MARKOV CHAIN APPROACH TO PURCHASING POWER CONVERGENCE IN THE 15 EUROPEAN UNION.

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Abstract

The price of the consumption basket could cause distortions in a global market like the European Union, formed by diverse countries with different habits of consumption. In the present paper we study the degree of convergence in Absolute Purchasing Power Parity (APPP) in the European Union. We estimate monthly series of Absolute Purchasing Power Parity (APPP) for every country in the 15 European Union from 1995 to 2002, using the harmonized consumption price index and the nominal exchange rates of the diverse currencies with the euro.

Based on these monthly estimations, we study the degree of mobility of the APP distribution and the long term evolution using different approaches to estimate Markov Chains because of the continuous character of APPP. Also, we test for structural changes with Euro entry as financial currency in 1999, differences between countries in and not in the Monetary Union, and we also test for distribution equality between countries two by two.

Key words: Purchasing Power Parity, Convergence, Markov Chains

1. Introduction

Purchasing Power Parity Theory (PPP) was formally enunciated by Gustav Cassel in 1918. This theory is fulfilled when "the equilibrium rate of exchange equalizes the purchasing power of a currency in a country, with what it might buy in the exterior if it was changed into a foreign currency" [mentioned in Spiegel (1996), p. 690]. From this theory, its territorial comparison character in terms of prices is deduced, including the interior price in each territory and the price which they are interrelated: the exchange rate.

In the last decades, studies on PPP have become more relevant because of several reasons. Monetary policies must take the stability of prices as an objective; due to its movements can produce important imbalances**,** originating changes in the production and consumption decisions. The globalization process has increased the exchanges volume between countries, which also has multiplied the risk of monetary flows due to the movements of internal and external prices. The increase of these risks can provoke again abnormal market behaviour and realizes an inefficient assignment of resources.

Nevertheless, studies on PPP for the European Union could only be done for the medium term, because periodicity of data is annual, are published with an important delay and are also short series. Previous works have approached to the problem of PPP using Consumer Price Indexes (CPI) instead of PPP's measures [Alberola and Marquess (2001), and Canceló et al (2000)]. Rodríguez, Gonzalez and Rodríguez (2002) and Rodríguez, Gonzalez and Rodríguez (2004) have showed some of the problems that this substitution brings up and propose a new index, which is obtained from CPI and exchange rates. This index measures changes in the Purchasing Power Parity between two areas.

When one PPP data are available and based on it, in the present paper we developed an expression to estimate Purchasing Power Parities using Consumer Price Index and Exchange Rates series. To study convergence on PPP in the European Union, we have estimated monthly PPP for the period January 1995 to June 2003.

From this sample, we analyze convergence using distribution dynamics. This methodology used initially by Quah (1993a, 1993b) in the discrete case for the Gross Domestic Product. This methodology has also been used in Lopez-Bazo and other (1999), Magrini (1999) and La Gallo (2001) for European Union regions, by Pekala (1999) for Finnish provinces, and by Tizonas (2002) for Greek regions. In the continuous case, proposed by Quah (1996a, 1996b, 1996c) has been used by Mancusi (2000) for the evolution of the industrialized countries technology or by Jonhson (2000) for the convergence in levels of relative income in the United States of America.

The structure of this paper is the following. In the second part, the estimation process of the Parity of Purchasing power for the countries members of the European Union is presented. In the third part, we show the estimations results, from the continuous and discrete viewpoint. Finally, the most relevant conclusions are presented.

1. Estimation of Purchasing Power Parity.

Following Rodriguez et al (2004), Absolute Purchasing Power Parity can be approximated using the $B_{0,t}^{iG}$ statistic in [1].

$$B_{0,t}^{iG} = \frac{\frac{e_t^{iG}}{e_0^{iG}} I_t^i - 1}{I_t^G - 1} \qquad [1]$$

where G represents a Global Market of n regions or countries represented by i. e_t^{iG} is the exchange rate of region i and the Global Market. I_t^G and I_t^i are the Consumer Price Index (CPI in the following) of G and i, in period t with base period in 0.

Generally speaking, CPI is the quotient of prices in two periods of time, we can write those of G and I as in [2]

$$I_t^i = \frac{P_t^i}{P_0^i}, I_t^G = \frac{P_t^G}{P_0^G} \qquad [2]$$

where P_t^i, P_t^G, P_0^i y P_0^G are prices in i and G in period t and 0.

Using [2] in [1] and ordering the resulting expression we have [3].

$$\frac{e_t^{iG} P_t^i}{e_0^{iG} P_0^i} - B_{0,t}^{iG} \frac{P_t^G}{P_0^G} = 1 - B_{o,t}^{iG} \qquad [3]$$

Multiplying and dividing the first quotient of [3] by P_t^G y P_0^G

$$\frac{e_t^{iG} P_t^i \frac{P_t^G}{P_t^G}}{e_0^{iG} P_0^i \frac{P_0^G}{P_0^G}} - B_{0,t}^{iG} \frac{P_t^G}{P_0^G} = 1 - B_{o,t}^{iG} \qquad [4]$$

PPP of region i and the global market G is defined in [5],

$$PPC_t^{iG} = \frac{e_t^{iG} P_t^i}{P_t^G} \qquad [5]$$

Using [5], expression [4] can be finally written as [6].

$$PPC_t^{iG} = PPC_0^{iG} \times \left[\frac{1 - B_{0,t}^{iG} \times \left[1 - I_t^G\right]}{I_t^G} \right] \qquad [6]$$

Estimation of Purchasing Power Parities of each country in the European Union have been carried out, based on [6], using Eurostats´ PPP for 1995, monthly Harmonized Consumer Price Index and Exchange Rates, for the period January 1995 – June 2003.

This preliminary estimate has been adjusted to the annual data provided by Eurostat for 1996-2002 using the disaggregation method proposed by Boot et al (1967). This methodology has been applied to the annual differences between real data and the preliminary estimates. This methodology is the most appropriate method when no additional information is available, as shown in Rodriguez et al (2003).

This obtained series corresponds with the definition of Absolute Purchasing Power Parity (APPP). This relates the general price of the economies that compare. In our case each country is related to the general or global situation of the European Union, which takes the value 100. Countries with values superior to 100 will be more expensive than the average of the UE, whereas countries with values below are cheaper that the average.

The results of this estimation are graphically shown in Figure 1. Slight changes in the dispersion of the distribution are observed that could suggest the presence of a convergence process. In spite of this, the presence of groupings of countries seems to be appraised, like the one formed by Greece, Portugal and Spain in the lower part of the distribution.

2. Evolution of the Purchasing power Parity in the UE-15. Estimation of the transition matrices.

First of all, we define nomenclature. The main element is the matrix of transition probabilities in k periods (P). Each element (p_{ij}) represents the probability of being in a state j, t+k periods of time after being in a state i, for a total set of M states. Rows in the transition matrix define the departure states and columns the arrival states. Transition probabilities are estimated by Maximun Likelihood (ML) [7]:

$$\hat{p}_{ij} = \frac{n_{ij}(t)}{n_i(t)} = \frac{n_{ij}(t)}{\sum_{j=1}^{M} n_{ij}(t)} \qquad [7]$$

where $n_{ij}(t)$ is the number of elements that, starting off in a state i at the moment t, arrive to a state j at the moment t+k, and $n_i(t)$ is the total number of elements in state i in period t.

Markov Chains are based on the markovian property, i.e., the probability that an element is in a certain state $j \in M$ in the period t+k, is only defined by the departure state at moment t. The evolution of the number (proportion) of elements in each of the M states for every moment of the time $N(t) = \left[n_1(t), n_2(t), ..., n_M(t) \right]$ can be obtained as in expression [8]

$$N(t+q) = PN(t+q-1) = P^2 N(t+q-2) = ... = P^q N(t) \qquad [8]$$

When the number of periods tends to infinite, and the Markov Chain fulfils the ergodic property, the steady state vector can be obtained. This vector, also called the ergodic distribution, estimates the number (or proportion) of elements in each state in the long term, which is independent of the starting situation.

Discrete Markov Chain allows to study the distribution in a very simple way, with clearly and easy to interpreter results. Nevertheless, the discretization process of a continuous series has important risks that can affect the commented properties and, therefore, to bias the final estimates, as it has been shown, among others, by Magrini (1999), Bulli (2001), or Hites (2001).

Magrini (1999) proposed the following procedure, using series of Gross Domestic Product per capita, to estimate the discrete density function in the case of histograms with equal interval amplitude. It is necessary to define two elements, Ω and h. The former indicates the origin point to calculate all the intervals using the expression (Ω+kh, Ω+ (k+1) h), for positive and negative values of k. In our case, the origin point is 100. This election is defined by the own construction of the APPP series, since 100 is the average of the European Union at every moment of time.

