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Abstract

In this paper we use an appropriate econometric technique to analyze residential water demand in Tunisia. The extension of the data used by Ayadi et al. (2002) leads us to a non-stationary panel dataset which allows the application of panel cointegration tests and the FMOLS method to estimate the long-run water price elasticity in Tunisia. Our work confirms the results which claim that water tariffs can play an active role in conserving the precious resource in countries characterized by scarcity, volatility and low water quality like Tunisia.

ملخص

نستخدم في هذه الورقة تقنية مناسبة للاقتصاد القياسي لتحليل الطلب السكني على المياه في تونس. و قد قادتنا البيانات المستخدمة من قبل العيادي وآخرون (2002) الى مجموعة لوحات بيانية غير ثابتة مما يسمح بتطبيق اختبارات لوحات التكامل المشترك وطريقة FMOLS لتقدير مرونة سعر المياه على المدى الطويل في تونس. و تؤكد الدراسة النتائج التي تزعم أن تعريفة المياه يمكن أن تلعب دورا فاعلا في الحفاظ على الموارد الثمينة في البلدان التي تتميز بالتقلب، والندرة وتدني نوعية المياه مثل تونس.

1. Introduction

Tunisian water resources are characterized by acute scarcity, quality problems, bad distribution as well as time and space volatility. Tunisia, like other similar countries, is committed to manage the sustainability of this very limited resource to meet actual population needs, boost its fragile economy and above all preserve this strategic resource for the next generations.

Even if residential water demand is limited when compared to irrigation demand which monopolizes more than 80 % of total mobilized resources, it must be carefully managed for at least two reasons:

- First, residential water demand can only be satisfied by water of good quality (softness, purity, etc.). Paradoxically Tunisia's freshwater is very limited and located only in the extreme North West of the country.
- Second, residential water needs to be regular, secure and reliable especially during the dry season. Such constraints are difficult to satisfy in a country where variability is a nature.

So if Tunisia, like other similar countries, wants to avoid, or postpone reverting to non-conventional water (desalinization, virtual water, etc.) with relatively higher costs, the only alternative is to rely on appropriate water demand management. Water pricing must be seriously considered as a useful tool, along with other non-price instruments, such as awareness, education, water conservation and participatory management to keep the demand evolution under control. Indeed this demand is exponentially increasing as a result of the rapid urban and economic development of an emerging country like Tunisia, where all activities require more water quantity, with acceptable quality, available in the right time and place.

During the last five decades, residential water demand estimation has been actively researched through applied econometrics. Most of these studies have been done in developed countries, mainly the Unites States. We will mention, only for illustration, some of them [Howe and Lineaweaver (1967), Hewitt and Hanemann (1995), Foster and Beattie (1979), Chicoine and Ramamurthy (1986), Nieswiadomy and Molina (1989), Hansen (1996), Höglund (1997), Schefter and David (1985), Nauges and Thomas (2003), Martínez Espiñeira (2007), Martínez Espiñeira (2003)]. To our knowledge, there is no published study which applies the panel cointegration method to estimate water demand in Tunisia. Unfortunately, there are few studies on developing countries, essentially because appropriate data is missing. To this end we attempt to contribute empirically to the literature.

Thanks to this intensive research many problems have been currently resolved, but there are a lot more which need to be addressed. Some of the more difficult issues follow:

- Since many water scarce countries use non-linear tariffs to harness the demand, the choice of the right price variable (average price, marginal price, etc.) is necessary for achieving a good estimation.
- What are the real determinants of the household's behavior?
- What is the right data aggregation level to choose? The problem is that many important variables, like income, are not available at the microeconomic level especially for developing countries.
- What is the right econometric tool to take care of the real specificity of this kind of demand equation.

Tunisian water utility, SONEDE[1], uses non-linear pricing based on five brackets. So the first step will be to design the right decomposition. We will show that the best choice is to build a

[1] The water authority in TUNISIA.

two blocks tariff (a lower and an upper block). SONEDE has a rich database for the residential demand by district and season from 1980. The only limit to conducting an empirical investigation at a desegregated level is unfortunately the lack of appropriate income data.

