evolution of equity premium components

This analysis has two objectives : - to structure the components of the equity premium i.e. to synthesize the relations existing between them (both their associations or their oppositions), - to position the individuals, in this case, the years, with common or opposing characteristics in connection with the equity premium components.

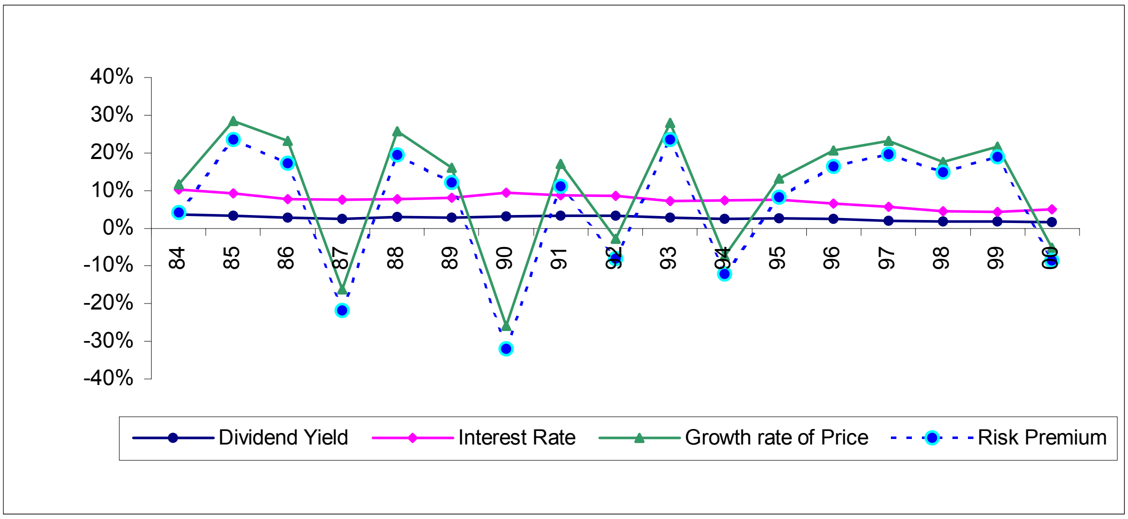
The evolution is studied through a Principal Components Analysis (PCA) of table 3, which shows the annual average rates calculated for the eleven stock markets studied. In this analysis, the active variables are the averages for the equity premium components and years play the role of the "individuals".

Table 3: Yearly average for equity risk premium and its components (%)

	Risk Premium	*Components*		
Year	*RP*	*GP*	*DY*	*IR*
1984	4,08	11,63	3,58	10,27
1985	23,50	28,41	3,28	9,32
1986	17,22	23,26	2,72	7,76
1987	-21,86	-16,15	2,54	7,60
1988	19,44	25,70	2,99	7,72
1989	12,22	16,03	2,73	8,06
1990	-32,06	-25,93	3,14	9,35
1991	11,20	17,04	3,24	8,80
1992	-8,07	-2,78	3,26	8,56
1993	23,53	27,92	2,79	7,18
1994	-12,17	-7,35	2,53	7,35
1995	8,15	13,11	2,64	7,59
1996	16,43	20,58	2,45	6,60
1997	19,54	23,16	1,99	5,61
1998	14,91	17,66	1,75	4,50
1999	19,01	21,69	1,71	4,39
2000	-8,62	-5,19	1,59	5,02

A first description from a one-dimensional statistical point of view of the average temporal evolution of the equity premium and its components over the studied period is shown in figure 2.

Fig. 2: Evolution of the equity risk premium and its components



Tables 4 and 5 (summary statistics and correlations of the variables studied) supply the following information:

- On average, over the period considered, a relative homogeneity of the dividend and interest rate distributions, and a significant heterogeneousness of stock price and equity premium growth rates can be observed.

- The first component of equity premium (stock price growth rate) is very weakly linearly correlated with two other components (dividend yield and interest rate), which are strongly correlated between themselves. Only the stock price growth rate is significantly and positively correlated to the equity premium.

Table 4: Summary statistics of variables

Num . Iden - Variable	Frequency	Mean	Std.Dev.	CV%	Minimum	Maximum
1. RP - Risk premium	17	6.26	16.27	259.90	-32.06	23.53
2 . GP - Growth rate of stock prices	17	11.11	15.92	143.29	- 25.93	28.41
3 . DY - Dividend yield	17	2.64	0.58	21.97	1.59	3.58
4 . IR - Interest rate	17	7.39	1.66	22.46	4.39	10.27

Table 5: Correlation matrix

	GP	DY	IR
GP	1.00		
DY	-0.04	1.00	
IR	-0.18	**0.97**	1.00

	RP
GP	**0.997**
DY	-0.108
IR	-0.247

Given the very different variable variances and despite the fact that the unit used is the same, we made a standardized PCA of the equity premium components. The data in table 3 are centered and reduced.

It must be mentioned that only the equity premium components are analyzed, and that the variable equity premium is considered as an illustrative element. This additional information is not used to determine the principal equity premium component factors, but is only given a posteriori positioned in order to assess its degree of similarity with the active variables (the equity premium components).

The first PCA result, presented in table 6, consists of the list of eigenvalues and variances explained by each factor. The first two factorial axes explain more than 99 % of the total inertia: a representation of the equity premium components as well as the years in the first factorial plane is sufficient.

Table 6: Eigenvalues of the correlation matrix

Axis	Eigenvalue	Proportion	Cumulative
1	1.9944	66.48	66.48
2	0.9848	32.83	**99.31**
3	0.0208	0.69	100.00

Table 7: Correlations of the components with each factor

Components	Factor 1	Factor 2
GP - Stock price growth rate	0.22	**0.97**
DY - Dividend yield	**-0.98**	0.18
IR - Interest rate	**-0.99**	0.04
PR - Equity premium	0,29	**0,96**

Table 7 represents the correlations of the equity premium components with the first two factors. Figure 3, the circle of correlations[4], gives a representation of these components on the first factorial plane. Thus we can point out the equity premium components which played a predominant role in the determination of the principal factors.

In figure 3, the first factor, which summarizes 66.48 % of the total information is a linear combination of the interest rate and the dividend yield. It therefore characterizes these two equity premium components, which are strongly and negatively correlated to the first axis. This axis may be interpreted as a time factor; indeed, we notice a rather linear temporal evolution as regards the years (figure 4) along axis 1. This means that components (interest rate and dividend yield) vary in a rather linear way with regard to time. In figure 2, we do in fact notice a linear evolution of these two components. Over the whole period studied, the interest rate and the dividend yield decline.

The second factor summarizes 32.83 % of the total information. It is specific for the stock price growth rate, which is strongly and positively correlated to the second axis. The average evolution of this component on this axis (figure 4) is rather chaotic. The stock price growth rate is the only equity premium component not to vary in a linear way (figure 2).