The second element (h) is the interval amplitude. The author presented two solutions to obtain an optimal value. The first one is proposed by Freedman and Diaconis (1981) whose expression is [9]

$$\hat{h}_2 = 2Rn^{-1/3} \qquad [9]$$

where R is intercuatilic rank and n the total number of elements of the sample. The second solution is the proposal by Devroye and Györfi (1985), taking h the value:

$$\hat{h}_1 = 2.72sn^{-1/3} \qquad [10]$$

where s is the standard deviation of the sample. Applying both criteria to our data base we obtain $\hat{h}_2 = 4.46$ and $\hat{h}_1 = 3.71$. Estimations of the resulting Markov chains (with 15 and 18 intervals each), can be seen respectively in Figure 2 and Figure 3. Values in the first row and column indicates upper limit of the interval. The total number of elements in each row is in the last column, the steady state vector is just bellow the last state row, being the last column for the expected time of recurrency, rest of values are the transition probabilities. The structure of the Markov Chains are the usual in this type of works, i.e., high probabilities in the main diagonal, and values different from zero in the diagonal inferior and superior immediately adjacent to the main diagonal. In the ergodic distributions derived from these estimations a slightly process of convergence around the 100-107 values is observed. These values retain in the long term about 43% of the distribution.

Nevertheless, one of the main objectives of the present paper is to test structural changes in the distribution, mainly with the entrance of the Euro, being or not in the Monetary Union, or between countries two by two. We have reduced the number of intervals, so the number of observations in each state is enough to ensure the desirable properties of the final transition probabilities estimations.

The criterion to divide the sample in m quantiles, where m varies between 3 and 6, was proposed by Quah (1993, a) and used by others in Lopez-Bazo et al (1999), Him Rooster (2001), Neven and Gouyette (1995), Hites (2002). It allows avoiding possible non-robust estimations because of having a small number of observation in a certain interval. Nevertheless, we cannot forget the objective to test changes in the distribution, reason why it will be necessary to estimate different Markov chains. To compare them, it is necessary that the different states are also equally defined. In the present work we have divided the whole sample in five equal parts.

But, it is still necessary to solve the discretization of the data problem. Hites (2002) proposes to apply fuzzy logic to avoid the binary representation of each transition in the ML estimation. True mobility $m_{ij}(t)$ is observed with an error $\varepsilon_{ij}(t)$, so the observed mobility $n_{ij}(t)$ used in the ML estimation is [11]:

$$n_{ij}(t) = m_{ij}(t) + \varepsilon_{ij}(t) \qquad [11]$$

[11] gives rise to the following set of probabilities

$$\begin{aligned} P\left(m_{ij}(t)=0 \big/ n_{ij}(t)=0\right) &= 1 - f\left[\varepsilon(t)\right] \\ P\left(m_{ij}(t)=0 \big/ n_{ij}(t)=1\right) &= 0 + f\left[\varepsilon(t)\right] \\ P\left(m_{ij}(t)=1 \big/ n_{ij}(t)=0\right) &= 0 + f\left[\varepsilon(t)\right] \\ P\left(m_{ij}(t)=1 \big/ n_{ij}(t)=1\right) &= 1 - f\left[\varepsilon(t)\right] \end{aligned} \qquad [12]$$

Where $f\left[\varepsilon(t)\right]$ is the probability function associated to the error term ε. In the ML estimation [7] of the transition probabilities, f [ε(t)] is equal to zero. It means that one transition is assigned solely to one state in the Markov chain. When the phenomenon in study is discrete, assignation to a state or not is perfectly delimited. Nevertheless, when continuous, allocation to one or another state depends on the value assigned to the limits between each state. In many situations these limits are arbitrary, based on a pre-established criterion, like for example, intervals of equal amplitude, or same number of observations in each interval.

Hites (2002) proposes to create zones around these limits where the allocation to each state is not unitary, but a distribution taking like centre point the value of the proposed limit. Whether the value of the APPP falls exactly on the centre point, 0.5 will be assigned to each state. The author proposes to form triangular distributions around these limits to distribute the unitary value between states.

After solving the estimation problem, tests on the estimated distributions will be carried out by using the test proposed by Bickenbach and Bode (2001) in [13]

$$\begin{aligned} &H_0 : \forall t : \hat{p}_{ij}(t) = p_{ij} \\ &H_1 : \exists t : \hat{p}_{ij}(t) \neq p_{ij} \\ &Q = \sum_{t=1}^{T}\sum_{i=1}^{M}\sum_{j=1}^{M} n_i(t) \frac{\left(\hat{p}_{ij}(t) - \hat{p}_{ij}\right)^2}{\hat{p}_{ij}} \sim asym\chi^2_{\sum_{i=1}^{M}(a_i-1)(b_i-1)} \end{aligned} \quad [13]$$

where $\hat{p}_{ij}(t), n_i(t)$ are the transition probabilities and number of observations for each subsample in which the total data set is divided, a_i is the number of subsamples, and b_i is the number of probabilities greater than zero in i^{th} column.

3. Results and Tests on the APPP behaviour.

In this section we show the estimated Markov Chains, their implications and results of testing the distribution for the appearance of the Euro as financial currency in 1999, and the pertinence or not to the Monetary union. We have also tested the equality between countries two by two. This section is also divided in four to show clearly the conclusions of each estimation and tests.

3.1. Analysis of the number of periods.

Firstly, we have studied the influence of the number of periods to define a transition. Transition matrices for 1, 6, 12 and 18 moths ahead have been considered and estimated. Their ergodic distributions are shown in Figure 4. The ML estimation of 1 and 12 periods ahead can, respectively, be seen in Figure 5 and Figure 7. There is a slightly different behaviour. Probabilities on the main diagonal are diminishing as the number of periods ahead is increasing. This allows a greater mobility of the distribution, since the values on the main diagonal correspond with probabilities of permanence in the same state k periods ahead. Ergodic distributions are more concentrated in the middle of the distribution as more distance between two observation are used to define a transition.

Moreover, Figure 6 shows elasticities of the different values of the ergodic distributions to changes in the ML probabilities in Figure 6 and Figure 8. Elasticities less to the unity, that are shaded, indicates that a change in a probability outside the main diagonal would lead to a lesser proportional change in the ergodic value. It is easily seen that the ergodic distribution of the one period ahead are more sensitive to changes in probabilities than the 12 periods ahead. This is also a sign of how sensitive is the ML estimation to the discretization process, because of the small number of observation allocated outside the main diagonal. Including one more or re-allocation of one transition could lead to significant changes in the ergodic distribution.

In the following, we present the results for the distribution of 1 and 12 months ahead. The election of the second value is made with the purpose of having enough data in each interval to guarantee the consistency of the estimations.

3.2. Euro as financial currency 1999

In Figure 9 and Figure 10 estimations of the transitions matrices for 1 and 12 periods can be respectively observed. The first group of columns is for the transition matrix estimated with the whole sample. The second group of column is for the 1995 to 1998 sub-sample, and the last group is for the 1999 to 2002 sub-sample. The tables are organized as following. Estimations have been made for values of 0% (maximum likelihood estimators), 5%, 10%, 20%, 30%, 40%, and 50% of the amplitude (γ) of the interval. The base of the triangle is centre in the state limit and its length is 2 times the amplitude multiplied by that percentage (γ). Estimated transition probabilities are shown and the last row (ERG) is for the ergodic distribution. The test specified in [12] is shown in the last two columns of each table.

It is observed that the movement of the distribution is towards the convergence in the central state of the distribution. This behaviour is repeated in both matrices, although in the 12 periods ahead is more accused. Nevertheless, in both cases as we extended the margin on the limit of the interval the behaviour is to reduce that convergent process.

The behaviour of the distributions is similar to the previously described in the two studied sub-sample; although a greater central concentration of values in the second is appraised. We also can see a different behaviour between 1 and 12 periods estimated matrices. In the 1 period matrices the equality test cannot be rejected for the maximum likelihood estimation (0%) and for a γ=5% for a significant level of 1%. For higher values of amplitude (γ), the hypothesis of equality is rejected. This rejection is determined by the different behavior observed in the intermediate interval in both distributions.

For 12 periods the equality test is rejected from the maximum likelihood estimation, and for all values of γ. It is observed a greater accumulation in the third and fourth interval, being these two those that take to reject the equality test.