Thanks to a Larequad[2] funding we were allowed the chance to benefit from a rich dataset on temperature and rainfall.

The main objective of this research is to provide the Tunisian water authority with more policy recommendations using an extended database compared to the one used by Ayadi et al. (2002). Those authors had conducted their empirical work on a semi-aggregated dataset covering the period 1980–1996. We extend this period to 2007. Since the Tunisian economy has radically changed, this extension introduces a structural change in the new dataset. The first step is analyzing the data to see if a structural change has in fact happened. Our preliminary results can be briefly summed up as:

- - The panel data considered by Ayadi et al. (2002) is stationary.
- - The new dataset (extended to 2007) is characterized by non-stationarity.

This structural change prevents us from using the same econometric techniques to estimate the price elasticity for Tunisian residential water demand. We must then look for the appropriate tools, which explicitly integrate the non-stationarity of our new time series, to derive adequate results with the rights properties.

Section 2 will present a description of our database. The new econometric techniques, which have been extensively developed during the last period and on which we will rely, are briefly surveyed in section 3. The empirical investigation, as well as the comments and the analysis of the main results are presented in section 4. Finally policy recommendations conclude the paper in section 5.

2. Data Description and Analysis

The database used by this work will cover the period 1980 –2007. The data has been collected by SONEDE since 1980, by bracket of consumption, quarter and district. SONEDE provides household consumption data for 13 brackets. We aggregate those into five brackets corresponding to those used for the five different tariff rates:

- - Bracket 1: 0–20 m^3 per connected household, per quarter,
- - Bracket 2: 21–40 m^3 per connected household, per quarter,
- - Bracket 3: 41–70 m^3 per connected household, per quarter,
- - Bracket 4: 71–150 m^3 per connected household, per quarter, and
- - Bracket 5: more than 150 m^3 per connected household, per quarter.
- Our sample is then composed of 112 quarterly observations on six regions:
- - Great Tunis **(GT)**, which includes Tunis and its suburbs.
- - North East of Tunisia **(NE)**,
- - North West of Tunisia **(NW),**
- - Center East of Tunisia **(CE),**
- - Center West of Tunisia **(CW)** and
- - South of Tunisia **(S).**

The analysis of figures 1 and 2 clearly reveals a stabilization of the consumption during the last few decades, which indicates a structural change that we will detect analytically.

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[2] Laboratory of research on development and quantitative economics.

After careful observation of the figures above, we will intuitively attempt for the moment, before confirming by objective analysis, to explain the long-run consumer's behavior.

- The smooth decrease of the fourth and the fifth brackets' average consumption is certainly the result of water tariffs which have rapidly increase during the last few years and perhaps to shifting to alternative resources such as pumping directly from a shallow aquifer.

- The stability of the lower brackets is certainly due to the inelasticity of water consumption as low income households are just barely satisfying their necessary needs.

Consequently the best way to conduct this research is to conduct our estimation on a two block decomposition, rather than on five brackets. We think that a complicated decomposition into five blocks will rather divert the consumer from rational behavior. The lower block will encompass the consumers of the first two brackets while the upper block will include the fourth and the fifth brackets.

3. Econometric Method

We begin by testing the panel unit roots then we implement the seven tests proposed by Pedroni (1999) to obtain the long-term relation between all the variables. We then use the full-modified OLS (FMOLS) technique to estimate the cointegration vector for heterogeneous cointegrated panels, which correct the standard OLS for the bias induced by the endogeneity and serial correlation of the regressors.