Fig. 3: Representation of the components on the first factorial plane

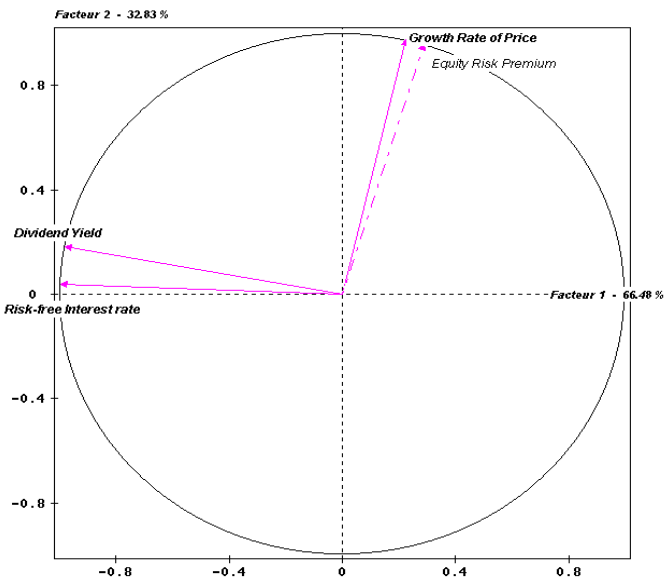
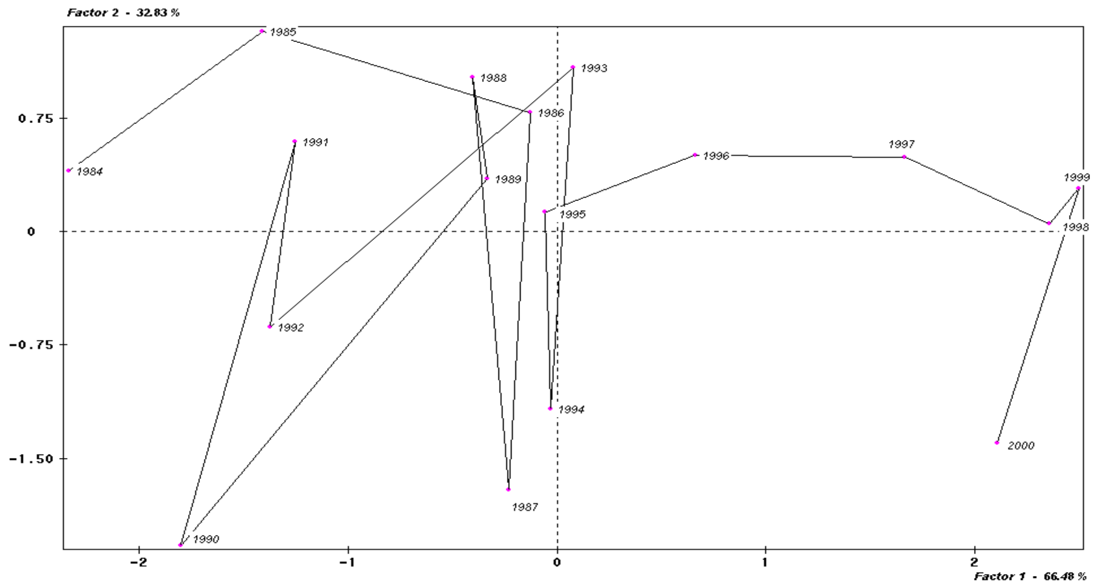


Figure 4 groups together years that are alike with regard to the average equity premium components. These periods with the same characteristics are characterized by a Hierarchical

[4] The data being centered here reduced, the coordinates of the components of the equity premium on axes are the coefficients of correlations between these components and the factors.

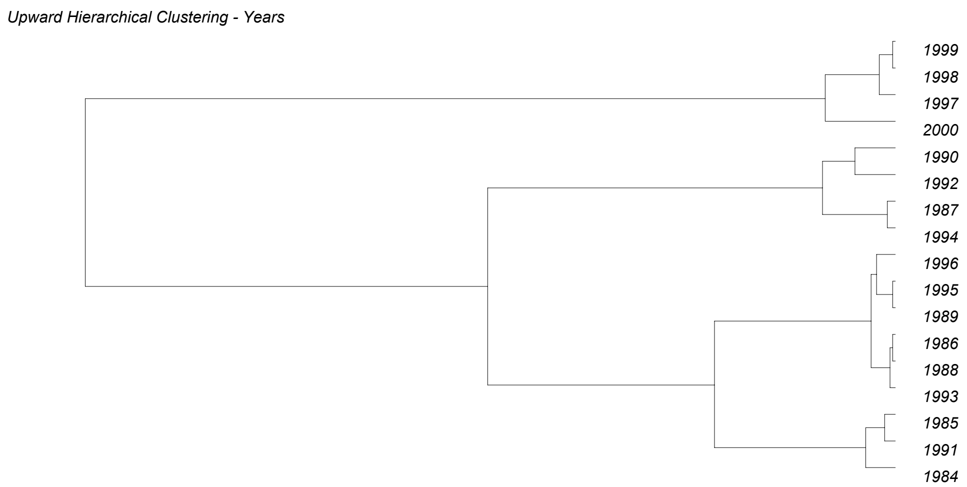
Cluster Analysis (HCA) on the two first significant factors of PCA equity risk premium components. This method allows period classes to be distinguished according to the equity risk premium components.

Fig. 4: Representation of the seventeen years studied, on the first factorial plane



A Clustan Graphics Tree summarizing the final classification of the seventeen years studied is shown in figure 5. This was obtained using a HCA with Ward's criteria[5].

Fig. 5: Hierarchical Tree of the years studied according to equity risk premium components



This first analysis of the equity premium component evolution for eleven stock markets led us to split the hierarchical tree into four periods which are characterized in table A7 in the appendix and illustrated in figure 5. The four class division was strengthened around the centers of gravity for the classes thanks to the k-means method.

The statistical description (with a significance of less than 5%) of the content of each class of the four classes retained is given in the appendix (table A7). The class standard profile is based upon comparisons between means of the variable in the class (CLASSE) and the same variable out of the class (GENERALE). The selection of the most characteristic components of each class stems from the gap between the relative values of the class and the global values. These statistics are converted into a test-value criterion (V.TEST). These values are given in a decreasing order with a lower than 5% error risk (PROBA) which allows us to classify the most characteristic components for each period class.

The first class corresponds to a period of three years: the beginning of the period - 1984, 1985 - and 1991. It is characterized by significantly high dividend yield and interest rates. In the second class which includes six years, we observe a marked increase in the stock price growth rate. Furthermore, the years in this class were years with a strong equity premium. Unlike the second class, the third class consists of four years, and is characterized by a significantly weak stock price growth rate with regard to the average rate for the whole period studied. Here the period is characterized by years with a weak equity premium. The fourth class covers the end of the period from 1997 till 2000. These last four years are characterized by dividend yield and interest rates significantly lower than the mean values for the same rates over the whole period studied. This class differs from the first one. We can notice that the years towards the end of the period have the same characteristics.

3.2. Temporal analysis of stock markets and of equity premium components

The objective is to characterize the evolution of eleven stock markets according to the results of various equity premium components over the period from 1984 till 2000.

3.2.1. Annual analysis

Table 8 presents the synthesis of the results of the analysis carried out year by year on the eleven stock markets. Every analysis is included in a classification chain. This classification chain contains the PCA significant factors of the equity premium components over a one year period.

[5] Generalised Ward's Criteria: aggregation based on the criterion of the loss of minimal inertia.

Table 8: Annual analysis summary

Year	Japan	←	European Countries	→	United States
1984	J SW G N DY^- IR^-		I UK F GP^+	→	US C GP^-
1985	J SW G DY^- IR^-	←	I GP^+ IR^+		US C N F UK DY^+ GP^-
1986	J F I DY^- GP^+		SW G GP^-	→	US C UK N DY^+
1987	J DY^- IR^-		G SW F I GP^-	→	US C UK N DY^+
1988	J SW G DY^- IR^- GP^+	←	F GP^+		US C I UK N GP^- DY^+ IR^+
1989	J GP^- DY^- IR^-	←	SW G DY^- IR^- GP^+		US C F I UK N GP^- DY^+ IR^+
1990	J SW GP^- DY^- IR^-		F B G I	→	US C UK N GP^+ DY^+
1991	J GP^- DY^- IR^-		F B G I C UK N DY^+ IR^+	→	US SW GP^+
1992	J GP^- DY^- IR^-		I S IR^+	→	US F G C B SW UK N GP^+
1993	J SW DY^- IR^-		S DY^+ IR^+	→	US F I G C B UK N
1994	J SW DY^- IR^-		S F UK GP^- DY^+	→	US G C B N GP^+
1995	J SW G DY^- IR^-		I GP^- DY^-		US C B N S F UK DY^+
1996	J SW G GP^- DY^- IR^-				US C B N S I F UK DY^+ IR^+ GP^+
1997	J GP^- DY^- IR^-				US G C B N S I F UK SW DY^+ IR^+ GP^+
1998	J GP^- DY^- IR^-		F S N UK C DY^+	→	US G B I SW
1999	J IR^- DY^- GP^+		SW B GP^-	→	US G I F S N UK C DY^+ IR^+
2000	J IR^- DY^- GP^-		SW B F I S N UK C DY^+ GP^+	→	US G

For example, the year 1984 is divided into three classes. The first class contains four stock markets (Japan, Switzerland, Germany and the Netherlands) and is characterized by significantly weak dividend yield and interest rates. The second class consists of three European stock markets with very high stock price growth rates. The third class, consisting of the U.S. and Canadian stock markets, is characterized by a significantly weak stock price growth rate with regard to the annual average rate of all the nine stock markets (the Spanish and Belgian stock markets do not appear because of the missing data for the year 84[6]). If we choose a less detailed partition into two classes, we can observe that the European markets (Italy, United Kingdom and France) are closer to the American market than to the Japanese market relative to the risk premium components. The arrow shows the direction of the link between the European stock markets and the American market.

