

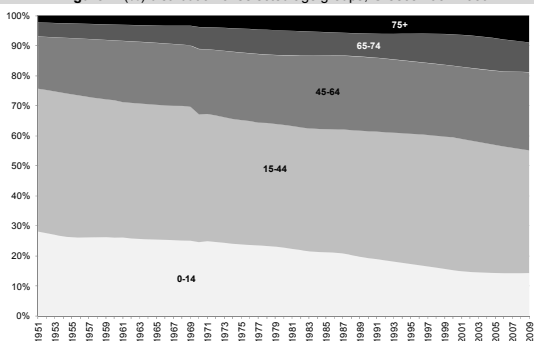
Regional dynamics of population ageing in Greece, 1981-2001

Michail AGORASTAKIS & Zacharoula MICHOU
 Laboratory of Demographic & Social Analyses, University of Thessaly

1. Introduction

During the postwar period, south European countries (Italy, Greece, Spain, and Portugal) have experienced remarkable demographic trends leading to an equally remarkable rapid population ageing (Tomassini & Lamura, 2009). In this paper we focus on Greece, from the beginning of the 80s as starting point since, at least at national level, completed its demographic transition, entering a **period of falling below-replacement level fertility** accompanied by low overall mortality, which both continue up to nowadays. In Greece, the number of old persons (aged 65+ years) has **doubled** in 20 years (1951-1973) and **quadrupled** in 60 years (1951-2009), *figure 1*. The older population grows faster than the total population as well as the young population (aged 0-14 years), especially since the 90s. **Ageing index** notes values close to 50% in the beginning of the 80s, 65% in 90s and above 100 in 2000s.

Figure 1: (%) distribution of selected age groups, Greece 1951-2009



Ageing trends can also be seen in regional as well as in national level. However, ageing process is dissynchronous among Greek regions due to differentiated past and contemporary trends of **fertility** (Kotzamanis & Sofianopoulou, 2007), **mortality** (Agorastakis, 2012) and **migration** (both external (Kotzamanis et al., 2006) and internal (Michou, 2009)).

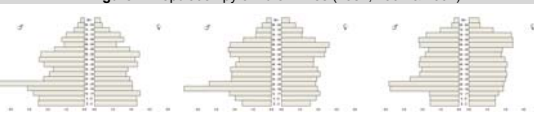
In this paper we aim to address the following issues: firstly, the **geographic variations of population ageing** within three successive census years (1981-1991-2001) among 51 Greek departments and secondly, the **dynamics of population ageing** by determining the pace of ageing process for the intermediate periods 1981-1991 and 1991-2001, as well as a whole (1981-2001).

2. Data & Methods

Population census data by sex and 5-year age groups were provided by the National Statistical Service of Greece (ELSTAT) for 1981, 1991 and 2001; corresponding to two spatial scales: i) country as a total and ii) 51 regions (departments, NUTS level 3). Before proceeding to the methodological part of this paper, issues regarding **data quality** and **peculiarities** originating, firstly, from census data *per se* and, secondly, from the ability of certain regions to attract individuals of specific age group and sex (strong selectivity effect), should be addressed.

Specifically, during the given period (1981-2001), neither census results nor population definitions derived or were uniformly, respectively. The 1981 *de facto* population census results were based on a **10% sample** of total households, while the later two successive censuses (1991,2001) were based on the **total number** of households. Additionally, usual resident population was introduced in 1991. The change of population definition, although insignificant at national level, is a matter of great consequence when lower spatial scales are considered. Especially in Greece, a paradox was observed during the census day concerning the last three censuses. A substantial mobility, from the urban to the rural areas of the country was taking place, reflecting opposite streams of past internal migration flows; resulting in altering the population size and structure, both in place of origin and destination. Subsequently, the lower the spatial scale, the higher the degree of alteration and greater the difference between *de facto* and usual resident population. This **paradox** has small effect upon the selected spatial scale(departments) regarding 1981 census, however corresponding data and results should be treated with caution; while for 1991 and 2001 usual resident population data by age and sex were used. The second issue can be clearly seen in *figure 2*, where the population pyramid of Evros department is presented. The **excess of males** aged between 15 and 24 years is attributed to the presence of military to a small number of departments, mostly eastern island departments (Samos, Chios) and northern Greece (Kilkis, Evros). Since military service (a duration of 9 months) is still obligatory for males in Greece, soldiers are enumerated as part of the usual resident population. In our analysis we focus on the overall shape of the pyramids of those departments by ignoring the aforementioned age and sex selective phenomenon.