3.1 Panel Unit Root Tests

The Levin, Lin and Chu test (LLC thereafter) is the founding work in non-stationary panel data literature. The logic is inspired by that of Augmented Dicky-Fuller (ADF) test in time series. Thus, LLC tests the null hypothesis of $\delta = 0$ for all i, against the alternative of $\delta < 0$ in the following equation:

$$\Delta y_{it} = \delta \mathrm{y}_{\mathrm{i,t-1}} + \sum_{l=1}^{P_i} \theta_{\mathrm{ip}} \, \Delta y_{i,t-1} + \alpha_{mi} d_{mt} + u_{it}$$

Where $d_{1t} = \emptyset$, $d_{2t} = \{1\}$ and $d_{3t} = \{1, t\}$ are used to define the three ADF cases.

LLC propose a three-step procedure to implement their test. The adjusted statistic used here is:

$$\mathrm{t}_{\delta}^{*} = \frac{\mathrm{t}_{\delta} - \mathrm{N} \times \mathrm{std}(\delta) \times \mu_{\mathrm{m}\tilde{\mathrm{T}}}^{*} \times \hat{\sigma}_{\tilde{\varepsilon}}^{-2} \times \hat{\mathrm{S}}_{\mathrm{N}} \times \tilde{\mathrm{T}}}{\sigma_{\mathrm{m}\tilde{\mathrm{T}}}^{*}} \sim N(0,1)$$

With $\frac{\sqrt{N}}{T} \to 0$.

Where $\hat{\mathrm{S}}_{\mathrm{N}}$, $\mu_{\mathrm{m}\tilde{\mathrm{T}}}^{*}$ and $\sigma_{\mathrm{m}\tilde{\mathrm{T}}}^{*}$ are respectively the average standard deviation ratio calculated in the second step, the mean and standard deviation adjustments simulated by the authors for different order of m and time series dimension $\tilde{\mathrm{T}}$ (Levin et al. 2002)

The Im, Pesaran and Shin test (IPS thereafter) is formulated by the LLC equation when m=2 and δ_i varies across individual cross-sectional units.

Thus, IPS tests the null hypothesis of $\delta_i = 0$ for all I, against the alternative of $\delta_i < 0$ for $i = 1, \dots, N_1$ and $\delta_i = 0$ for $i = N_1$ +1,…,N.

With $N_1 \in\ ]0, N[$, $such\ as$ $\lim_{N \to \propto} ({N_1}/{N})= \delta$ $where$ $0 \le \delta \le 1$.

If $N_1 = 0$, we find the null hypothesis.

IPS proposes to use the average of the individual ADF statistics defined as:

$$\bar{\mathbf{t}}_{\mathbf{NT}} = \frac{\mathbf{1}}{\boldsymbol{N}}\sum_{\boldsymbol{i}=\mathbf{1}}^{\boldsymbol{N}} \mathbf{t}_{\mathbf{iT}}\,(\boldsymbol{P}_{\boldsymbol{i}}, \boldsymbol{\beta}_{\boldsymbol{i}})$$

$t_{iT}= (P_i, \beta_i)$ is the individual student statistic associated to the null hypothesis for a given lag order P_i and a vector of ADF coefficients $\boldsymbol{\beta_i} = (\boldsymbol{\beta_{i,1}}, \boldsymbol{\beta_{i,2}}, \ldots\ldots\ldots\ldots\ldots\ldots, \boldsymbol{\beta_{i,p_i}})'$

IPS uses the standard normal statistic Z.

$$\bar{\boldsymbol{Z}} = \left[\sqrt{\boldsymbol{N}}\,\frac{(\bar{\boldsymbol{t}}_{\boldsymbol{NT}} - \boldsymbol{E}(\boldsymbol{t}_{\boldsymbol{iT}}))}{\sqrt{\boldsymbol{var}(\boldsymbol{t}_{\boldsymbol{iT}})}}\right] \xrightarrow[\boldsymbol{N}\to\infty]{} \mathbf{N(0,1)}$$

Where the terms $E(t_{iT})$ and $var(t_{iT})$ are, respectively, the mean and variance of each statistic, and they are generated by simulations and are tabulated in IPS (1997).