The main results of the annual analysis are :

- Japan is often alone or associated with Germany and Switzerland. In 1984, it is associated with Germany, Switzerland and the Netherlands and in 1986, only with France and Italy. This last result can be explained by the privatization program in France and the development of mutual funds in Italy during 1986. These factors contributed to the dynamism of the equity market (the price growth rate is significantly higher). At the end of the period, this position can be explained by the fact that the Japanese market remained weak until 1998 and only rejoined the global trend in 1999. Developments in the banking sector provided the major boost. We should point out that for several years, Germany and Switzerland share common features with the Japanese market i.e. significantly low equity premium components.
- We also notice the convergence of all the European stock markets with the American market in 1996, except for the German and Swiss markets which tend more towards the Japanese market. In 1997, all the European stock markets share common features with the American market i.e. significantly high rates for all three equity premium components, unlike the Japanese stock market.
- Globally, in the period under study, the European countries – except for Switzerland and Germany – seem closer to the American market than to the Japanese one

3.2.2 Global stock market analysis

Global stock market evolution is studied by a Multiple Factorial Analysis (MFA) (Escoufier and Pagès (1985), (1988)) which is based on a weighted analysis of the principal components of all the data (the three equity premium components for the eleven stock markets over the

[6] Average annual data are available from 1990 for Belgium and from 1992 for Spain.

seventeen years studied). This analysis is specially designed to study individuals - i.e. stock markets - characterized by a certain number of groups of the same variables - i.e. equity premium components - measured at each of the different moments in time. Its originality results from a weighting[7] of variables, the objective of which is to balance the influence of the various groups of variables.

Thus, the structure of each component group is retained. The direct comparison of distinct annual analysis (table 8) does not directly achieve the aim of global analysis because these analyses, when carried out separately, do not take into account the same possible structures.

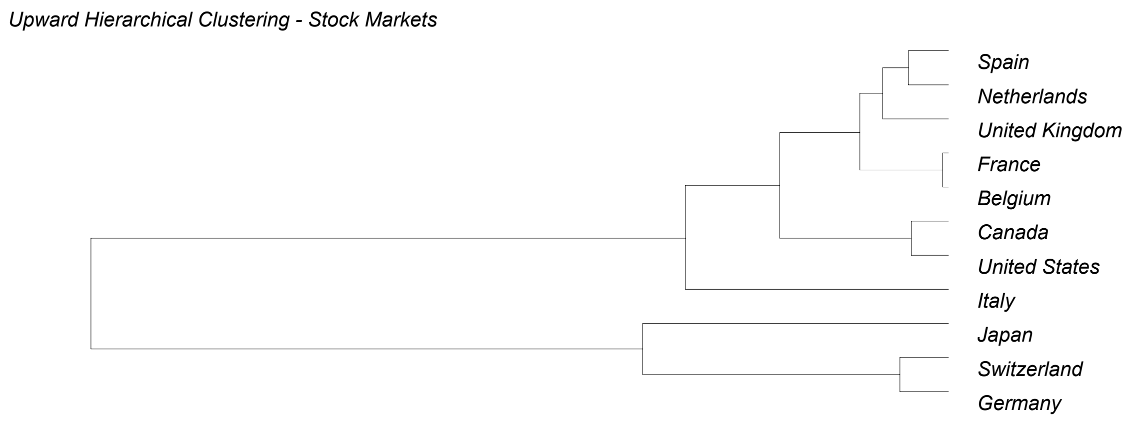
The eigenvalues and the part of inertia explained by each of the common principle factors for the whole analysis are presented in table 9.

Table 9: Eigenvalues for the overall analysis - MFA

Axis	1	2	3	4	5	6	7	8	9	10
Eigenvalue	**14.723**	**4.97**	**2.577**	**2.313**	**1.318**	**1.157**	0.783	0.596	0.425	0.363
Proportion	**50.42**	**16.94**	**8.82**	**7.92**	**4.51**	**3.96**	2.68	2.04	1.45	1.24
Cumulative	**50.42**	**67.36**	**76.18**	**84.10**	**88.62**	**92.58**	95.26	97.30	98.76	100.00

A Hierarchical Cluster Analysis with Ward's method was then used on the six first significant factors of the MFA, (where explained inertia accounts for 92.58 % of the total), to characterize classes of stock markets according to the evolution of the equity premium components.

Fig. 6: Hierarchical Tree of the stock markets



[7] The weight given by the AFM to each of the equity premium components of a table is equal to the inverse, contrary to the first principal component inertia of this table. So, the inertia of the first principal component of every group of components of the equity premium is equal to 1. It does not modify the structure of the various groups because every component of the same group is weighted by the same coefficient.

Table 10 summarizes the two class division from the results of the Ward classification criterion represented by the hierarchical tree of figure 6.

Table 10. Synthesis of the two class divisions

Japan	←	European Countries	→	United States
J SW G				US C F B UK N S I

The division is based on the stock market positions on the MFA factorial axes. The two class characterization (see table A8 in the appendix) is obtained by interpreting the trajectories of the gravity centers in factorial planes.

The first class groups together three stock markets: Japan, Switzerland and Germany. For these markets, the yield dividends and interest rates are significantly weak on the considered period. This class is also characterized by a growth rate of price significantly low in 1996 with regard to the average on the whole stock markets. The second class, that includes the other eight stock markets, presents the same characteristics but in a perfect opposition. Finally, for the European stock markets, we note a link: Switzerland and Germany towards the Japanese market and the others European countries towards the American market.

4. Equity premium convergence

4.1 Methodology

The intuitive notion of convergence is straightforward, namely, that the difference between two (or more) series should become arbitrarily small or convergent on some constant c as time elapses, $\lim_{t\to\infty} (X - Y) = c$. For random series, such as most economic variables, this can be extended by the introduction of the notion of stochastic convergence $E\left[\lim_{t\to\infty} (X - Y)\right] = c$. In this case the probability that the two series differ by a specific amount has to become arbitrarily small. Some alternative approaches may be considered to implement these criteria[8]. If we believe that convergence has not occurred before the data sample being used but is in the process of taking place over the sample we need a measure of convergence which allows dynamic structural change. So, in this paper, we study the convergence by using the time-varying parameter technique methodology suggested by Haldane and Hall (1991). The Kalman filter estimation method is typically used to estimate regression-type models where the coefficients follow a random process over time.

Consider two countries *i* and *j*. To measure the convergence of variable *X* in country *i* with variable *X* in country *j*, we estimate the measurement equation:

$$X_t^i = \alpha_t + \beta_t X_t^j + \varepsilon_t \tag{7}$$

where α_t and β_t are time-varying parameters defined in state equations:

$$\alpha_t = \alpha_{t-1} + \eta_{1t} \tag{8a}$$

$$\beta_t = \beta_{t-1} + \eta_{2t} \tag{8b}$$

State equations describe the dynamics of the time-varying parameters, which are assumed to follow a random walk. The disturbance vectors ε_t , η_{1t} and η_{2t} are assumed to be gaussian independent white noises. The system of equations (7), (8a) and (8b) is called a state space model and it can be estimated by the Kalman filter[9].

If β converges towards zero, then movements of X_t^j do not explain movements of X_t^i . On the other hand, if β converges towards 1 we may consider that there is a convergence from X_t^i on X_t^j . If a convergence process is ongoing but not yet complete, then, the β coefficient is near zero at the beginning of the period and converges towards 1 over time. However, this measure is not precise enough. In particular, it does not allow the distinction between a two country convergence and a global convergence. If we want to distinguish the convergence between the European Union stock markets from international stock market convergence, it is therefore necessary to compare the movements of a variable between two European countries in respect of the movements of this variable in relation to the rest of the world.

Now, consider three countries *i*, *j* and *k*. So, the measurement equation is :

$$(X_t^j - X_t^i) = \alpha_t + \beta_t (X_t^j - X_t^k) + \varepsilon_t \tag{9}$$

where α_t and β_t are defined in state equations:

$$\alpha_t = \alpha_{t-1} + \eta_{1t} \tag{10a}$$

$$\beta_t = \beta_{t-1} + \eta_{2t} \tag{10b}$$

A formal measure of convergence is given directly by the trend of α and β parameters. So, when β tends towards zero, the movements of *X* in country *i* are explained by the fluctuations of *X* in country *j* independently of country *k:* we then speak of relative convergence from *j* to *i*. When β tends towards 1, the difference between countries *i* and *j* is explained by the difference between countries *j* and *k*, so there is no convergence between X^i

[8] See Fuss C. (1999).

and X^j. α(t) is a stochastic constant and partials out all systematic influences upon the differential between X^i and X^j except those resulting from movements in the differential between X^j and X^k.