3.3. Monetary Union Effect

The effect of being or not in the Monetary Union can be seen in Figure 11 for 1 period ahead and the whole sample, and in Figure 12 for 1 period ahead and the second studied sub-sample. In both cases, differences in behavior between countries are observed. The three countries non-pertaining to the Monetary Union are mainly located in the 2 last intervals, i.e., in the more expensive countries of the UE. These differences are reflected in the statistical values of equality tests in the fourth considered interval, which is systematically rejected.

In addition, as it could be observed in the estimated matrices for the period 1999-2002, the number of transitions in the last considered interval is zero (or tending to zero) for the countries within the Monetary Union. This effect could be observed in Figure 11. If we analyzed the behavior in states 3, 4, and 5 in the two matrices (Figure 11, first group of matrices (0%), columns of Total MU and Total nonMU), we have the following situation.

$$UM = \begin{matrix} E3 \\ E4 \\ E5 \end{matrix}\begin{bmatrix} 96.2\% & 2.4\% & 0\% \\ 4.3\% & 95.4\% & 0.3\% \\ 0\% & 10\% & 90\% \end{bmatrix}; NoUM = \begin{matrix} E3 \\ E4 \\ E5 \end{matrix}\begin{bmatrix} 80\% & 20\% & 0\% \\ 3\% & 89.6\% & 7.4\% \\ 0\% & 2.2\% & 97.8\% \end{bmatrix} \quad [13]$$

The behavior is clearly different, whereas in the case of the countries within the UM the probabilities of lowering a state (4% and 10%) are very superior to those to raise (2,4% and 0,3%). For the countries outside the MU the situation is the opposite.

4.4 Two Countries Equality Test

Results of the two by two equality test for all the countries in the 15 EU (Figure 13) show a group of countries with similar distribution. We focus our attention in the possible formation of cluster more than in the differences between countries, mainly because of the methodology and data. In Figure 13 only those probabilities above 0 are shown, i.e, those tests where the equal distribution hypothesis can not be rejected. It can be seen a cluster formed mainly by Germany, France and Belgium and three countries around them, Luxemburg, Austria, and The Netherlands.

4. Conclusions

In the present paper the proposal of Rodriguez et al (2004) is extended to estimate monthly series of the Absolute Purchasing Power Parity for the countries in the 15 European Union. This estimation is carried out by using the yearly values of the APPP and monthly data of the Harmonized Consumer Price Index by Eurostat and the nominal exchange rate with the Euro.

The results of applying the Markov Chains Methodology show a slow convergent process throughout all the considered period, as it could be seen in the ergodic distribution. Nevertheless, it has been tested a different behaviour in the whole distribution before and after 1999. Significant differences also appeared when tested whether being in the Monetary Union or not, affects to APPP. This peculiarity is in their relative position, as in their movement into the APPP distribution. Also, a cluster of countries seems to appear in the middle of the distribution formed by Germany, France, Belgium, Luxemburg, Austria, and The Netherlands.

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Figure 1: Monthly Absolute Purchasing Power Parity Evolution. 1995-2002

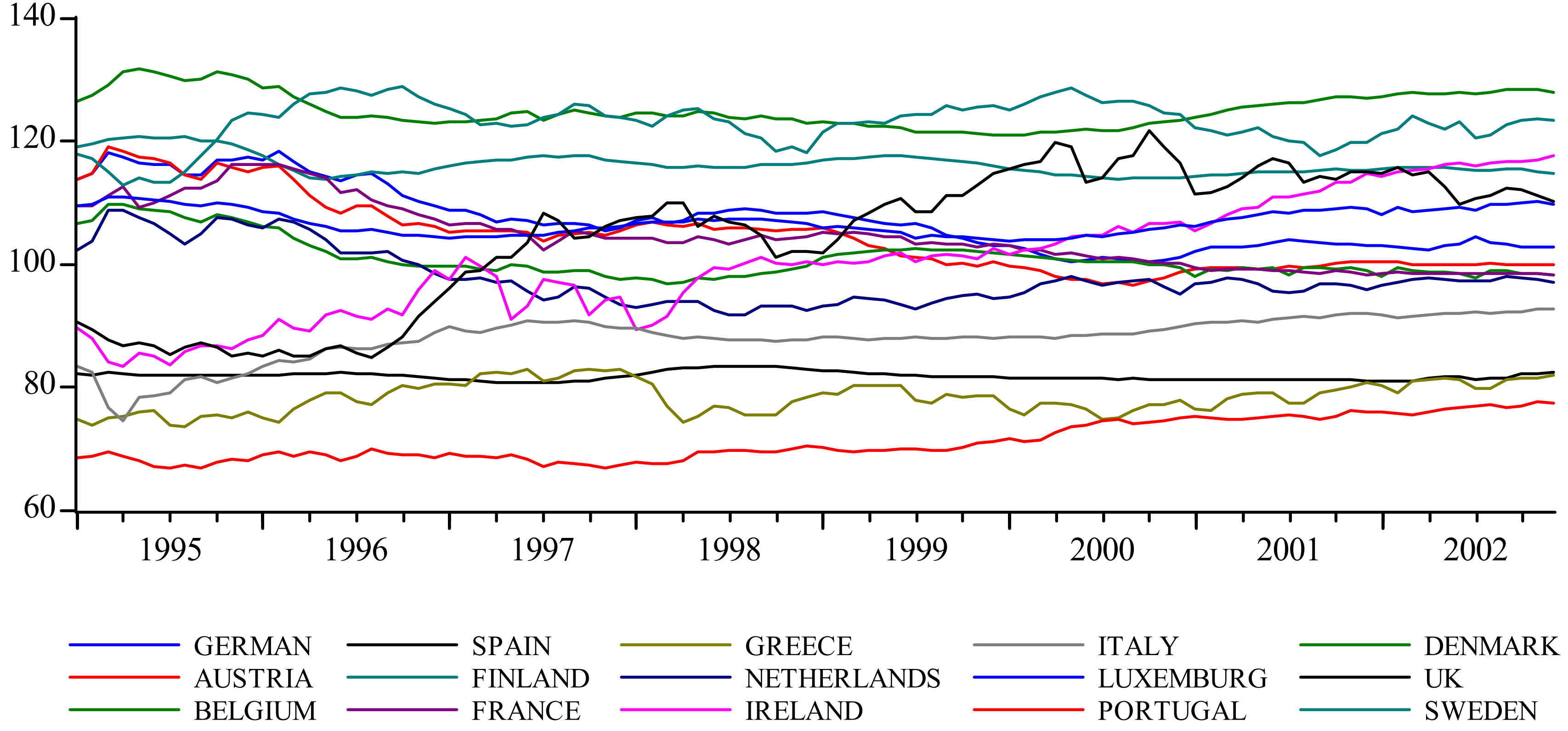

Figure 2: Transition Matrix using Freedman and Diaconis (1981) criterion (h_2=4.46)

IT IS	68.73	73.19	77.66	82.13	86.60	91.06	95.53	100.00	104.47	108.94	113.40	117.87	122.34	126.81	133.39	nor
68.73	0.78	0.22	-	-	-	-	-	-	-	-	-	-	-	-	-	23
73.19	0.12	0.85	0.03	-	-	-	-	-	-	-	-	-	-	-	-	40
77.66	-	0.01	0.87	0.12	-	-	-	-	-	-	-	-	-	-	-	78
82.13	-	-	0.04	0.88	0.08	-	-	-	-	-	-	-	-	-	-	129
86.60	-	-	0.01	0.10	0.80	0.09	-	-	-	-	-	-	-	-	-	69
91.06	-	-	-	-	0.06	0.88	0.06	-	-	-	-	-	-	-	-	77
95.53	-	-	-	-	-	0.03	0.86	0.11	-	-	-	-	-	-	-	69
100.00	-	-	-	-	-	-	0.03	0.91	0.06	-	-	-	-	-	-	187
104.47	-	-	-	-	-	-	-	0.08	0.83	0.09	-	-	-	-	-	176
108.94	-	-	-	-	-	-	-	-	0.09	0.85	0.06	-	-	-	-	190
113.40	-	-	-	-	-	-	-	-	-	0.16	0.74	0.10	-	-	-	82
117.87	-	-	-	-	-	-	-	-	-	-	0.05	0.90	0.05	-	-	166
122.34	-	-	-	-	-	-	-	-	-	-	0.02	0.09	0.80	0.09	-	64
126.81	-	-	-	-	-	-	-	-	-	-	-	-	0.05	0.92	0.03	104
133.39	-	-	-	-	-	-	-	-	-	-	-	-	-	0.07	0.93	46
Ergodic	0.002	0.004	0.01	0.03	0.02	0.03	0.06	0.21	0.16	0.16	0.06	0.10	0.05	0.08	0.04	
Recurrence Time	528.32	288.17	96.05	37.84	52.02	34.68	17.34	4.73	6.31	6.31	16.82	9.94	21.86	12.14	28.34	