3.2 Panel Cointegration Tests

After testing for stationarity of the variables, we turn to test for the existence of a long-run relationship among the variables. We apply the residual-based method developed by Pedroni (1999) where the cointegration rank is *a priori* known and equal to one. Thus, to test for the null of no cointegration in heterogeneous panels with multiple regressors, Pedroni (1999) considers the following regression;

$$\boldsymbol{y_{it}}=\boldsymbol{\alpha_i}+\boldsymbol{\delta_i}\,\boldsymbol{t} + \boldsymbol{\beta_{1i}}\boldsymbol{x_{1,it}}+\boldsymbol{\beta_{2i}}\boldsymbol{x_{2,it}}+\ldots\ldots+\boldsymbol{\beta_{Mi}}\,\boldsymbol{x_{M,it}}+\boldsymbol{\varepsilon_{it}} \qquad \textbf{Eq.(4)}$$

Where $i = 1, \ldots.., N\,, t = 1, \ldots.., T\ and\ m = 1, \ldots\ldots.., M.$

T, N and M refer to the time series dimension, the number of cross sectional regions and the number of regression variables, respectively. Pedroni (1999) develops asymptotic and finite sample properties of testing statistics to examine the null hypothesis of non-cointegration in the panel. The tests allow for heterogeneity among individual members of the panel.

Of the seven tests suggested by Pedroni, four are based on the within-dimension and three on the between-dimension. The two categories examine the null hypothesis of no cointegration in the panel. The first approach includes four statistics. They are panel m-statistic, panel q-statistic, panel PP-statistic, and panel ADF-statistic. These statistics pool the autoregressive coefficients across different members for the unit root tests on the estimated residuals. The second approach includes three statistics. They are group q-statistic, group PP-statistic, and group ADF-statistic. These statistics are based on estimators that simply average the individually estimated coefficients for each member.

Following Pedroni (1999), the heterogeneous panel and heterogeneous group mean panel cointegration statistics are calculated as follows:

Panel m-statistic:

$$\mathrm{T}^2\, \mathrm{N}^{3/2}\, \mathrm{Z}_{\mathrm{N,T},\hat{\nu}} \equiv \mathrm{T}^2\, \mathrm{N}^{3/2}(\textstyle\sum_{\mathrm{i=1}}^{\mathrm{N}} \sum_{\mathrm{t=1}}^{\mathrm{T}} \hat{\mathrm{L}}_{11\mathrm{i}}^{-2}\, \hat{\varepsilon}_{\mathrm{i,t-1}}^2)^{-1}$$

Panel q-statistic:

$$\boldsymbol{T}\,\boldsymbol{N}^{\mathbf{1}/2}\,\boldsymbol{Z}_{\boldsymbol{N},\boldsymbol{T}^{-1},\hat{\boldsymbol{\rho}}} \equiv \boldsymbol{T}\,\boldsymbol{N}^{\mathbf{1}/2}(\left(\sum_{\boldsymbol{i}=\mathbf{1}}^{\boldsymbol{N}}\sum_{\boldsymbol{t}=\mathbf{1}}^{\boldsymbol{T}} \hat{\boldsymbol{L}}_{\mathbf{11}\boldsymbol{i}}^{-\mathbf{2}}\,\hat{\boldsymbol{\varepsilon}}_{\boldsymbol{i},\boldsymbol{t}-\mathbf{1}}^{\mathbf{2}}\right))^{-\mathbf{1}}$$

$$\times\,(\sum_{\boldsymbol{i}=\mathbf{1}}^{\boldsymbol{N}}\sum_{\boldsymbol{t}=\mathbf{1}}^{\boldsymbol{T}} \hat{\boldsymbol{L}}_{\mathbf{11}\boldsymbol{i}}^{-\mathbf{2}}\,(\hat{\boldsymbol{\varepsilon}}_{\boldsymbol{i},\boldsymbol{t}-\mathbf{1}}\Delta\hat{\boldsymbol{\varepsilon}}_{\boldsymbol{it}} - \hat{\div}_{\boldsymbol{i}})$$