The disadvantage of this method is that the results are sensitive to the country's reference. The convergence is relative and depends on the country's reference. In this paper we study several types of convergence and we choose several countries as reference.

$$(X_t^{US} - X_t^i) = \alpha_t + \beta_t (X_t^{US} - X_t^{JAP}) + \varepsilon_t \quad (11a)$$

$$(X_t^{GE} - X_t^i) = \alpha_t + \beta_t (X_t^{GE} - X_t^{US}) + \varepsilon_t \quad (11b)$$

$$(X_t^{FR} - X_t^i) = \alpha_t + \beta_t (X_t^{FR} - X_t^{US}) + \varepsilon_t \quad (11c)$$

$$(X_t^{UK} - X_t^i) = \alpha_t + \beta_t (X_t^{UK} - X_t^{US}) + \varepsilon_t \quad (11d)$$

The first equation, (11a) allows the study of the convergence with the international reference, the United States, while the rest of the world is represented by Japan. Equations (11b), (11c) and (11d) allow the analysis of the relative convergence between European stock markets with respect to Germany, France and the United Kingdom. The rest of the world is represented by the United States.

4.2. Kalman filter results

The α(t) coefficients are potentially important as they allow for the possibility that our specific alternative explanation is either inadequate or irrelevant. In this instance it was not the case as α tends towards zero and is not significantly different from zero on a two-tailed t-test at a 5% level. So we will focus solely on the β(t) coefficients.

Figures 7 to 10 report the β(t) coefficients with the US as reference and Japan for the rest of the world. These figures strongly suggest convergence towards the US. In Germany, France, Italy and the Netherlands the convergence achieved over the 1987-1994 period. This movement can be explained by the liberalization of financial markets. The β coefficients declined significantly and reached their lowest level in 1993 or 1994, depending on the country: 0.16 in Germany, 0.21 in France and Italy and 0.18 in the Netherlands. For these four European countries, the convergence process seems to have stopped since 1994. After moving closer to the US until 1994, there has been little further convergence. During the 1992 to 1995 period, the European economies suffered an exchange crisis and a bond market crash. As regards Belgium and Spain, the small size of our data samples does not allow us to analyze

[9] See Harvey A. C. (1982). The Kalman filter is a recursive algorithm for sequentially updating the state vector given past information.

the convergence over the same period. Nevertheless, we can notice the stability of β at around 0.2 in Belgium since 1993 and a small decrease in Spain over the 1993-2001 period. These results suggest that convergence was established earlier, as occurred in the other European countries. We may suppose that the processes of convergence are very similar for the six European countries. So there has been a definite tendency for the coefficients to move towards zero but equity risk premiums have not fully converged. This result must be treated with caution given the small number of observations for Belgium and Spain. Concerning the United Kingdom, Canada and Switzerland, β is relatively stable and remains below 0.2 (0.1 in Canada since 1987) over the whole period, suggesting an earlier convergence process, completed before the mid-1980s.

Figures 11 and 12 reproduce the exercise with respect to France with the United States for the rest of the world. The aim is to analyze convergence between the European Union countries. Germany, Italy and the Netherlands steadily converged with France over the 1987-1999 period. Over the year 2000, the link between France and Italy strengthened, and β reached 0.07 in 2001, while the link between the Netherlands and France slackened. Concerning Switzerland and the United Kingdom, β remained high over the whole period (above 0.55 in Switzerland and above 0.63 in the United Kingdom) and shows no tendency to converge. In Belgium, β steadily decreased from 1991 to the end of 1999. We observe a strong divergence in 2000, with β above 0.75. This can be explained by the under performance of Belgian prices which is particularly marked at the end of 1999 continued until mid-March 2000. We may suppose that convergence occurred before 1991 but data were only available since June 1989, so no similarity between the European countries can be shown. In Spain, β is stable over the 1993-2001 period around 0.2 suggesting an earlier convergence. Results outline a definite tendency for European countries to converge (France, Germany, the Netherlands, Italy, Belgium and Spain). Equity risk premiums moved closer but some divergence appeared in 2000 in the Netherlands and Belgium.

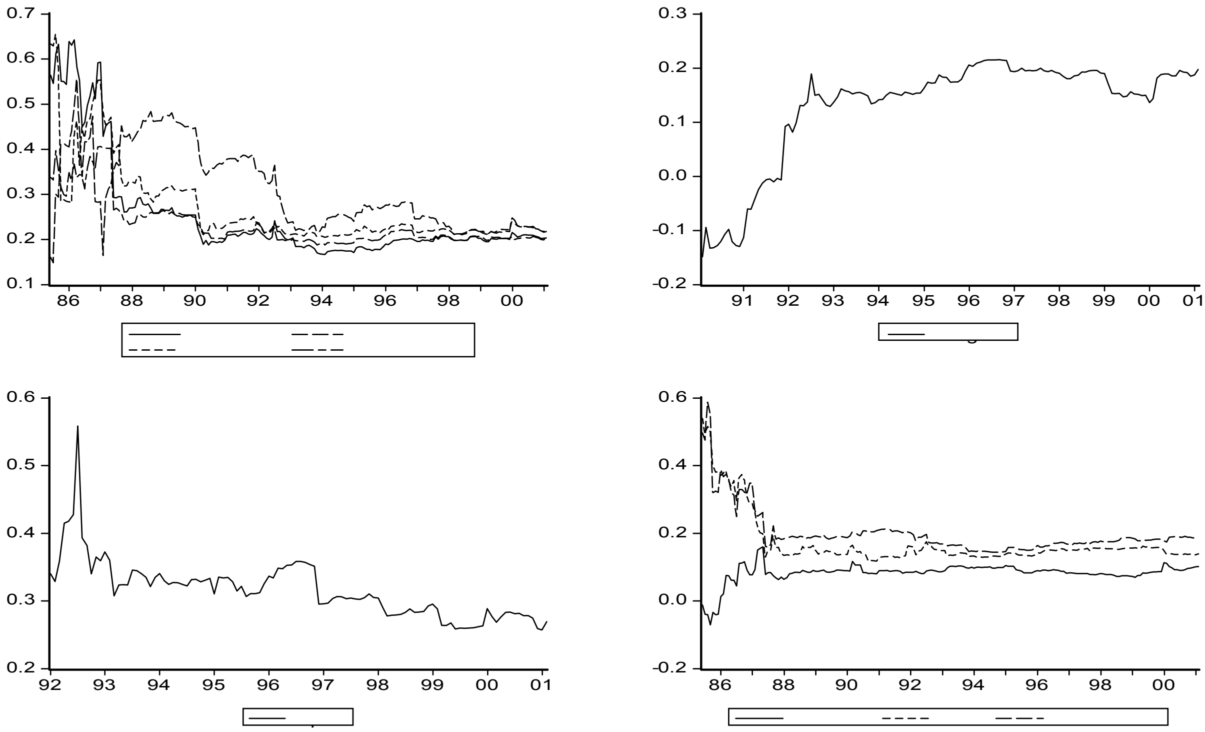
Figures 13 to 15 report the β(t) coefficients with Germany as European reference and the United States for the rest of the world. Results are very similar to those obtained with France as reference. The link between Italy, France and Germany strengthened over the 1987-1999 period. Concerning the Netherlands, the convergence is more moderate and β rose during the year 2000 and at the beginning of 2001. The convergence process is not fully completed. Concerning the United Kingdom and Switzerland, no convergence can be established. In Switzerland, β is stable around 0.44 on the whole period. In the United

Kingdom, β always stands above 0.77. In Belgium, β sharply decreased from 0.8 in 1991 to 0.2 in 1996, showing a marked convergence towards Germany even though it was above 1 at the end of the period, suggesting a strong divergence. Results concerning Spain show no particular tendency to converge, β ranged from 0.2 to 0.4 and increased over the 1996-2001 period.

