

Persistency and Convergence among EMP Countries: a Semi-parametric Approach

*Persistenza e Convergenza nei Paesi del PEM:
un Approccio Semi-parametrico*

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Riassunto: Il lavoro riguarda il processo di convergenza dei paesi appartenenti al partenariato Euro-Mediterraneo nel periodo 1980-1999. Per la misura della convergenza viene proposto un indicatore ed una matrice di “persistenza” che rappresentano, in modo sintetico, il risultato di un algoritmo di classificazione. L’informazione fornita dalla matrice di persistenza viene ridotta successivamente in una tabella “di mobilità”, a partire dalla quale vengono stimati alcuni modelli loglineari utilizzati per verificare l’ipotesi di convergenza tra i paesi.

Keywords: persistency matrix, log-linear models

1. Introduction

The concept of countries (or regions) disparities is intrinsically linked to convergence, which is the tendency of lower income countries to exhibit higher growth rates of per-capita income. The most common statistical measure of convergence, based on cross-section regressions of growth rates on initial levels (absolute convergence), has been largely criticized. The main argument is that this test turns out to be plagued by Galton’s classical fallacy of regression towards mean (Quah, 1993). Furthermore, a strong empirical evidence suggests that convergence could be conditional rather than absolute; this argument implies to consider other variables in addition to per capita output. In this paper we propose an alternative method to measure convergence through a “persistency matrix”, built on the basis of several relevant variables. This tool is initially adopted as an alternative to regression-based cross-sectional analysis. After reducing the information of the matrix to four categories, some log-linear models were estimated in order to make inference. The exercise concerns some of the countries belonging to Euro-Mediterranean Partnership (EMP), chosen in order to test the effects of the agreements on reducing gaps among heterogeneous contexts.

2. The measure of “persistence”: a proposal

Only 20 among the 27 countries agreeing to EMP were chosen, due to the availability in the period 1980-1999 of five indicators, concerning the overall economic performance and the relationships with foreign economies ⁽¹⁾. Ward’s hierarchical agglomerative cluster method was then applied to standardized variables, to obtain a clustering of countries useful for successive classifications in each year; the linkage distance, the same for each year, was chosen on the basis of empirical evidence (we tried to obtain five clusters per year), and it is equal to 4. It is clear that the more per-capita differences on variables performances reduce, the more the countries will be part of the same cluster placed under the cutting line.

The frequency in which two countries i and j (among the N considered) are present in the same year (x_{ij}) is then reported in the cell of (i, j) coordinate (and also (j, i) due to transitivity) of a (consequently) symmetric $N \times N$ matrix, whose principal diagonal contains the frequencies of years in which a cluster is made of only one country. To obtain a matrix expressing the “degree of persistency ⁽²⁾” of two countries in the same cluster through a value included in the interval $[0, 1]$ ⁽³⁾, we normalized each frequency as regards to the total number of years of considered time interval (20). A general synthetic index to evaluate the “degree of persistency” of countries in the same cluster is then given by:

$$\psi = \sum_{i=1}^k \sum_{j \neq i=1}^k (x_{ij} + x_{ji}) / k(k-1) \quad (1)$$

where “ k ” is the order of a principal submatrix, obtained considering the k countries whose persistence in the same cluster has to be tested. As before, the resulting value is included in the interval $[0, 1]$. Two matrices were calculated on two intervals of the whole 1980-1999 period. The first one concerns the period 1980-1992, in order to catch the effects of the foreign debt of poor countries’ crisis; the second one (1992-1999) relates to the first Euro-Mediterranean agreements and to Barcelona Conference (1995), to evaluate the effects of international policies on non-EU Mediterranean countries (see table 1). The resulting matrices were used to elaborate four categorical variables created on the basis of ψ values of 210 statistical units (200 couples plus 10 units of the principal diagonal); each category qualifies the persistency of units in the time interval. Thus each one corresponds to particular values of ψ : specifically, we have “Often” ($1 \leq$

⁽¹⁾ From the 2001 *World Development Indicators* database we extracted, in addition to per capita GDP (from *GDP, constant 1995 US\$* indicator) conventionally used in convergence analysis, *Genuine domestic savings* (per capita gross domestic savings plus education expenditure less natural resources depletion, *Labor force, total* and *Population, total* ratio (activity rate), *Foreign direct investment, net inflows (BoP, current US\$)* (per capita foreign direct investments), *Exports of goods and services (constant 1995 US\$)* and *Imports of goods and services (constant 1995 US\$)* ratio (net exports).