Panel PP-statistic:

$$Z_{tN,T} \equiv \left(\tilde{\sigma}^2_{N,T} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}^{-2}_{11i} \, \hat{\varepsilon}^2_{i,t-1} \right))^{-1/2}$$

$$\times (\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}^{-2}_{11i} \, (\hat{\varepsilon}_{i,t-1} \Delta \hat{\varepsilon}_{it} - \hat{\lambda}_i)$$

Panel ADF-statistic:

$$\tilde{Z}^*_{tN,T} \equiv (\left(\tilde{s}^{*2}_{N,T} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}^{-2}_{11i} \, \hat{\varepsilon}^{*2}_{i,t-1} \right))^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}^{-2}_{11i} \hat{\varepsilon}^*_{i,t-1} \, \Delta \hat{\varepsilon}^*_{i,t}$$

group q-statistic:

$$T \, N^{1/2} \, \tilde{Z}_{N,T^{-1},\hat{\rho}} \equiv T \, N^{1/2} \left(\sum_{i=1}^{N} (\sum_{t=1}^{T} \hat{\varepsilon}^2_{i,t-1} \right))^{-1}$$

$$\times (\sum_{t=1}^{T} (\hat{\varepsilon}_{i,t-1} \Delta \hat{\varepsilon}_{it} - \hat{\lambda}_i)$$

group PP-statistic:

$$N^{-1/2} \, \tilde{Z}_{N,T,t} \equiv N^{-1/2} \left(\sum_{i=1}^{N} (\hat{\sigma}^2_i \sum_{t=1}^{T} \hat{\varepsilon}^2_{i,t-1} \right))^{-1/2}$$

$$\times (\sum_{t=1}^{T} (\hat{\varepsilon}_{i,t-1} \Delta \hat{\varepsilon}_{it} - \hat{\lambda}_i)$$

group ADF-statistic:

$$N^{-1/2} \tilde{Z}^*_{tN,T} \equiv N^{-1/2} (\left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{S}^{*2}_i \, \hat{\varepsilon}^{*2}_{i,t-1} \right))^{-1/2}$$

$\times (\sum_{t=1}^{T} \hat{\varepsilon}^*_{i,t-1} \, \Delta \hat{\varepsilon}^*_{i,t})$

Where $\hat{\varepsilon}_{it}$ is the estimated residual from equation (4) and $\hat{L}^2_{11i}$ is the estimated long-run covariance matrix for $\Delta \hat{\varepsilon}^*_{i,t}$ .Similarly $\hat{\sigma}^2_i$ and $\hat{S}^{*2}_i$ $(\tilde{s}^{*2}_{N,T})$ are, respectively, the long-run and contemporaneous variance for individual *i*. The other terms are properly defined in Pedroni (1999) with the appropriate lag length determined by the Newey-West method. All seven tests are distributed as being standard normal asymptotically. This requires a standardization based on the moments of the underlying Brownian motion function. The panel m-statistic is a one-sided test where large positive values reject the null of no cointegration. The remaining statistics diverge to negative infinitely, which means that large negative values reject the null. The critical values are also tabulated by Pedroni (1999).

4. Empirical Estimation, Comments and Analysis of the Main Results

We begin our empirical estimation by testing the stationarity of our main variables, namely:

- - Quarterly data for average water consumption (C),
- - Water average prices (P),
- - Income (R), (this variable is constructed from the expenditure surveys by the National Statistics Institute),

- - Rainfall (RL), and
- - Network expansion (ER)

We begin by testing the panel unit roots for the used data by Ayadi et al. (2002) . Table 1A presents those results. We can clearly see that for the sample from 1980 to 1996, the variables C, P, ER and RL are stationary for the two blocks.

We then test the panel unit roots for the extended sample to 2007. Table 1B presents the results obtained. We see that all the variables are not stationary for the two blocks. We mention that only the upper block income variable is I (2), while all the others variables are I(1).