Figure 3: Transition Matrix applying Devroye and Györfi (1985) criterion, (h_1=3.71)

IT IS	70.32	74.03	77.74	81.45	85.16	88.87	92.58	96.29	100.00	103.71	107.42	111.13	114.84	118.55	122.26	125.97	129.68	133.39	nor
70.32	0.96	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56
74.03	0.08	0.62	0.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
77.74	-	0.03	0.85	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	73
81.45	-	-	0.07	0.83	0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	87
85.16	-	-	0.01	0.07	0.85	0.07	-	-	-	-	-	-	-	-	-	-	-	-	95
88.87	-	-	-	-	0.09	0.83	0.08	-	-	-	-	-	-	-	-	-	-	-	64
92.58	-	-	-	-	-	0.05	0.78	0.17	-	-	-	-	-	-	-	-	-	-	58
96.29	-	-	-	-	-	-	0.10	0.70	0.20	-	-	-	-	-	-	-	-	-	46
100.00	-	-	-	-	-	-	0.01	0.03	0.89	0.07	-	-	-	-	-	-	-	-	180
103.71	-	-	-	-	-	-	-	-	0.10	0.84	0.05	0.01	-	-	-	-	-	-	140
107.42	-	-	-	-	-	-	-	-	-	0.07	0.87	0.06	-	-	-	-	-	-	179
111.13	-	-	-	-	-	-	-	-	-	-	0.14	0.81	0.05	-	-	-	-	-	102
114.84	-	-	-	-	-	-	-	-	-	-	-	0.08	0.67	0.24	0.01	-	-	-	71
118.55	-	-	-	-	-	-	-	-	-	-	-	-	0.12	0.83	0.05	-	-	-	128
122.26	-	-	-	-	-	-	-	-	-	-	-	-	0.02	0.11	0.76	0.11	-	-	55
125.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05	0.91	0.04	-	97
129.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.09	0.89	0.02	47
133.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.11	0.89	9
Ergodic	0.003	0.002	0.017	0.024	0.030	0.023	0.038	0.043	0.213	0.149	0.128	0.065	0.041	0.079	0.034	0.074	0.033	0.006	
Recurrence Time	301.67	603.38	60.34	41.48	33.19	42.67	26.67	23.53	4.71	6.72	7.84	15.32	24.52	12.60	29.70	13.50	30.38	167.09	

Figure 4: Ergodic distributions comparison for different period transition matrices

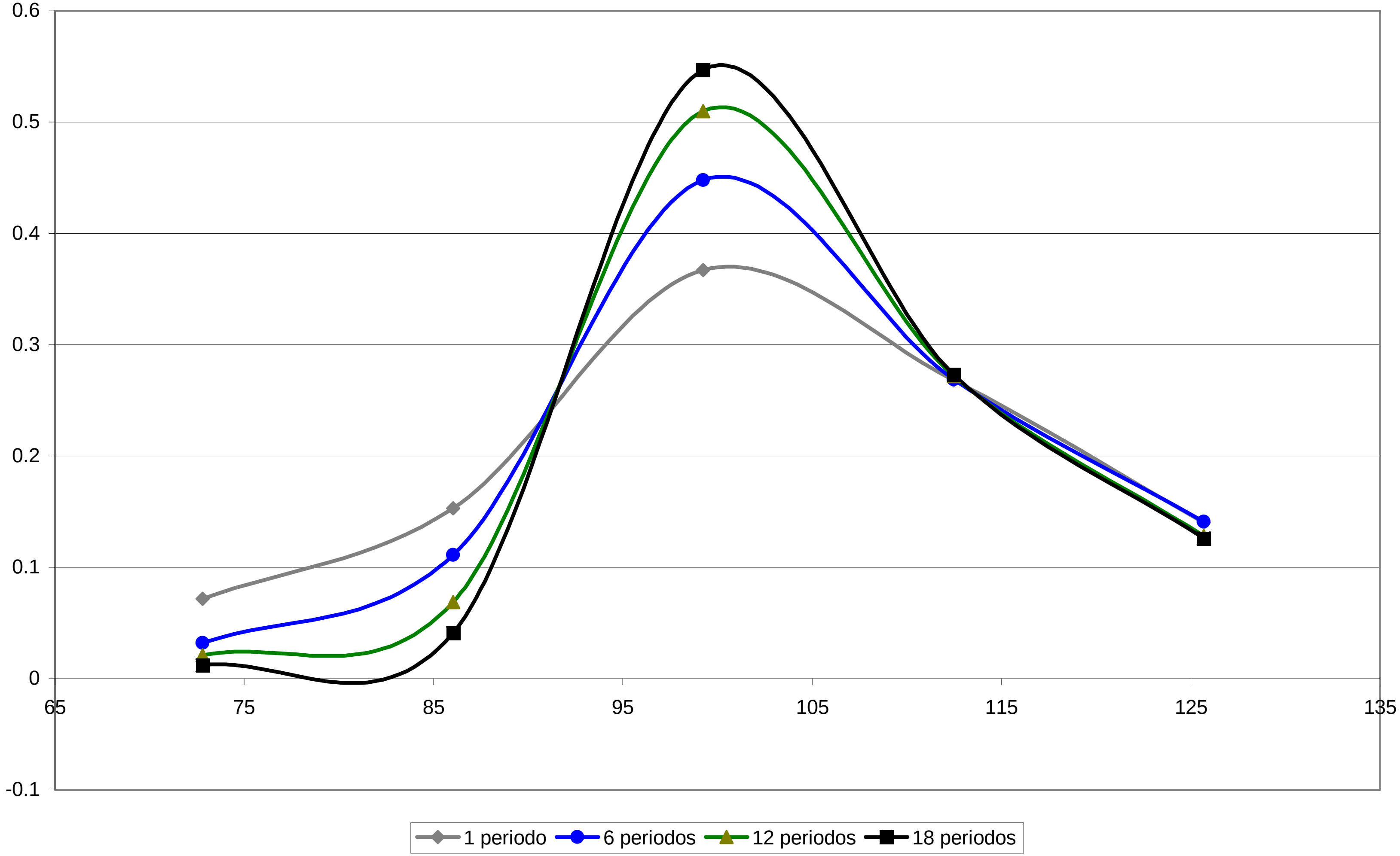

Figure 5: 1 period ahead transition matrix.

	(66.2-79.42)	(79.42-92.64)	(92.64-105.86)	(105.86-119.08)	(119.08-132.3)
E1	97,006%	2,994%	-	-	-
E2	1,394%	95,122%	3,484%	-	-
E3	-	1,493%	95,736%	2,771%	-
E4	-	-	4,103%	94,359%	1,538%
E5	-	-	-	2,475%	97,525%
ERG	7,379%	15,851%	36,994%	24,990%	15,527%

Figure 6: Elasticities for the 1 period transition probabilities.

- 2.268	4.871	- 1.618	3.776	- 1.063	0.718	- 1.390	0.734
0.385	- 0.827	- 3.475	8.109	- 2.284	1.542	- 1.577	1.577
0.899	- 1.930	2.431	- 5.673	- 5.329	3.599	- 3.680	3.680
0.607	- 1.304	1.642	- 3.831	5.351	- 3.614	- 2.485	2.485
- 0.377	- 0.810	1.020	- 2.381	3.325	- 2.246	8.476	- 5.267

Figure 7: 12 periods ahead transition matrix.

	(66.2-79.42)	(79.42-92.64)	(92.64-105.86)	(105.86-119.08)	(119.08-132.3)
E1	78,523%	21,477%	0,000%	0,000%	0,000%
E2	6,612%	79,752%	12,397%	1,240%	0,000%
E3	0,000%	1,867%	82,667%	15,467%	0,000%
E4	0,000%	0,000%	28,221%	66,258%	5,521%
E5	0,000%	0,000%	0,000%	11,310%	88,690%
ERG	2,128%	6,913%	50,494%	27,977%	13,656%

Figure 8: Elasticities for the 12 periods transition probabilities

- 0.105	0.340	- 0.168	1.113	- 0.060	0.033	- 0.096	0.055
0.008	- 0.026	- 0.545	3.616	- 0.196	0.107	- 0.180	0.180
0.053	- 0.173	0.392	- 2.605	- 1.302	0.714	- 1.196	1.196
0.029	- 0.095	0.215	- 1.428	1.047	- 0.574	- 0.656	0.656
- 0.014	- 0.046	0.105	- 0.697	0.511	- 0.280	2.088	- 1.019

Figure 9: 1 period Markov Chains. Structural Change in 1999 Test.