⁽²⁾ From an economic point of view, the tendency of countries to be part of the same group is a significant indication of the reduction of economic differences, so that we can evaluate these information as “convergence”, according to the neoclassical concept (Barro and Sala-i-Martin, 1992; Pellegrini, 2001; Arbia *et al.*, 2002).

⁽³⁾ “0” is the case of absence of persistency in the considered interval, while “1” indicates a persistency in each of the considered years.

$\psi \leq 0.6$), “Sometimes” ($0.6 < \psi \leq 0.3$), “Rarely” ($0.3 < \psi \leq 0$), “Never” ($\psi = 0$). Information of the two matrices was then reduced in a squared contingency table that considers the four categories (table 2). Therefore the matrix contains two variables (status in period 1980-1992 and status in the period 1993-1999) with the same modalities. This “mobility matrix” highlights in dynamic terms the attitude of the countries to be “part of the same group”.

Table 1: Persistency matrices for 1980-1992 and 1993-1999

80-92	ALG	EGY	JOR	ISR	MOR	SYR	TUN	AUS	BEL	DEN	FIN	FRA	GRE	IRE	ITA	NET	POR	SPA	SWE	UK
ALG		0,46	0,23	0,38	0,69	0,31	0,69						0,23							
EGY	0,46		0,77	0,31	0,15	0,62	0,15						0,08							
JOR	0,23	0,77		0,46	0,08	0,69	0,08						0,08							
ISR	0,38	0,31	0,46		0,54	0,38	0,54						0,31	0,08	0,08		0,08			0,08
MOR	0,69	0,15	0,08	0,54		0,08	1,00					0,08	0,46	0,23	0,15		0,15	0,08		
SYR	0,31	0,62	0,69	0,38	0,08	0,08	0,08													
TUN	0,69	0,15	0,08	0,54	1,00	0,08						0,08	0,46	0,23	0,15		0,15	0,08		
AUS									0,08	0,85	0,92	0,77	0,23	0,15	0,15	0,15	0,15	0,15	0,85	0,15
BEL								0,08	0,08	0,15	0,08	0,15	0,08	0,08	0,08	0,69	0,08	0,08	0,15	0,62
DEN								0,85	0,15		0,92	0,62		0,08	0,08		0,08		1,00	0,08
FIN								0,92	0,08	0,92		0,69	0,15	0,15	0,08	0,15	0,08	0,92	0,15	
FRA					0,08		0,08	0,77	0,15	0,62	0,69		0,23	0,54	0,46	0,15	0,31	0,46	0,62	0,08
GRE	0,23	0,08	0,08	0,31	0,46	0,46	0,46		0,08			0,23		0,46	0,69		0,62	0,54		0,08
IRE				0,08	0,23	0,23	0,23	0,23	0,08	0,08	0,15	0,54	0,46		0,77	0,15	0,62	0,69	0,08	0,08
ITA				0,08	0,15	0,15	0,15	0,15	0,08	0,08	0,15	0,46	0,69	0,77		0,08	0,85	0,77	0,08	0,15
NET						0,15	0,69		0,08	0,15	0,08	0,15	0,08	0,15	0,08	0,08	0,08	0,23		0,77
POR				0,08	0,15	0,15	0,15	0,15		0,08	0,15	0,31	0,62	0,62	0,85	0,08		0,77	0,08	0,31
SPA					0,08	0,08	0,08	0,15	0,08		0,08	0,46	0,54	0,69	0,77	0,23	0,77			0,23
SWE						0,85	0,15	1,00	0,92	0,62	0,92	0,08	0,08	0,08	0,08		0,08			0,08
UK				0,08		0,15	0,62	0,08	0,15	0,08	0,15	0,08	0,08	0,08	0,15	0,77	0,31	0,23	0,08	