Figure 2: Population pyramid of Evros (1981, 1991 & 2001)



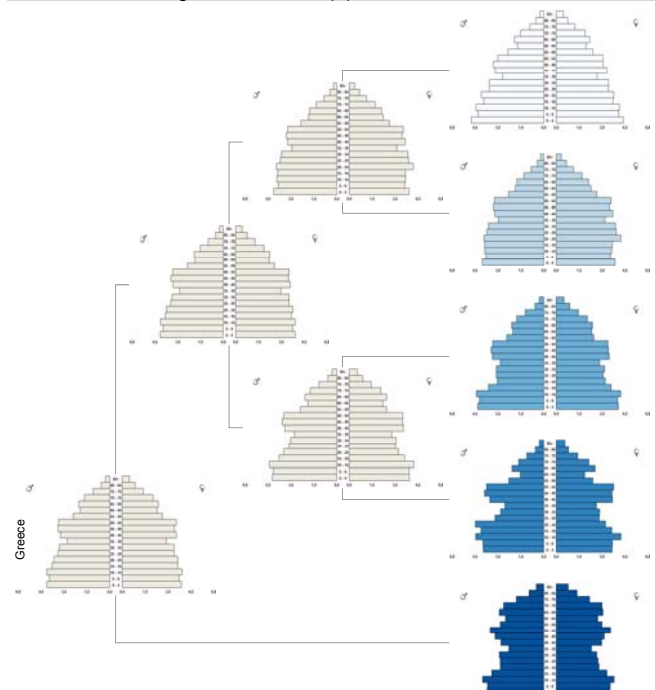
In order to study the level and geographic variations of population ageing within each census year, typologies through classification of the relative size age-sex population structures (i.e. percent population pyramids) of the 51 departments were derived, based on a modified version of Korenjack et al. (2008) methodology. Although, statistical analysis remained the same, namely **hierarchical cluster analysis** using Ward's method, **additional variables** were introduced, in order to account for differences between successive age groups. The new variables were equal to: $sP_0 - c$, where c is a random constant and sP_0 was the percentage of population aged 0 to 4 years over the total population; for the remaining age groups we calculated their successive differences for example $sP_{10} - sP_5$, $sP_{15} - sP_{10}$ etc., separately for males and females per census year. The derived clusters (profiles of relative size population structures) 5 for 1981 and 1991, and 4 for 2001, were represented by their corresponding aggregated population pyramids of the departments per cluster.

The above yearly profiles are summarized (using apart from the overall age structure also the median age as well as the difference between mean and median age) into a second typology for the whole period (1981-2001) and by taking into account similar or different pathways (stability or shifting) of population ageing type according to the initial state of the population pyramid (1981); we determine the differentiated pace of ageing process among regions.

3. Geographic variations of population ageing

The yearly profiles (1981-1991-2001) of population structures are represented in a form of dendrogram (*figures 3, 4, 5, respectively*), with country's population pyramid at the top row. Clusters (profiles) are represented to *Maps 1, 2 and 3*, while additional information to *Tables 1, 2 and 3*.