The results in Table1, lead us to test the relationships between water consumption (C) and its determinants (P, R, ER and RL). The seven tests proposed by Pedroni (1999) are implemented. We obtain, without ambiguity, a long-term relation between all the variables for the two blocks. All the statistics significantly reject the null hypothesis of no cointegration. The main results are reported in Table 2.

We then conduct our individual and panel group estimation by FMOLS. The main results obtained by our estimations are summarized in Table 3.

As we see from this table, the results are rather good and in accordance with the intuitions and theoretical requirements. To soundly summarize the analysis of the estimations presented above, we can put forward the following:

- All price elasticities have the right sign and are significant (with only one exception).
- The water prices for the lower block are inelastic, as expected, while those for the upper block are rather elastic.
- The estimations are comparable to the results obtained in other similar works.
- The income elasticities have the right sign but are generally non-significant. This is due to the weakness of our income data.
- The impacts of rainfall on the Tunisian water demand are import for all the regions and for the two blocks.
- The network extension effects are significant but weak. This is due to the fact that the Tunisian water network, after a rapid expansion, is now becoming stable.
- The estimations with the panel data are good and confirm the previous ones.
- The price elasticities are different between the six regions. This difference is related to the climate effect. The results of this estimation clearly demonstrate that a water demand model can't be estimated without the climate variable.
- It is important to mention that the elasticities obtained here —which rely on extended data and a new econometric technique— are rather similar to those obtained by Ayadi et al. (2002). It follows that the price elasticities of Tunisian water demand are now well estimated and can thus be relied on to design appropriate recommendations for the decision makers in this strategic sector.

5. Policy Recommendations

Our results show that water demand management must be considered seriously in Tunisia as well as in the similar regions. For the upper block, appropriate pricing will lead to a reduction in water consumption and better conservation of this scarce and precious resource. However the pricing instrument must be combined with non-price instruments such as water conservation and participatory allocations. The best way is to design a toolkit of integrated measures which properly combines price and non-price instruments. For the lower block—which is essentially composed of low income households characterized by inelastic water demand—all tariff increases will certainly deteriorate this block's wellbeing. Indeed this category has the opportunity to satisfy only the essential needs and cannot possibly reduce water consumption any further even at the price of impoverishment.

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Figure 1: Annual Average Water Consumption by Area