Figures 16 to 18 report the $\beta(t)$ coefficients with the United Kingdom as European reference and the United States for the rest of the world. These results confirm there is no convergence process between the United Kingdom and the other European countries. Even if β decreased in most countries, it remained above 0.4 on the whole period. However, we observe that France and Spain moved closer to the United Kingdom. β decreased from 0.8 at the beginning of 1990 to 0.33 in November 1999 in France and from 0.5 in 1993 to 0.25 in 1996 in Spain and grew at the end of the studied period.

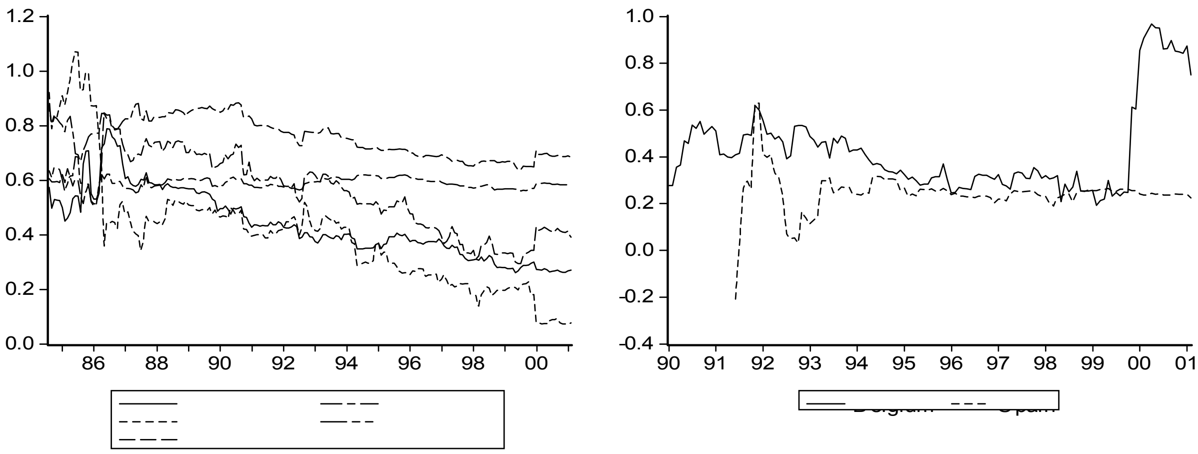
Figs. 7 to 10: Equity Risk Premium Differentials:

US Differential versus US-Japan Differential



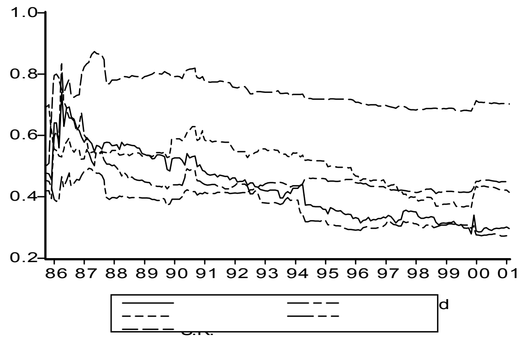
Figs. 11 and 12: Equity Risk Premium Differentials:

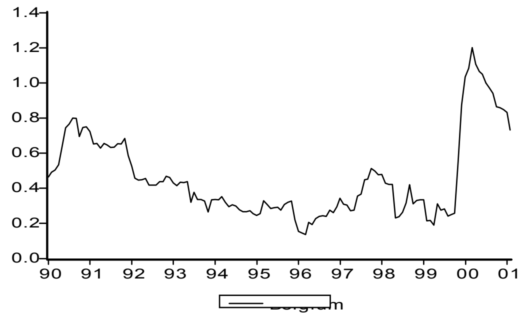
France Differential versus France-US Differential



Figs. 13 to 15: Equity Risk Premium Differentials:

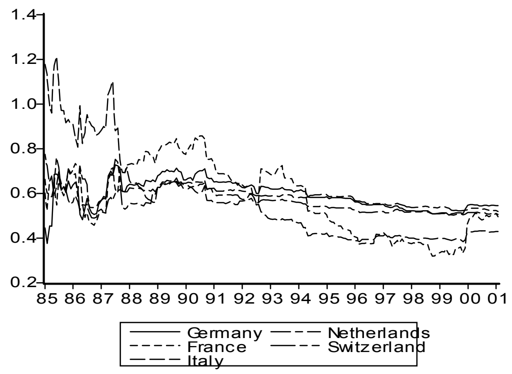
Germany Differential versus Germany-US Differential

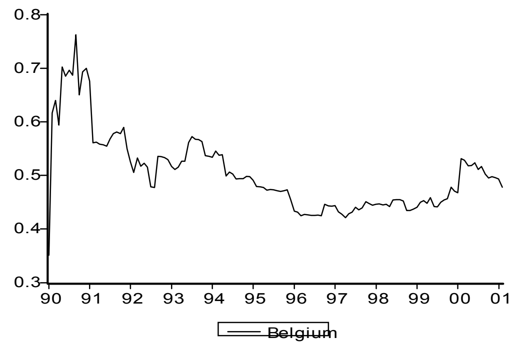


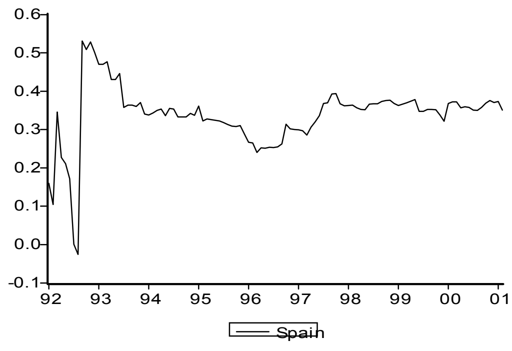


Figs. 16 to 18: Equity Risk Premium Differentials:

UK Differential versus UK-US Differential







5. Conclusion

The aim of this paper was to study the integration of financial markets in eleven countries during the period 1984-2001 with regard to the equity risk premium. Two complementary approaches were developed: a multidimensional analysis taking into account the three components of the equity premium and an analysis of the convergence of the equity premium using a time-varying parameter methodology.

The analysis of the mean evolution of equity premium components from 1984 until 2000 emphasizes the relative homogeneity of the dividend yield and interest rate distributions and a significant heterogeneity of stock price and equity premium growth rates. The data analysis conducted on average equity premium components for the eleven stock markets allowed us to identify common characteristics for certain years. For example, the years at the end of the period (1997 to 2000) have the same characteristics: significantly low dividend yield and long-term interest rates. The temporal analysis of the eleven stock markets is carried out using two different methods: annual analysis and global analysis. We point out that the European stock markets (France, Italy, the Netherlands, Spain, Belgium, the United Kingdom) and the Canadian stock market are closer to the American market. They are characterized by significantly higher dividend yields and interest rates. On the other hand, the German and Swiss markets are closer to the Japanese market and are characterized by significantly lower dividend yields and interest rates.

We point out convergence of the equity premium with that of the United States. Convergence occurred in the 1987-1994 period in Germany, France, the Netherlands, Italy and probably Belgium and Spain. As regards the United Kingdom, Canada and Switzerland, convergence was achieved earlier but we could not date the process because the available data only begins in 1984. We have to underline that the process of convergence seems to have halted in European countries since 1994 and that convergence has not been completed. In every country, the β coefficient is significantly different from zero on a two-tailed t-test at a 5% level. The results emphasize the convergence between equity risk premium stock markets in the European countries, except for the United Kingdom and Switzerland. While convergence with the United States stopped in the mid-1990s, it continued to increase until 1999 between the European countries. A divergence appeared in 2000 and at the beginning of 2001 between Belgium and the Netherlands, and the other European countries.

These results underline the great importance of the stock price growth rate as a determinant of the equity premium. In fact, the data analysis methods emphasize similarities between Japan, Switzerland and Germany with respect to the equity premium components while the other European stock markets have similar characteristics to those of the American market. The similarities are synthesized in a linear way in terms of linear correlation. But, the estimation of time-varying parameter models shows a convergence of equity premiums with the American market and between European stock markets, Germany included and the United Kingdom and Switzerland excepted. Convergence analysis shows that the price growth rate is the main factor explaining significant equity premium variations. Dividend yield and long-term interest rate are less important factors.

Finally, this study leads to the conclusion that the links between the national stock markets have been strengthened over the 1984-2001 period but that convergence has not yet been achieved. The integration of financial markets in the eleven countries under study is not yet fully complete, so international portfolio diversification still allows some gains.