Figure 3: Classification of population structures 1981



Map 1: Clusters of population structures 1981

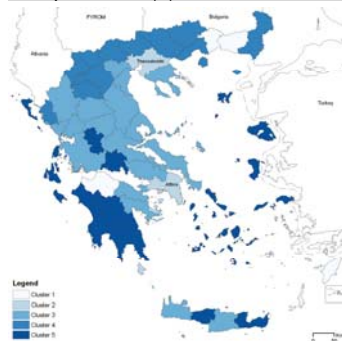


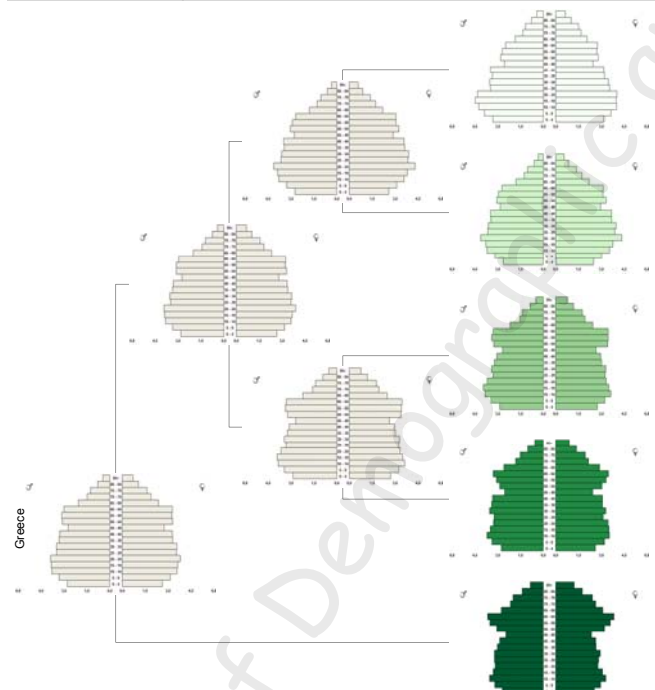
Table 1: Clusters 1981

	1	2	3	4	5
#	7	2	16	11	15
(%)	7.84	3.92	35.28	21.87	21.07
Population	160,803	862,412	648,943	268,718	265,375
0-14	255,120	1,866,212	991,179	442,080	404,505
15-44	128,967	964,873	607,964	259,305	291,916
45-64	363,717	2,831,085	1,578,863	703,037	696,621
65+	71,589	448,210	342,106	147,884	228,589
75+	25,411	154,279	128,646	53,878	50,783
85+	4,468	23,497	21,323	8,880	15,587
Total	618,670	4,346,187	3,279,972	1,118,461	1,166,395
Mean Age	26.88	22.70	28.28	34.63	32.39
Median Age	41.36	44.01	36.55	36.27	33.39
Δ (mean-median)	20.86	22.76	22.86	21.18	26.49
15-44	62.24	66.77	61.41	62.79	68.47
65+	11.68	10.68	10.21	12.21	19.24
75+	4.12	3.64	3.00	4.79	7.43
85+	0.71	0.55	0.63	0.88	1.26
Total	6.58	46.49	62.65	48.45	100.20
Mean Age	33.65	34.66	35.55	35.59	36.33
Median Age	31.00	32.59	33.98	33.96	36.48
Δ (mean-median)	2.65	2.07	1.58	1.63	-1.15
Ageing index	44.77	46.41	52.65	55.03	66.29
Young dependency ratio	41.91	33.99	41.17	38.28	38.13
Elderly dependency ratio	18.70	15.78	21.67	21.07	32.80

Cluster 1: Relative young structure, wide base, 3 out of 10 belong to 0-14 age group, 1 out of 10 belong to 65+ age group, Δ(mean - median) 2,85 years - Dispersed geography, northern departments with Muslim population.
Cluster 2: Mature, moderate base, 2 out of 10 belong to 0-14 age group, 1 out of 10 belong to 65+ age group, Δ(mean - median) 2,07 years - Main urban centers Attica & Thessaloniki.
Cluster 3: Mature with irregularities (deficit of 1942-1966 cohorts), wide base, 3 out of 10 belong to 0-14 age group, 1 out of 10 belong to 65+ age group, Δ(mean - median) 1,57 years - Majority of mainland departments & Crete (35%).