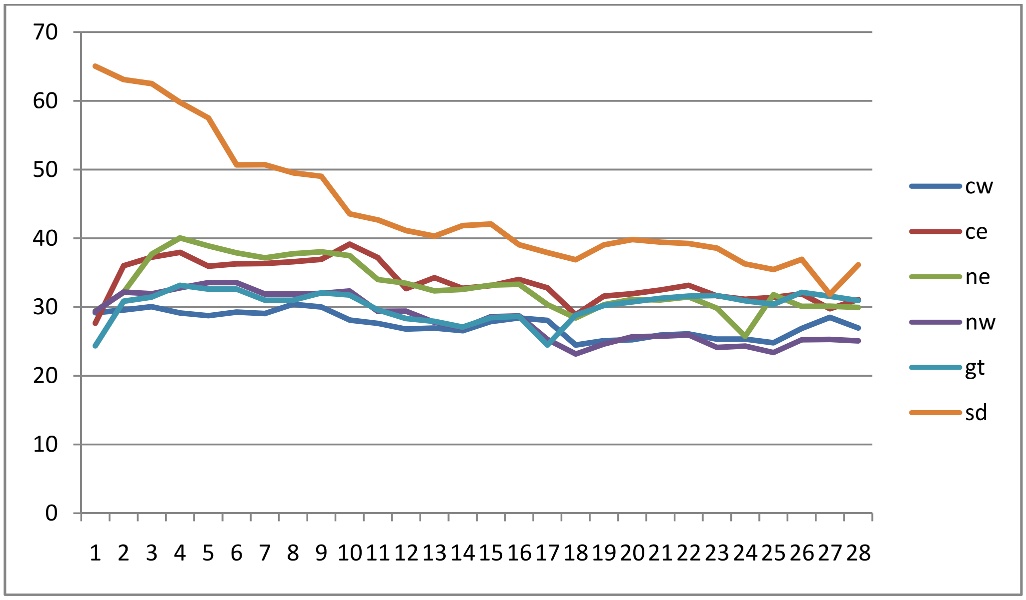

Figure 2: Annual Average Water Consumption by Bracket

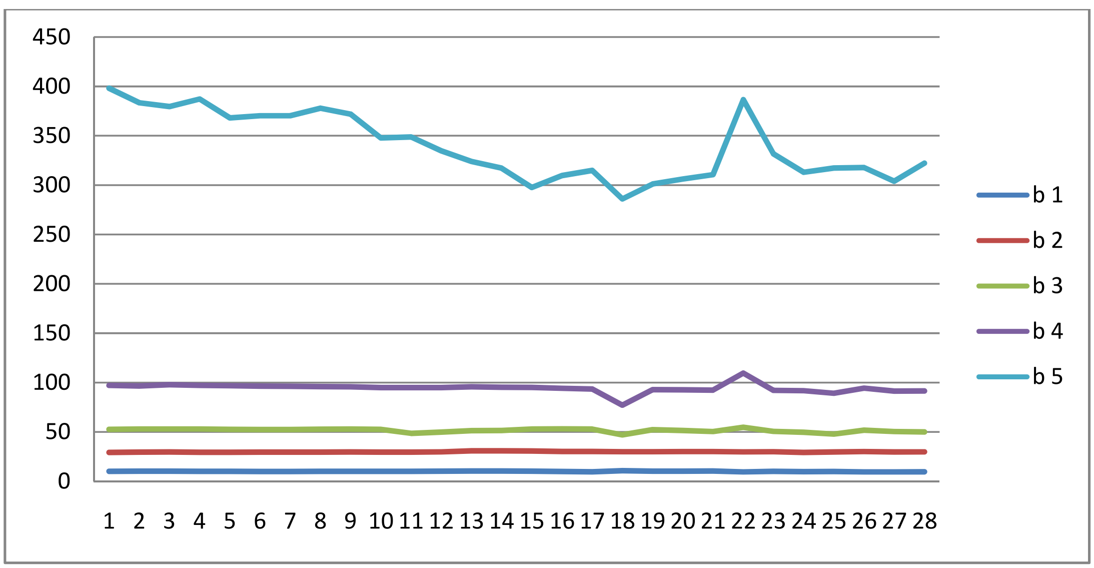

Table 1A: Panel Unit Root Tests for the Sample (1980-1996)

	Lower bloc				*Upper bloc*			
	LLC		IPS		LLC		IPS	
	Trend	noTrend	Trend	noTrend	Trend	noTrend	Trend	noTrend
C	-12.87	-14.19	-	-	-10.29	-2.86	-	-
P	-13.38	-5.22	-	-	-2.61	1.63	-	-
R	-0.68*	1.21*			-0.66*	0.87*		
ER	-7.23	-0.50			-13.80	-12.33		
RL	-5.45	-4.36			-5.45	-4.36		

*accepte the null of unit root at the 5% level.

The variables are in natural logarithms.

Table 1B: Panel Unit Root Result

	Lower bloc				*Upper bloc*			
	LLC		IPS		LLC		IPS	
	Trend	noTrend	Trend	noTrend	Trend	noTrend	Trend	noTrend
C	-2,21*	-1,9	-3,31*	-4,09*	-7,07*	-0,51	-10,9*	-0,81
P	-4,93*	-0,19	-6,22*	-0,22	1,94	-0,49	4,17	-0,67
R	-0,97	0,94	-1,06	1,04	2,61	3,59	1,66	0,71
ER	0,28	1,99	1,2	2,65	-0,48	1,04	-0,01	1,16
RL	-0,84	-1,18	-1,21	-1,91				
ΔC	-27,4*	-25,7*	-39,6*	-39,8*	-16,06*	-19,2*	-26,7*	-25,6*
ΔP	-14,3*	-12,6*	-23,6*	-26,5*	-16,5*	-17,2*	-27,9*	-22,8*
ΔR	-17,01*	-17,56*	-28,1*	-29,2*	-1,06	-2,1*	-1,2	-4,7*
ΔER	-11,16*	-13,6*	-14,3*	-14,9*	-18,03*	-21,7*	-24,1*	-23,7*
ΔRL	-18,57*	-18,1*	-31,2*	-30,56*				

* Rejects the null of panel unit root at the 5% level.