		Total of the sample					Sub-it shows: 1995-1998					Sub-it shows: 1999-2002					$\chi2$	Prob
0%	E1	97,0%	3,0%	0,0%	0,0%	0,0%	97,6%	2,4%	0,0%	0,0%	0,0%	96,1%	3,9%	0,0%	0,0%	0,0%	0.3	58,2%
	E2	1,4%	95,1%	3,5%	0,0%	0,0%	1,3%	95,0%	3,8%	0,0%	0,0%	1,8%	96,4%	1,8%	0,0%	0,0%	1.1	57,3%
	E3	0,0%	1,5%	95,7%	2,8%	0,0%	0,0%	3,2%	91,7%	5,1%	0,0%	0,0%	0,4%	97,8%	1,9%	0,0%	9.7	0,8%
	E4	0,0%	0,0%	4,1%	94,4%	1,5%	0,0%	0,0%	5,1%	94,0%	0,9%	0,0%	0,0%	2,6%	95,4%	2,0%	2.1	35,9%
	E5	0,0%	0,0%	0,0%	2,5%	97,5%	0,0%	0,0%	0,0%	2,2%	97,8%	0,0%	0,0%	0,0%	3,1%	96,9%	0.2	64,8%
	ERG	7,4%	15,9%	37,0%	25,0%	15,5%	11,8%	22,8%	26,8%	26,9%	11,6%	3,9%	8,4%	40,9%	28,6%	18,2%	13.4	10,0%
5%	E1	96,5%	3,5%	0,0%	0,0%	0,0%	97,1%	2,9%	0,0%	0,0%	0,0%	95,7%	4,3%	0,0%	0,0%	0,0%	0.2	62,1%
	E2	1,7%	94,7%	3,6%	0,0%	0,0%	1,5%	94,2%	4,3%	0,0%	0,0%	2,2%	96,5%	1,3%	0,0%	0,0%	2.1	34,6%
	E3	0,0%	1,5%	95,1%	3,3%	0,0%	0,0%	3,5%	90,2%	6,3%	0,0%	0,0%	0,3%	97,6%	2,0%	0,0%	12.7	0,2%
	E4	0,0%	0,0%	4,8%	93,4%	1,9%	0,0%	0,0%	5,8%	93,0%	1,2%	0,0%	0,0%	2,9%	95,1%	2,0%	2.2	32,8%
	E5	0,0%	0,0%	0,0%	3,1%	96,9%	0,0%	0,0%	0,0%	3,0%	97,0%	0,0%	0,0%	0,0%	3,2%	96,8%	0.0	95,7%
	ERG	7,5%	15,7%	36,2%	25,2%	15,1%	11,2%	21,9%	26,8%	28,9%	11,2%	5,3%	10,3%	39,8%	27,7%	17,4%	17.3	2,7%
10%	E1	95,5%	4,5%	0,0%	0,0%	0,0%	96,4%	3,6%	0,0%	0,0%	0,0%	94,3%	5,7%	0,0%	0,0%	0,0%	0.4	52,4%
	E2	2,3%	93,5%	4,2%	0,0%	0,0%	1,8%	93,5%	4,7%	0,0%	0,0%	3,3%	94,3%	2,4%	0,0%	0,0%	1.6	44,4%
	E3	0,0%	2,0%	93,7%	4,4%	0,0%	0,0%	3,9%	87,4%	8,7%	0,0%	0,0%	0,7%	96,9%	2,4%	0,0%	15.4	0,0%
	E4	0,0%	0,0%	6,0%	92,0%	2,1%	0,0%	0,0%	7,6%	91,1%	1,3%	0,0%	0,0%	3,6%	94,4%	2,0%	3.0	22,2%
	E5	0,0%	0,0%	0,0%	3,5%	96,5%	0,0%	0,0%	0,0%	3,4%	96,6%	0,0%	0,0%	0,0%	3,3%	96,7%	0.0	91,5%
	ERG	8,2%	16,3%	35,0%	25,4%	15,1%	10,9%	21,5%	26,0%	30,0%	11,7%	6,8%	11,7%	39,0%	25,7%	16,0%	20.5	0,9%
20%	E1	91,8%	8,2%	0,0%	0,0%	0,0%	93,6%	6,4%	0,0%	0,0%	0,0%	90,1%	9,9%	0,0%	0,0%	0,0%	0.7	40,9%
	E2	4,5%	90,0%	5,5%	0,0%	0,0%	3,2%	91,4%	5,4%	0,0%	0,0%	6,6%	88,6%	4,8%	0,0%	0,0%	1.8	40,2%
	E3	0,0%	2,7%	90,4%	6,9%	0,0%	0,0%	4,5%	81,5%	14,0%	0,0%	0,0%	1,6%	94,8%	3,6%	0,0%	20.9	0,0%
	E4	0,0%	0,0%	9,1%	88,0%	3,0%	0,0%	0,0%	11,5%	86,1%	2,3%	0,0%	0,0%	5,9%	91,3%	2,8%	3.7	15,3%
	E5	0,0%	0,0%	0,0%	5,2%	94,8%	0,0%	0,0%	0,0%	5,7%	94,3%	0,0%	0,0%	0,0%	4,5%	95,5%	0.1	72,2%
	ERG	9,2%	16,7%	33,6%	25,6%	14,5%	10,7%	21,0%	25,2%	30,5%	12,7%	8,7%	12,9%	39,0%	24,0%	15,0%	27.3	0,1%
30%	E1	86,3%	13,7%	0,0%	0,0%	0,0%	89,5%	10,5%	0,0%	0,0%	0,0%	83,7%	16,3%	0,0%	0,0%	0,0%	1.2	27,6%
	E2	8,2%	84,9%	6,9%	0,0%	0,0%	5,7%	87,9%	6,4%	0,0%	0,0%	12,1%	81,0%	6,9%	0,0%	0,0%	3.6	16,8%
	E3	0,0%	3,5%	87,3%	9,2%	0,0%	0,0%	5,4%	77,0%	17,6%	0,0%	0,0%	2,3%	92,3%	5,4%	0,0%	21.7	0,0%
	E4	0,0%	0,0%	11,9%	83,5%	4,7%	0,0%	0,0%	14,5%	81,6%	3,9%	0,0%	0,0%	8,8%	86,3%	4,9%	3.1	21,4%
	E5	0,0%	0,0%	0,0%	8,4%	91,6%	0,0%	0,0%	0,0%	8,7%	91,3%	0,0%	0,0%	0,0%	8,1%	91,9%	0.0	87,7%
	ERG	10,2%	16,9%	33,2%	25,9%	14,4%	11,2%	20,8%	24,8%	30,0%	13,3%	9,7%	13,0%	38,6%	23,7%	14,6%	29.5	0,0%
40%	E1	81,6%	18,4%	0,0%	0,0%	0,0%	85,4%	14,6%	0,0%	0,0%	0,0%	78,9%	21,1%	0,0%	0,0%	0,0%	1.2	26,6%
	E2	11,8%	79,8%	8,4%	0,0%	0,0%	8,4%	83,9%	7,7%	0,0%	0,0%	16,5%	74,4%	9,1%	0,0%	0,0%	4.2	12,1%
	E3	0,0%	4,3%	84,1%	11,5%	0,0%	0,0%	6,4%	73,4%	20,2%	0,0%	0,0%	3,2%	89,4%	7,5%	0,0%	19.8	0,0%
	E4	0,0%	0,0%	14,7%	78,4%	6,9%	0,0%	0,0%	17,1%	77,2%	5,7%	0,0%	0,0%	12,0%	80,3%	7,7%	2.2	33,1%
	E5	0,0%	0,0%	0,0%	12,4%	87,6%	0,0%	0,0%	0,0%	12,2%	87,8%	0,0%	0,0%	0,0%	12,7%	87,3%	0.0	91,1%
	ERG	10,8%	16,9%	32,8%	25,7%	14,4%	11,9%	20,6%	24,8%	29,4%	13,8%	10,5%	13,4%	38,5%	23,9%	14,5%	27.5	0,1%
50%	E1	77,9%	22,1%	0,0%	0,0%	0,0%	81,9%	18,1%	0,0%	0,0%	0,0%	75,1%	24,9%	0,0%	0,0%	0,0%	1.3	26,3%
	E2	14,7%	74,7%	10,6%	0,0%	0,0%	10,9%	79,7%	9,4%	0,0%	0,0%	19,7%	68,2%	12,1%	0,0%	0,0%	4.6	20,0%
	E3	0,0%	5,6%	80,7%	13,7%	0,0%	0,0%	7,7%	70,0%	22,3%	0,0%	0,0%	4,4%	85,9%	9,6%	0,0%	17.2	0,0%
	E4	0,0%	0,0%	17,3%	73,2%	9,4%	0,0%	0,0%	19,2%	72,8%	8,0%	0,0%	0,0%	15,3%	74,2%	10,6%	1.5	47,3%
	E5	0,0%	0,0%	0,0%	16,8%	83,2%	0,0%	0,0%	0,0%	16,4%	83,6%	0,0%	0,0%	0,0%	17,5%	82,5%	0.0	97,8%
	ERG	11,1%	16,8%	31,8%	25,2%	14,2%	12,3%	20,3%	24,7%	28,7%	14,0%	10,8%	13,7%	37,5%	23,7%	14,3%	24.6	0,6%

Figure 10: 12 period Markov Chains. Structural Change in 1999 Test.