It is left to further research to widen the choice of stock markets in order to study a possible process of convergence more precisely, or the similarities between euro zone countries and countries outside the euro zone. It will also be of great interest to study the occurrence of a sector-based effect on the various stock markets in order to isolate different behavior patterns from one sector to another and to underline the specificities of some sectors, in particular sectors in the new economy.

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APPENDIX

Table A1: Summary statistics for monthly stock price growth rates

Countries	Mean	Median	Maximum	Minimum	Standard Deviation	CV (%)
Belgium	10.898	12.095	218.850	-349.818	59.811	548.82
Canada	8.461	6.888	150.482	-287.143	53.979	637.97
France	13.080	17.975	181.439	-304.394	64.207	490.88
Germany	9.636	14.810	158.649	-398.590	64.388	668.20
Italy	12.138	11.388	231.196	-330.641	86.060	709.01
Japan	3.145	-0.003	238.761	-194.693	70.074	2228.11
Netherlands	11.661	13.756	132.279	-322.265	52.540	450.56
Spain	9.865	13.754	179.055	-398.072	75.953	769.92
Switzerland	12.815	16.017	164.674	-426.609	61.570	480.45
United Kingdom	10.715	9.010	160.952	-403.124	56.445	526.78
United States	11.726	15.822	187.363	-251.887	51.190	436.55

Table A2: Contemporaneous correlations between monthly stock price growth rates

	Belgium	Canada	France	Germany	Italy	Japan	Netherlands	Spain	Switzerland	United Kingdom	United States
Belgium	1.000										
Canada	0.434	1.000									
France	0.657	0.652	1.000								
Germany	0.683	0.675	0.823	1.000							
Italy	0.429	0.479	0.604	0.659	1.000						
Japan	0.394	0.415	0.411	0.416	0.290	1.000					
Netherlands	0.750	0.698	0.796	0.842	0.612	0.457	1.000				
Spain	0.646	0.584	0.705	0.700	0.551	0.465	0.744	1.000			
Switzerland	0.736	0.596	0.682	0.779	0.525	0.448	0.825	0.706	1.000		
United Kingdom	0.579	0.608	0.627	0.668	0.527	0.366	0.766	0.611	0.712	1.000	
United States	0.614	0.787	0.662	0.668	0.434	0.430	0.739	0.619	0.699	0.690	1.000

Table A3: Summary statistics for monthly dividend yields

Countries	Mean	Median	Maximum	Minimum	Standard Deviation	CV (%)
Belgium	2.964	2.920	4.950	1.380	0.796	26.85
Canada	2.612	2.700	3.790	1.170	0.705	26.99
France	3.034	3.010	4.880	1.610	0.691	22.77
Germany	1.995	1.980	3.040	1.210	0.422	21.15
Italy	2.307	2.180	3.880	1.140	0.644	27.91
Japan	0.769	0.740	1.320	0.430	0.209	27.18
Netherlands	3.480	3.740	5.060	1.720	0.932	26.78
Spain	3.315	3.270	5.890	1.540	1.085	32.73
Switzerland	1.758	1.690	2.870	0.900	0.433	24.63
United Kingdom	3.943	4.010	5.700	2.280	0.822	20.85
United States	2.799	2.810	5.260	0.950	1.090	33.94

Table A4: Contemporaneous correlations between monthly dividend yields

	Belgium	Canada	France	Germany	Italy	Japan	Netherlands	Spain	Switzerland	United Kingdom	United States
Belgium	1.000										
Canada	0.747	1.000									
France	0.832	0.685	1.000								
Germany	0.753	0.840	0.696	1.000							
Italy	0.711	0.741	0.605	0.725	1.000						
Japan	0.010	-0.330	0.250	-0.216	-0.059	1.000					
Netherlands	0.839	0.962	0.760	0.913	0.771	-0.217	1.000				
Spain	0.882	0.747	0.908	0.674	0.647	0.142	0.816	1.000			
Switzerland	0.750	0.834	0.594	0.869	0.740	-0.333	0.874	0.622	1.000		
United Kingdom	0.827	0.929	0.818	0.777	0.757	-0.100	0.921	0.856	0.783	1.000	
United States	0.687	0.968	0.589	0.837	0.635	-0.447	0.934	0.647	0.820	0.861	1.000

Table A5: Summary statistics for monthly risk-free interest rates

Countries	Mean	Median	Maximum	Minimum	Standard Deviation	CV (%)
Belgium	7.091	7.034	10.397	3.914	1.736	24.48
Canada	8.624	9.040	14.110	4.890	2.150	24.93
France	7.869	8.160	13.160	3.650	2.243	28.50
Germany	6.571	6.440	9.050	3.630	1.309	19.92
Italy	10.085	10.830	17.680	3.900	3.090	30.64
Japan	4.301	4.500	8.250	0.790	1.866	43.38
Netherlands	6.816	6.730	9.240	4.190	1.227	18.00
Spain	8.335	8.744	13.157	3.975	2.830	33.95
Switzerland	4.526	4.430	7.000	2.420	1.110	24.52
United Kingdom	8.531	8.910	12.450	4.190	2.001	23.46
United States	7.724	7.460	13.770	4.410	1.919	24.84

Table A6: Contemporaneous correlations between monthly risk-free interest rates

	Belgium	Canada	France	Germany	Italy	Japan	Netherlands	Spain	Switzerland	United Kingdom	United States
Belgium	1.000										
Canada	0.970	1.000									
France	0.978	0.958	1.000								
Germany	0.976	0.947	0.988	1.000							
Italy	0.909	0.918	0.929	0.895	1.000						
Japan	0.953	0.946	0.934	0.946	0.843	1.000					
Netherlands	0.989	0.964	0.982	0.988	0.909	0.950	1.000				
Spain	0.942	0.944	0.951	0.917	0.985	0.887	0.932	1.000			
Switzerland	0.958	0.914	0.965	0.968	0.866	0.929	0.958	0.901	1.000		
United Kingdom	0.935	0.936	0.944	0.952	0.924	0.918	0.952	0.928	0.902	1.000	
United States	0.913	0.909	0.910	0.931	0.794	0.891	0.927	0.818	0.872	0.884	1.000