The variables are in natural logarithms.

Table 2: Panel Cointegration Tests Results

$C_{it}=\alpha_i+\delta_i t+\beta_{1i}P_{it}+\beta_{2i}R_{it}+\beta_{3i}ER_{it}+\beta_{4i}RL_{it}+\varepsilon_{it}$				
	Lower bloc		Upper bloc	
	Trend	no Trend	Trend	no Trend
Pedroni[1999] cointegration tests				
Panel m	1,9	3,6	4,1*	5,8*
Panel q	-14,6*	-15,9*	-21,8*	-23,6*
Panel PP	-17,2*	-16,4*	-20,8*	-19,1*
Panel ADF	1,3	0,5	-18,8*	-15,6*
Group q	-14,2*	-16,5*	-21,9*	-25,3*
Group PP	-18,8*	-19,4*	-23,4*	-23,3*
Group ADF	2,3	1,4	-19,8*	-17,4*
* Rejects the null hypothesis at the 1% level.				
The variables are in natural logarithms				

Table 3: FMLOS Estimates

dep.vari	C^L : *lower bloc*				C^U : *upper bloc*			
	LP^L	LR^L	LER^L	LRL^L	LP^U	ΔLR^U	LER^U	LRL^U
INDIVIDUAL FMOLS RESULTS								
CW	-0,15*	0,22*	-0,22**	-0,03*	-0,27*	0,7**	-0,14*	-0,03*
	(-2,23)	(2,54)	(-1,61)	(1,94)	(-10,3)	(1,5)	(-6,5)	(2,18)
CE	-0,1*	0,08*	-0,1	-0,005*	-0,3*	0,001	-0,12*	-0,02**
	(-1,97)	(2,02)	(-1,26)	(-0,62)	(-11,9)	(0,03)	(-4,8)	(-1,72)
NE	-0,1*	0,12	-0,04	-0,005	-0,35*	0,27	-0,14*	-0,01*
	(-1,82)	(1,26)	(-0,46)	(-0,56)	(-18,4)	(0,48)	(-8,5)	(-1,82)
NW	-0,25*	0,26*	-0,06	-0,03**	-0,46*	0,1	-0,23*	-0,07*
	(-3,64)	(2,52)	(-0,4)	(-1,77)	(-7,4)	(0,1)	(-5,1)	(-1,8)
S	-0,04	0,004	-0,23*	-0,01**	-0,32*	0,02	-0,2*	-0,02*
	(-0,8)	(0,04)	(-2,27)	(-1,73)	(-11,2)	(0,01)	(-7,2)	(-1,81)
GT	-0,08*	0,01	-0,07*	-0,02*	-0,24*	0,1	-0,02	-0,02*
	(-2,22)	(0,37)	(-1,87)	(-5,48)	(-6,23)	(0,2)	(-0,86)	(2,85)
PANEL GROUP FMOLS RESULTS								
Panel (without trend)	-0,12*	0,12*	-0,12*	-0,008*	-0,32*	0,2	-0,14*	-0,01
	(-5,18)	(3,57)	(-3,22)	(-3,35)	(-26,8)	(0,96)	(-13,5)	(-0,86)
Panel (with trend)	-1,4*	0,06*	0,01	0,001	-1,09*	0,08*	-0,11*	-0,1
	(-87,7)	(3,46)	(-0,22)	(-1,7)	(-4,7)	(2,1)	(-4,1)	(-0,16)
* Indicate statistical significance at the 5% level.								
t-value in parenthesis.								
The variables are in natural logarithms								