		Total of the sample					Sub-it shows: 1995-1998					Sub-it shows: 1999-2002					$\chi2$	Prob
0%	E1	78,5%	21,5%	0,0%	0,0%	0,0%	72,6%	27,4%	0,0%	0,0%	0,0%	83,1%	16,9%	0,0%	0,0%	0,0%	2.1	14,8%
	E2	6,6%	79,8%	12,4%	1,2%	0,0%	7,8%	73,6%	16,3%	2,3%	0,0%	5,0%	91,3%	3,8%	0,0%	0,0%	11.1	1,1%
	E3	0,0%	1,9%	82,7%	15,5%	0,0%	0,0%	6,4%	68,2%	25,5%	0,0%	0,0%	0,0%	87,9%	12,2%	0,0%	28.0	0,0%
	E4	0,0%	0,0%	28,2%	66,3%	5,5%	0,0%	0,0%	36,1%	58,4%	5,4%	0,0%	0,0%	9,3%	85,0%	5,6%	24.4	0,0%
	E5	0,0%	0,0%	0,0%	11,3%	88,7%	0,0%	0,0%	0,0%	17,8%	82,2%	0,0%	0,0%	0,0%	8,1%	91,9%	3.8	5,0%
	ERG	2,1%	6,9%	50,5%	28,0%	13,7%	4,1%	14,5%	42,5%	30,9%	9,4%	0,0%	0,0%	31,3%	40,6%	28,1%	69.5	0,0%
5%	E1	78,7%	21,3%	0,0%	0,0%	0,0%	72,6%	27,4%	0,0%	0,0%	0,0%	83,4%	16,6%	0,0%	0,0%	0,0%	2.2	13,8%
	E2	6,6%	80,1%	12,1%	1,1%	0,0%	7,8%	73,6%	16,6%	2,1%	0,0%	5,2%	92,5%	2,3%	0,0%	0,0%	13.2	0,4%
	E3	0,0%	1,8%	82,6%	15,6%	0,0%	0,0%	6,1%	68,1%	25,8%	0,0%	0,0%	0,0%	87,9%	12,1%	0,0%	27.8	0,0%
	E4	0,0%	0,0%	28,3%	66,7%	5,1%	0,0%	0,0%	35,9%	58,7%	5,4%	0,0%	0,0%	9,3%	86,0%	4,7%	24.7	0,0%
	E5	0,0%	0,0%	0,0%	10,8%	89,2%	0,0%	0,0%	0,0%	18,0%	82,0%	0,0%	0,0%	0,0%	6,8%	93,2%	5.1	2,4%
	ERG	2,1%	6,8%	50,7%	28,3%	13,2%	3,9%	13,6%	41,9%	31,0%	9,3%	0,0%	0,0%	31,5%	40,8%	27,7%	72.9	0,0%
10%	E1	78,9%	21,1%	0,0%	0,0%	0,0%	72,8%	27,2%	0,0%	0,0%	0,0%	83,6%	16,4%	0,0%	0,0%	0,0%	2.2	13,6%
	E2	6,6%	79,5%	12,9%	1,1%	0,0%	7,8%	73,5%	16,8%	2,0%	0,0%	5,4%	90,7%	3,9%	0,0%	0,0%	10.7	1,3%
	E3	0,0%	2,0%	82,3%	15,7%	0,0%	0,0%	6,6%	68,0%	25,4%	0,0%	0,0%	0,1%	87,8%	12,1%	0,0%	27.2	0,0%
	E4	0,0%	0,0%	28,2%	66,7%	5,1%	0,0%	0,0%	35,6%	58,9%	5,5%	0,0%	0,0%	9,6%	85,7%	4,7%	23.9	0,0%
	E5	0,0%	0,0%	0,0%	10,9%	89,1%	0,0%	0,0%	0,0%	17,9%	82,1%	0,0%	0,0%	0,0%	7,0%	93,0%	4.9	2,7%
	ERG	2,3%	7,2%	49,6%	27,9%	13,0%	4,2%	14,6%	41,6%	30,5%	9,4%	0,2%	0,5%	31,7%	39,9%	26,9%	69.0	0,0%
20%	E1	78,1%	21,9%	0,0%	0,0%	0,0%	72,2%	27,8%	0,0%	0,0%	0,0%	82,5%	17,5%	0,0%	0,0%	0,0%	2.0	15,7%
	E2	7,8%	76,5%	14,6%	1,1%	0,0%	8,6%	71,8%	17,6%	2,0%	0,0%	8,0%	84,2%	7,8%	0,0%	0,0%	6.3	9,7%
	E3	0,0%	2,7%	81,5%	15,8%	0,0%	0,0%	7,7%	68,5%	23,7%	0,0%	0,0%	0,4%	87,4%	12,2%	0,0%	23.7	0,0%
	E4	0,0%	0,0%	28,1%	66,3%	5,6%	0,0%	0,0%	35,2%	58,9%	5,9%	0,0%	0,0%	10,6%	84,1%	5,3%	21.6	0,0%
	E5	0,0%	0,0%	0,0%	11,7%	88,3%	0,0%	0,0%	0,0%	17,9%	82,1%	0,0%	0,0%	0,0%	8,7%	91,3%	3.4	6,6%
	ERG	3,0%	8,3%	48,2%	27,4%	13,1%	5,0%	16,1%	40,8%	28,4%	9,3%	0,8%	1,7%	34,4%	39,6%	24,2%	57.0	0,0%
30%	E1	75,4%	24,6%	0,0%	0,0%	0,0%	70,1%	29,9%	0,0%	0,0%	0,0%	78,9%	21,1%	0,0%	0,0%	0,0%	1.4	23,0%
	E2	10,3%	72,1%	16,5%	1,1%	0,0%	9,9%	68,9%	19,0%	2,2%	0,0%	12,7%	76,0%	11,3%	0,0%	0,0%	4.6	20,3%
	E3	0,0%	3,5%	80,2%	16,3%	0,0%	0,0%	9,1%	68,1%	22,8%	0,0%	0,0%	0,9%	86,4%	12,7%	0,1%	21.5	0,0%
	E4	0,0%	0,0%	28,3%	64,5%	7,1%	0,0%	0,0%	35,3%	57,9%	6,8%	0,0%	0,0%	12,2%	80,4%	7,4%	18.7	0,0%
	E5	0,0%	0,0%	0,1%	14,6%	85,3%	0,0%	0,0%	0,2%	19,4%	80,5%	0,0%	0,0%	0,0%	12,6%	87,4%	1.8	41,5%
	ERG	3,9%	9,4%	46,4%	27,0%	13,3%	5,7%	17,3%	40,4%	27,1%	9,4%	1,6%	2,7%	35,6%	37,3%	22,1%	48.1	0,0%
40%	E1	73,0%	27,0%	0,0%	0,0%	0,0%	68,8%	31,2%	0,0%	0,0%	0,0%	75,5%	24,5%	0,0%	0,0%	0,0%	0.8	65,6%
	E2	12,5%	67,9%	18,3%	1,2%	0,0%	11,2%	65,8%	20,6%	2,4%	0,0%	16,1%	69,4%	14,4%	0,0%	0,0%	4.3	23,1%
	E3	0,0%	4,5%	78,3%	17,1%	0,1%	0,0%	10,3%	67,2%	22,5%	0,0%	0,0%	1,6%	84,7%	13,5%	0,2%	18.9	0,0%
	E4	0,0%	0,0%	29,0%	61,7%	9,3%	0,0%	0,0%	35,6%	56,2%	8,3%	0,0%	0,0%	14,6%	75,0%	10,5%	15.2	0,2%
	E5	0,0%	0,0%	0,3%	18,3%	81,4%	0,0%	0,0%	0,6%	21,6%	77,8%	0,0%	0,0%	0,0%	17,0%	83,0%	1.2	55,8%
	ERG	4,8%	0,0%	0,0%	0,0%	0,0%	6,4%	17,9%	39,8%	26,2%	9,8%	2,7%	4,1%	36,7%	34,6%	21,7%	40.3	0,0%
50%	E1	71,0%	28,9%	0,1%	0,0%	0,0%	68,0%	31,8%	0,2%	0,0%	0,0%	72,2%	27,8%	0,0%	0,0%	0,0%	0.5	91,4%
	E2	14,3%	64,1%	20,3%	1,3%	0,0%	12,3%	63,1%	22,1%	2,6%	0,0%	18,8%	63,8%	17,4%	0,0%	0,0%	4.3	23,2%
	E3	0,0%	5,8%	75,8%	18,2%	0,2%	0,0%	11,5%	65,8%	22,7%	0,0%	0,0%	3,0%	82,2%	14,5%	0,3%	14.9	0,5%
	E4	0,0%	0,1%	29,8%	58,7%	11,5%	0,0%	0,1%	35,7%	54,3%	9,9%	0,0%	0,0%	17,3%	69,1%	13,6%	11.8	0,8%
	E5	0,0%	0,0%	0,6%	22,2%	77,2%	0,0%	0,0%	1,3%	24,6%	74,1%	0,0%	0,0%	0,1%	21,2%	78,7%	1.3	52,2%
	ERG	5,7%	10,3%	44,6%	26,8%	13,6%	7,0%	18,3%	39,1%	25,8%	9,9%	4,2%	6,3%	36,9%	31,7%	20,8%	32.8	0,5%