Fig. A1: Stock price growth rates

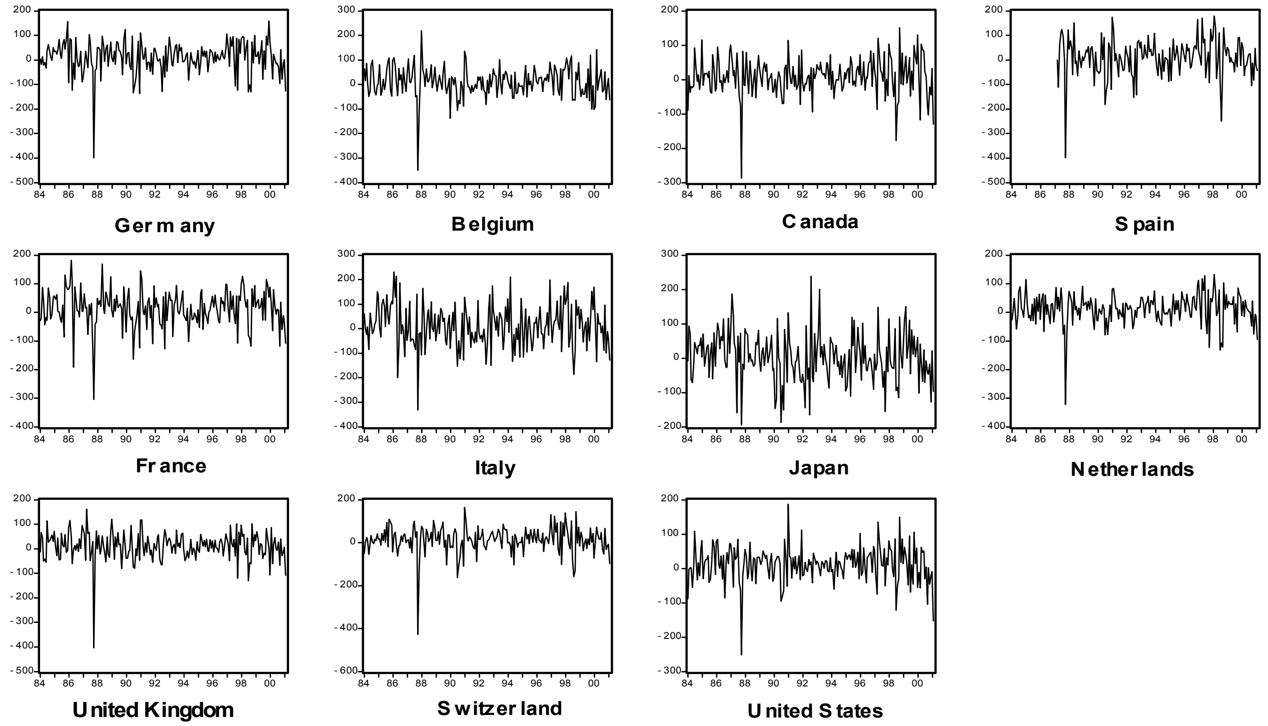

Fig. A2: Dividend yields

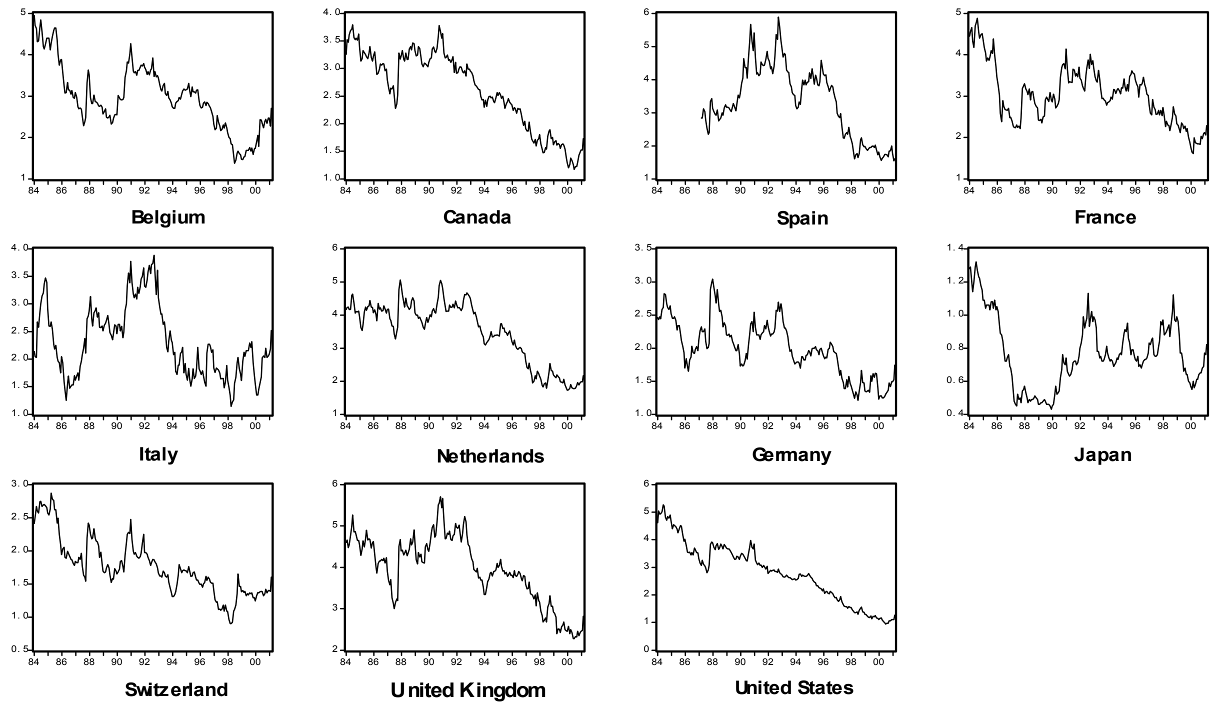

Fig. A3: Risk-free interest rates

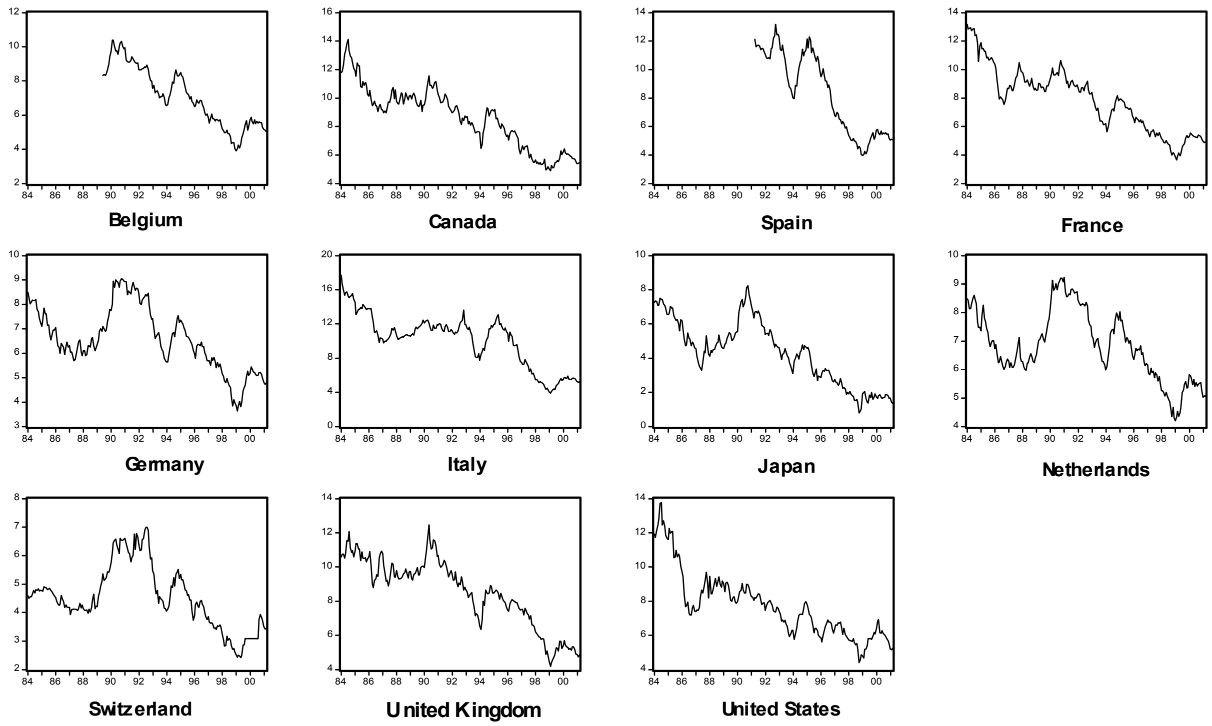

Table A7: Typology - Characterization of the 4 classes according to equity premium components

CLASSE 1 / 4 (EFFECTIF = 3 : 1984 1985 1991)

V.TEST	PROBA	MOYENNES CLASSE	MOYENNES GENERALE	ECARTS TYPES CLASSE	ECARTS TYPES GENERAL	VARIABLES CARACTERISTIQUES NUM.LIBELLE	IDEN
2.32	0.010	3.37	2.64	0.15	0.58	2.Dividend yield	DY
2.31	0.010	9.46	7.39	0.61	1.66	3.Risk-free interest rate	IR

CLASSE 2 / 4 (EFFECTIF = 6 : 1986 1988 1989 1993 1995 1996)

V.TEST	PROBA	MOYENNES CLASSE	MOYENNES GENERALE	ECARTS TYPES CLASSE	ECARTS TYPES GENERAL	VARIABLES CARACTERISTIQUES NUM.LIBELLE	IDEN
1.85	0.032	21.10	11.11	5.20	15.92	1.Growth Rate of Price	GP
1.80	0.036	16.17	6.26	4.93	16.27	4.Equity risk premium	PR

CLASSE 3 / 4 (EFFECTIF = 4 : 1987 1990 1992 1994)

V.TEST	PROBA	MOYENNES CLASSE	MOYENNES GENERALE	ECARTS TYPES CLASSE	ECARTS TYPES GENERAL	VARIABLES CARACTERISTIQUES NUM.LIBELLE	IDEN
-3.37	0.000	-13.05	11.11	8.85	15.92	1.Growth Rate of Price	GP
-3.38	0.000	-18.54	6.26	9.27	16.27	4.Equity risk premium	PR

CLASSE 4 / 4 (EFFECTIF = 4 : 1997 1998 1999 2000)

V.TEST	PROBA	MOYENNES CLASSE	MOYENNES GENERALE	ECARTS TYPES CLASSE	ECARTS TYPES GENERAL	VARIABLES CARACTERISTIQUES NUM.LIBELLE	IDEN
-3.36	0.000	4.88	7.39	0.48	1.66	3.Risk-free interest rate	IR
-3.39	0.000	1.76	2.64	0.14	0.58	2.Dividend yield	DY