92-99	ALG	EGY	JOR	ISR	MOR	SYR	TUN	AUS	BEL	DEN	FIN	FRA	GRE	IRE	ITA	NET	POR	SPA	SWE	UK
ALG		0,71	0,71	0,29	0,29	0,71	0,29						0,29							
EGY	0,71		0,43	0,57	0,57	0,43	0,57						0,57				0,14			0,14
JOR	0,71	0,43				1,00														
ISR	0,29	0,57			0,86		0,86						0,86				0,43			0,29
MOR	0,29	0,57		0,86		0,14	1,00						1,00				0,43			0,29
SYR	0,71	0,43	1,00		0,14		0,14						0,14							
TUN	0,29	0,57		0,86	1,00	0,14							1,00				0,43			0,29
AUS											0,29	1,00		0,43	0,86	0,29	0,57	1,00		0,71
BEL									0,14	0,57	0,29			0,57		0,71			0,71	
DEN									0,57		0,71			0,29		0,43			0,86	
FIN								0,29	0,29	0,71		0,29		0,57	0,29	0,43		0,29	0,57	0,14
FRA								1,00			0,29			0,43	1,00	0,29	0,57	1,00		0,71
GRE	0,29	0,57		0,86	1,00	0,14	1,00										0,43			0,29
IRE								0,43	0,57	0,29	0,57	0,43			0,43	0,86	0,14	0,43	0,43	0,29
ITA								0,86			0,29	1,00			0,43	0,29	0,57	1,00		0,71
NET								0,29	0,71	0,43	0,43	0,29		0,86	0,29		0,14	0,29	0,57	0,14
POR		0,14		0,43	0,43		0,43				0,57	0,43	0,14	0,57	0,14	0,14	0,57			0,86
SPA								1,00			0,29	1,00	0,43	1,00	0,29	0,57	0,57			0,71
SWE									0,71	0,86	0,57			0,43		0,57				
UK		0,14		0,29	0,29		0,29	0,71			0,14	0,71	0,29	0,29	0,71	0,14	0,86	0,71		

3. Log-linear analysis as a test of convergence

The contingency table 2 explains the attitude of a statistical unit, categorized as belonging to the i modality at the first period (A), to belong to j modality in the second period (B). In order to evaluate the log of expected frequencies ($\log f_{ij}$) two log-linear models were estimated, beyond the saturated model: the pure symmetry and the quasi-symmetry (Agresti, 1990). As shown (table 3), the quasi-symmetry model fits data better: considering the difference between the marginal frequencies ($f_{i.} \neq f_{.j}$), the expected attitude of countries to cluster according to a “positive” direction (for example, “rarely” in the first period and “often” in the second) will happen with the same frequency of that with “negative” direction (i.e., “often” – “rarely”). We can conclude that no convergence patterns can be then detected for EMP countries. At a first look,

this suggests that growth and integration policies in Mediterranean basin have to be improved to get a significant gap reduction among economic performances of the countries.

Table 2: Observed frequencies

1980-1992	1993-1999			
	<i>Often</i>	<i>Sometimes</i>	<i>Rarely</i>	<i>Never</i>
<i>Often</i>	7	6	5	3
<i>Sometimes</i>	7	3	1	6
<i>Rarely</i>	12	15	18	29
<i>Never</i>	0	2	5	91

Table 3: Expected frequencies under pure-symmetry model and quasi-symmetry model

1980-1992	1993-1999			
	<i>Often</i>	<i>Sometimes</i>	<i>Rarely</i>	<i>Never</i>
<i>Often</i> (sat)	7	6	5	3
<i>Often</i> (p-s)	7	3,89	4,11	6
<i>Often</i> (q-s)	7	6	3,2	4,8
<i>Sometimes</i> (sat)	7	3	1	6
<i>Sometimes</i> (p-s)	3,36	3	4,32	6,32
<i>Sometimes</i> (q-s)	7	3	2,8	4,2
<i>Rarely</i> (sat)	12	15	18	29
<i>Rarely</i> (p-s)	13,65	16,67	18	25,68
<i>Rarely</i> (q-s)	11,17	15,83	18	29
<i>Never</i> (sat)	0	2	5	91
<i>Never</i> (p-s)	1,99	2,44	2,82	91
<i>Never</i> (q-s)	0,81	1,17	5	91

<i>Goodness of fit</i>	Likelihood Ratio		DF
	sat	0	0
	p-s	16,3971	5
	q-s	6,1039	2

<i>Pure-symmetry model</i>		<i>Quasi symmetry model</i>	
$\log f_{ij} = \mu + \lambda_i^A + \lambda_j^B + \lambda_{ij}^{AB}$	$(\lambda_{ij} = \lambda_{ji})$	$\log f_{ij} = \mu + \lambda_i^A + \lambda_j^B + \lambda_{ij}^{AB}$	$(i,j = 1,2,\dots, I)$
$\lambda_i^A = 0; \lambda_{ij}^{AB} = 0 \quad \forall j$		$\lambda_i^A = \lambda_j^B = \lambda_{ij}^{AB} = 0$	
		$\lambda_{ij}^{AB} = \lambda_{ji}^{AB}$	

Notes: sat = saturated model; p-s = pure-symmetry model; q-s = quasi-symmetry model; A = first period; B = second period.

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