Figure 11: 1 period Markov Chains. MU test. Total Sample

		Total of the sample					Total UM					Total nonUM					$\chi2$	Prob
0%	E1	97,0%	3,0%	0,0%	0,0%	0,0%	96,9%	3,1%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	93,4%
	E2	1,4%	95,1%	3,5%	0,0%	0,0%	1,6%	95,2%	3,2%	0,0%	0,0%	0,0%	95,7%	4,3%	0,0%	0,0%	0.5	77,7%
	E3	0,0%	1,5%	95,7%	2,8%	0,0%	0,0%	1,4%	96,2%	2,4%	0,0%	0,0%	0,0%	80,0%	20,0%	0,0%	16.9	0,0%
	E4	0,0%	0,0%	4,1%	94,4%	1,5%	0,0%	0,0%	4,3%	95,4%	0,3%	0,0%	0,0%	3,0%	89,6%	7,4%	18.6	0,0%
	E5	0,0%	0,0%	0,0%	2,5%	97,5%	0,0%	0,0%	0,0%	10,0%	90,0%	0,0%	0,0%	0,0%	2,2%	97,8%	2.4	12,2%
	ERG	7,4%	15,9%	37,0%	25,0%	15,5%	10,3%	19,9%	44,2%	24,8%	0,8%	0,0%	0,0%	3,3%	22,2%	74,5%	38.4	0,0%
5%	E1	96,5%	3,5%	0,0%	0,0%	0,0%	96,4%	3,6%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	92,8%
	E2	1,7%	94,7%	3,6%	0,0%	0,0%	1,9%	94,9%	3,2%	0,0%	0,0%	0,0%	95,7%	4,3%	0,0%	0,0%	0.6	73,2%
	E3	0,0%	1,5%	95,1%	3,3%	0,0%	0,0%	1,5%	95,5%	3,0%	0,0%	0,0%	0,0%	79,5%	20,5%	0,0%	14.5	0,1%
	E4	0,0%	0,0%	4,8%	93,4%	1,9%	0,0%	0,0%	5,1%	94,6%	0,4%	0,0%	0,0%	3,2%	88,6%	8,1%	18.5	0,0%
	E5	0,0%	0,0%	0,0%	3,1%	96,9%	0,0%	0,0%	0,0%	13,1%	86,9%	0,0%	0,0%	0,0%	2,5%	97,5%	3.8	5,1%
	ERG	7,5%	15,7%	36,2%	25,2%	15,1%	11,1%	20,8%	42,8%	25,2%	0,7%	0,0%	0,0%	3,6%	22,5%	73,9%	37.4	0,0%
10%	E1	95,5%	4,5%	0,0%	0,0%	0,0%	95,3%	4,7%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	91,8%
	E2	2,3%	93,5%	4,2%	0,0%	0,0%	2,6%	93,5%	3,8%	0,0%	0,0%	0,0%	95,6%	4,4%	0,0%	0,0%	0.7	69,1%
	E3	0,0%	2,0%	93,7%	4,4%	0,0%	0,0%	1,9%	94,0%	4,1%	0,0%	0,0%	0,0%	79,1%	20,9%	0,0%	10.8	0,5%
	E4	0,0%	0,0%	6,0%	92,0%	2,1%	0,0%	0,0%	6,6%	92,9%	0,5%	0,0%	0,0%	3,5%	88,2%	8,3%	17.2	0,0%
	E5	0,0%	0,0%	0,0%	3,5%	96,5%	0,0%	0,0%	0,0%	16,9%	83,1%	0,0%	0,0%	0,0%	2,5%	97,5%	6.3	1,2%
	ERG	8,2%	16,3%	35,0%	25,4%	15,1%	11,6%	20,8%	41,2%	25,7%	0,7%	0,0%	0,0%	3,8%	22,4%	73,7%	35.0	0,0%
20%	E1	91,8%	8,2%	0,0%	0,0%	0,0%	91,8%	8,2%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	99,0%
	E2	4,5%	90,0%	5,5%	0,0%	0,0%	5,0%	89,7%	5,3%	0,0%	0,0%	0,0%	95,5%	4,5%	0,0%	0,0%	1.3	51,3%
	E3	0,0%	2,7%	90,4%	6,9%	0,0%	0,0%	2,8%	90,4%	6,9%	0,0%	0,0%	0,3%	76,8%	22,9%	0,0%	7.0	3,1%
	E4	0,0%	0,0%	9,1%	88,0%	3,0%	0,0%	0,0%	10,3%	88,4%	1,3%	0,0%	0,0%	4,3%	86,4%	9,3%	14.2	0,1%
	E5	0,0%	0,0%	0,0%	5,2%	94,8%	0,0%	0,0%	0,0%	37,2%	62,8%	0,0%	0,0%	0,0%	3,0%	97,0%	25.7	0,0%
	ERG	9,2%	16,7%	33,6%	25,6%	14,5%	12,7%	20,7%	39,8%	26,5%	0,9%	0,0%	0,2%	4,3%	23,2%	72,4%	48.2	0,0%
30%	E1	86,3%	13,7%	0,0%	0,0%	0,0%	86,6%	13,4%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	89,8%
	E2	8,2%	84,9%	6,9%	0,0%	0,0%	9,0%	84,1%	6,9%	0,0%	0,0%	0,0%	95,2%	4,8%	0,0%	0,0%	2.5	28,4%
	E3	0,0%	3,5%	87,3%	9,2%	0,0%	0,0%	3,6%	87,1%	9,3%	0,0%	0,0%	1,1%	73,5%	25,4%	0,0%	5.6	6,1%
	E4	0,0%	0,0%	11,9%	83,5%	4,7%	0,0%	0,0%	13,7%	83,6%	2,7%	0,0%	0,0%	5,1%	82,4%	12,5%	15.0	0,1%
	E5	0,0%	0,0%	0,0%	8,4%	91,6%	0,0%	0,0%	0,0%	55,6%	44,4%	0,0%	0,0%	0,0%	4,3%	95,7%	47.5	0,0%
	ERG	10,2%	16,9%	33,2%	25,9%	14,4%	13,4%	19,9%	38,3%	26,0%	1,3%	0,0%	1,1%	4,8%	24,1%	69,5%	70.7	0,0%
40%	E1	81,6%	18,4%	0,0%	0,0%	0,0%	82,2%	17,8%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	82,5%
	E2	11,8%	79,8%	8,4%	0,0%	0,0%	12,8%	78,6%	8,6%	0,0%	0,0%	0,0%	94,7%	5,3%	0,0%	0,0%	3.8	14,8%
	E3	0,0%	4,3%	84,1%	11,5%	0,0%	0,0%	4,5%	83,9%	11,6%	0,0%	0,0%	2,2%	69,6%	28,2%	0,0%	5.0	8,3%
	E4	0,0%	0,0%	14,7%	78,4%	6,9%	0,0%	0,0%	17,1%	78,6%	4,4%	0,0%	0,0%	5,9%	77,3%	16,9%	17.6	0,0%
	E5	0,0%	0,0%	0,0%	12,4%	87,6%	0,0%	0,0%	0,0%	65,2%	34,8%	0,0%	0,0%	0,0%	6,3%	93,7%	58.2	0,0%
	ERG	10,8%	16,9%	32,8%	25,7%	14,4%	14,4%	19,9%	38,3%	26,1%	1,8%	0,0%	2,1%	5,2%	25,2%	67,5%	84.7	0,0%
50%	E1	77,9%	22,1%	0,0%	0,0%	0,0%	78,7%	21,3%	0,0%	0,0%	0,0%	0,4%	99,6%	0,1%	0,0%	0,0%	0.3	55,7%
	E2	14,7%	74,7%	10,6%	0,0%	0,0%	15,9%	73,2%	10,9%	0,0%	0,0%	0,3%	93,4%	6,3%	0,0%	0,0%	4.9	17,8%
	E3	0,0%	5,6%	80,7%	13,7%	0,0%	0,0%	5,8%	80,4%	13,8%	0,0%	0,0%	3,5%	65,0%	31,5%	0,0%	5.0	8,3%
	E4	0,0%	0,0%	17,3%	73,2%	9,4%	0,0%	0,0%	20,2%	73,7%	6,1%	0,0%	0,0%	6,8%	71,2%	22,1%	21.8	0,0%
	E5	0,0%	0,0%	0,0%	16,8%	83,2%	0,0%	0,0%	0,0%	69,1%	30,9%	0,0%	0,0%	0,0%	8,9%	91,1%	59.0	0,0%
	ERG	11,1%	16,8%	31,8%	25,2%	14,2%	14,8%	19,9%	37,7%	25,8%	2,3%	0,0%	3,1%	5,7%	26,4%	65,3%	91.0	0,0%