Table A8: Profiles of the partition retained according to equity risk premium components

V.TEST	PROBA	MOYENNES CLASSE	MOYENNES GENERALE	ECARTS TYPES CLASSE	ECARTS TYPES GENERAL	VARIABLES CARACTERISTIQUES NUM.LIBELLE	IDEN
CLASSE 1 / 2 (EFFECTIF = 3 : japan, Switzerland, Germany)							
-1.92	0.028	1.10	1.59	0.34	0.49	66.Dividend Yield 2000	DY00
-2.05	0.020	1.19	1.71	0.32	0.50	62.Dividend Yield 1999	DY99
-2.06	0.020	1.17	1.75	0.18	0.55	58.Dividend Yield 1998	DY98
-2.09	0.018	6.58	8.56	1.22	1.83	35.Iterest Rate 1992	IR92
-2.10	0.018	1.56	2.54	0.75	0.91	14.Dividend Yield 1987	DY87
-2.16	0.015	4.99	7.59	1.35	2.34	47.Iterest Rate 1995	IR95
-2.17	0.015	1.54	2.72	0.50	1.07	10.Dividend Yield 1986	DY86
-2.18	0.015	7.14	8.80	1.08	1.50	31.Iterest Rate 1991	IR91
-2.18	0.015	5.26	7.76	0.83	2.29	11.Iterest Rate 1986	IR86
-2.18	0.015	3.48	16.43	12.54	11.49	52.Risk Premium 1996	RP96
-2.23	0.013	1.40	2.45	0.51	0.91	50.Dividend Yield 1996	DY96
-2.23	0.013	6.62	10.27	1.41	3.27	3.Iterest Rate 1984	IR84
-2.25	0.012	1.18	1.99	0.29	0.69	54.Dividend Yield 1997	DY97
-2.26	0.012	6.54	20.58	13.01	12.04	49.Growth Rate of Price 1996	GP96
-2.26	0.012	1.48	2.64	0.47	0.99	46.Dividend Yield 1995	DY95
-2.27	0.012	5.07	7.18	1.04	1.80	39.Iterest Rate 1993	IR93
-2.28	0.011	5.75	8.06	0.90	2.02	23.Iterest Rate 1989	IR89
-2.28	0.011	1.75	2.99	0.91	1.04	18.Dividend Yield 1988	DY88
-2.29	0.011	7.45	9.35	0.98	1.63	27.Iterest Rate 1990	IR90
-2.30	0.011	1.97	3.28	0.65	1.12	6.Dividend Yield 1985	DY85
-2.33	0.010	4.46	6.60	1.27	1.77	51.Iterest Rate 1996	IR96
-2.37	0.009	6.12	9.32	0.99	2.65	7.Iterest Rate 1985	IR85
-2.38	0.009	5.02	7.72	0.88	2.26	19.Iterest Rate 1988	IR88
-2.40	0.008	5.24	7.35	1.02	1.70	43.Iterest Rate 1994	IR94
-2.41	0.008	4.78	7.60	0.92	2.34	15.Iterest Rate 1987	IR87
-2.43	0.008	2.15	3.58	0.65	1.15	2.Dividend Yield 1984	DY84
-2.49	0.006	3.42	5.02	1.41	1.25	67.Iterest Rate 2000	IR00
-2.49	0.006	3.01	4.50	1.26	1.16	59.Iterest Rate 1998	IR98
-2.50	0.006	3.86	5.61	1.33	1.35	55.Iterest Rate 1997	IR97
-2.51	0.006	1.41	2.73	0.69	1.02	22.Dividend Yield 1989	DY89
-2.52	0.006	1.74	3.26	0.60	1.17	34.Dividend Yield 1992	DY92
-2.53	0.006	1.37	2.53	0.47	0.88	42.Dividend Yield 1994	DY94
-2.54	0.005	1.50	2.79	0.54	0.98	38.Dividend Yield 1993	DY93
-2.56	0.005	2.95	4.39	1.07	1.09	63.Iterest Rate 1999	IR99
-2.59	0.005	1.50	3.14	0.64	1.23	26.Dividend Yield 1990	DY90
-2.64	0.004	1.67	3.24	0.70	1.15	30.Dividend Yield 1991	DY91

V.TEST	PROBA	MOYENNES CLASSE	MOYENNES GENERALE	ECARTS TYPES CLASSE	ECARTS TYPES GENERAL	VARIABLES CARACTERISTIQUES NUM.LIBELLE	IDEN
CLASSE 2 / 2 (EFFECTIF = 8 : United States Canada France Belgium United Kingdom Netherlands Spain Italy)							
2.64	0.004	3.83	3.24	0.61	1.15	30.Dividend Yield 1991	DY91
2.59	0.005	3.76	3.14	0.73	1.23	26.Dividend Yield 1990	DY90
2.56	0.005	4.93	4.39	0.36	1.09	63.Iterest Rate 1999	IR99
2.54	0.005	3.27	2.79	0.60	0.98	38.Dividend Yield 1993	DY93
2.53	0.006	2.96	2.53	0.55	0.88	42.Dividend Yield 1994	DY94
2.52	0.006	3.83	3.26	0.74	1.17	34.Dividend Yield 1992	DY92
2.51	0.006	3.22	2.73	0.59	1.02	22.Dividend Yield 1989	DY89
2.50	0.006	6.26	5.61	0.53	1.35	55.Iterest Rate 1997	IR97
2.49	0.006	5.06	4.50	0.33	1.16	59.Iterest Rate 1998	IR98
2.49	0.006	5.62	5.02	0.28	1.25	67.Iterest Rate 2000	IR00
2.43	0.008	4.19	3.58	0.69	1.15	2.Dividend Yield 1984	DY84
2.41	0.008	9.01	7.60	1.35	2.34	15.Iterest Rate 1987	IR87
2.40	0.008	8.14	7.35	1.14	1.70	43.Iterest Rate 1994	IR94
2.38	0.009	9.06	7.72	1.35	2.26	19.Iterest Rate 1988	IR88
2.37	0.009	10.70	9.32	1.83	2.65	7.Iterest Rate 1985	IR85
2.33	0.010	7.40	6.60	1.17	1.77	51.Iterest Rate 1996	IR96
2.30	0.011	3.85	3.28	0.74	1.12	6.Dividend Yield 1985	DY85
2.29	0.011	10.17	9.35	1.09	1.63	27.Iterest Rate 1990	IR90
2.28	0.011	3.45	2.99	0.64	1.04	18.Dividend Yield 1988	DY88
2.28	0.011	9.21	8.06	1.31	2.02	23.Iterest Rate 1989	IR89
2.27	0.012	7.98	7.18	1.33	1.80	39.Iterest Rate 1993	IR93
2.26	0.012	3.07	2.64	0.76	0.99	46.Dividend Yield 1995	DY95
2.26	0.012	25.84	20.58	5.84	12.04	49.Growth Rate of Price 1996	GP96
2.25	0.012	2.29	1.99	0.54	0.69	54.Dividend Yield 1997	DY97
2.23	0.013	12.10	10.27	2.25	3.27	3.Iterest Rate 1984	IR84
2.23	0.013	2.85	2.45	0.69	0.91	50.Dividend Yield 1996	DY96
2.18	0.015	21.29	16.43	6.01	11.49	52.Risk Premium 1996	RP96
2.18	0.015	9.02	7.76	1.69	2.29	11.Iterest Rate 1986	IR86
2.18	0.015	9.51	8.80	1.01	1.50	31.Iterest Rate 1991	IR91
2.17	0.015	3.22	2.72	0.82	1.07	10.Dividend Yield 1986	DY86
2.16	0.015	8.57	7.59	1.82	2.34	47.Iterest Rate 1995	IR95
2.10	0.018	2.96	2.54	0.60	0.91	14.Dividend Yield 1987	DY87
2.09	0.018	9.30	8.56	1.43	1.83	35.Iterest Rate 1992	IR92
2.06	0.020	1.97	1.75	0.48	0.55	58.Dividend Yield 1998	DY98
2.05	0.020	1.91	1.71	0.40	0.50	62.Dividend Yield 1999	DY99
1.92	0.028	1.77	1.59	0.41	0.49	66.Dividend Yield 2000	DY00