Figure 12: 1 period Markov Chains. MU test 1999 -2002

		Total Sample 1999-2002					Total UM					Total nonUM					$\chi 2$	Prob
0%	E1	96,1%	3,9%	0,0%	0,0%	0,0%	96,1%	3,9%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E2	1,8%	96,4%	1,8%	0,0%	0,0%	1,8%	96,4%	1,8%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E3	0,0%	0,4%	97,8%	1,9%	0,0%	0,0%	0,4%	98,1%	1,5%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E4	0,0%	0,0%	2,6%	95,4%	2,0%	0,0%	0,0%	3,7%	96,3%	0,0%	0,0%	0,0%	0,0%	93,0%	7,0%	9.2	1,0%
	E5	0,0%	0,0%	0,0%	3,1%	96,9%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	3,1%	96,9%	0.0	100,0%
	ERG	3,9%	8,4%	40,9%	28,6%	18,2%	5,6%	12,1%	58,6%	23,6%	0,0%	0,0%	0,0%	0,0%	30,9%	69,1%	9.2	32,9%
5%	E1	95,7%	4,3%	0,0%	0,0%	0,0%	95,7%	4,3%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E2	2,2%	96,5%	1,3%	0,0%	0,0%	2,2%	96,5%	1,3%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E3	0,0%	0,3%	97,6%	2,0%	0,0%	0,0%	0,3%	98,0%	1,7%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E4	0,0%	0,0%	2,9%	95,1%	2,0%	0,0%	0,0%	4,1%	95,9%	0,0%	0,0%	0,0%	0,0%	93,2%	6,8%	9.2	1,0%
	E5	0,0%	0,0%	0,0%	3,2%	96,8%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	3,2%	96,8%	0.0	100,0%
	ERG	5,3%	10,3%	39,8%	27,7%	17,4%	7,4%	14,4%	55,4%	22,5%	0,0%	0,0%	0,0%	0,0%	31,6%	68,4%	9.2	32,9%
10%	E1	94,3%	5,7%	0,0%	0,0%	0,0%	94,3%	5,7%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E2	3,3%	94,3%	2,4%	0,0%	0,0%	3,3%	94,3%	2,4%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E3	0,0%	0,7%	96,9%	2,4%	0,0%	0,0%	0,7%	97,3%	2,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E4	0,0%	0,0%	3,6%	94,4%	2,0%	0,0%	0,0%	5,1%	94,9%	0,0%	0,0%	0,0%	0,0%	93,0%	7,0%	9.8	0,7%
	E5	0,0%	0,0%	0,0%	3,3%	96,7%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	3,3%	96,7%	0.0	100,0%
	ERG	6,8%	11,7%	39,0%	25,7%	16,0%	9,4%	16,1%	53,3%	21,1%	0,0%	0,0%	0,0%	0,0%	31,8%	68,2%	9.8	28,0%
20%	E1	90,1%	9,9%	0,0%	0,0%	0,0%	90,1%	9,9%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E2	6,6%	88,6%	4,8%	0,0%	0,0%	6,6%	88,6%	4,8%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E3	0,0%	1,6%	94,8%	3,6%	0,0%	0,0%	1,6%	95,2%	3,3%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E4	0,0%	0,0%	5,9%	91,3%	2,8%	0,0%	0,0%	8,3%	91,3%	0,5%	0,0%	0,0%	0,0%	91,4%	8,6%	11.0	0,4%
	E5	0,0%	0,0%	0,0%	4,5%	95,5%	0,0%	0,0%	0,0%	94,2%	5,8%	0,0%	0,0%	0,0%	4,1%	95,9%	8.8	0,3%
	ERG	8,7%	12,9%	39,0%	24,0%	15,0%	11,6%	17,3%	51,7%	20,4%	0,1%	0,0%	0,0%	0,0%	32,4%	67,6%	19.8	1,1%
30%	E1	83,7%	16,3%	0,0%	0,0%	0,0%	83,7%	16,3%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E2	12,1%	81,0%	6,9%	0,0%	0,0%	12,1%	81,0%	6,9%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E3	0,0%	2,3%	92,3%	5,4%	0,0%	0,0%	2,4%	92,7%	5,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E4	0,0%	0,0%	8,8%	86,3%	4,9%	0,0%	0,0%	12,3%	86,1%	1,6%	0,0%	0,0%	0,5%	86,7%	12,8%	13.5	0,1%
	E5	0,0%	0,0%	0,0%	8,1%	91,9%	0,0%	0,0%	0,0%	87,7%	12,3%	0,0%	0,0%	0,0%	6,4%	93,6%	16.8	0,0%
	ERG	9,7%	13,0%	38,6%	23,7%	14,6%	12,9%	17,2%	50,5%	20,5%	0,4%	0,0%	0,0%	0,3%	33,1%	66,6%	30.4	0,0%
40%	E1	78,9%	21,1%	0,0%	0,0%	0,0%	78,9%	21,1%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E2	16,5%	74,4%	9,1%	0,0%	0,0%	16,5%	74,4%	9,1%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E3	0,0%	3,2%	89,4%	7,5%	0,0%	0,0%	3,2%	89,8%	7,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E4	0,0%	0,0%	12,0%	80,3%	7,7%	0,0%	0,0%	16,8%	79,9%	3,4%	0,0%	0,0%	1,1%	81,2%	17,7%	15.9	0,0%
	E5	0,0%	0,0%	0,0%	12,7%	87,3%	0,0%	0,0%	0,0%	85,2%	14,8%	0,0%	0,0%	0,0%	9,3%	90,7%	21.1	0,0%
	ERG	10,5%	13,4%	38,5%	23,9%	14,5%	13,4%	17,0%	48,6%	20,2%	0,8%	0,0%	0,0%	0,7%	34,4%	65,6%	37.0	0,0%
50%	E1	75,1%	24,9%	0,0%	0,0%	0,0%	75,1%	24,9%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E2	19,7%	68,2%	12,1%	0,0%	0,0%	19,7%	68,2%	12,1%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E3	0,0%	4,4%	85,9%	9,6%	0,0%	0,0%	4,5%	86,5%	9,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0.0	100,0%
	E4	0,0%	0,0%	15,3%	74,2%	10,6%	0,0%	0,0%	21,1%	73,5%	5,3%	0,0%	0,0%	2,0%	75,6%	22,4%	17.7	0,0%
	E5	0,0%	0,0%	0,0%	17,5%	82,5%	0,0%	0,0%	0,0%	83,0%	17,0%	0,0%	0,0%	0,0%	12,3%	87,7%	22.5	0,0%
	ERG	10,8%	13,7%	37,5%	23,7%	14,3%	13,8%	17,5%	47,3%	20,2%	1,3%	0,0%	0,0%	1,1%	35,0%	63,8%	40.2	0,0%

Figure 13: Equality test countries two by two. 1 period, total sample

	Belgium	France	Germanny	Luxemburg	Netherlands	Spain
Austria	0.07	0.05	0.18	0.11	0.01	
Belgium		0.39	0.03			
France			0.14	0.01		
Germanny				0.67		
Italy						0.03