Cluster 4: Mature with irregularities (deficit of 1942-1966 cohorts), moderate base, 1 out of 4 belong to 0-14 age group, 1 out of 10 belong to 65+ age group, Δ(mean - median) 1,63 years - Zoning across northern Greece.
Cluster 5: Ageing with irregularities (deficit of 1932-1966 cohorts), moderate base, 2 out of 10 belong to 0-14 age group, 2 out of 10 belong to 65+ age group, Δ(mean - median) -0,15 years - South mainland Greece and islands.

Figure 4: Classification of population structures 1991



Map 2: Clusters of population structures 1991

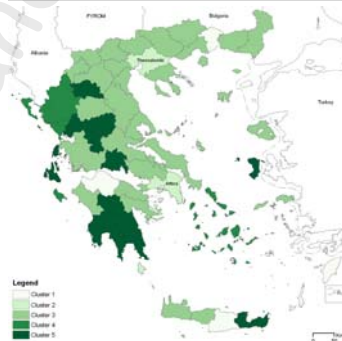


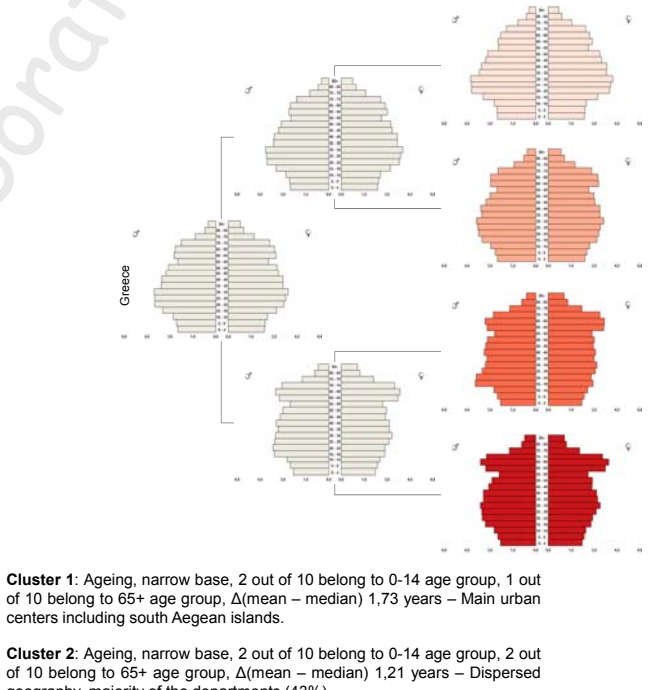
Table 2: Clusters 1991

	1	2	3	4	5
#	7	3	27	4	12
(%)	7.84	3.92	62.84	11.76	23.63
Population	181,564	848,744	700,500	92,567	148,539
0-14	209,686	2,076,479	1,417,074	191,860	200,516
15-44	83,343	1,180,569	1,336,907	307,732	409,378
45-64	173,447	1,102,120	909,323	119,866	208,862
65+	101,914	1,528,574	1,516,439	69,851	104,689
75+	45,278	217,869	229,382	35,275	78,475
85+	1,361	40,109	41,268	1,858	16,169
Total	458,535	2,489,438	2,126,282	289,324	531,837
Mean Age	39.74	34.09	32.89	32.59	28.37
Median Age	78.72	63.46	62.07	61.34	49.34
Δ (mean-median)	116.68	127.76	109.44	106.40	95.69
15-44	37.96	44.27	42.77	40.06	48.92
65+	22.39	21.63	24.29	27.84	31.81
75+	9.91	8.74	10.79	12.20	15.04
85+	1.92	1.84	2.10	2.42	3.20
Total	3.78	45.87	72.29	55.66	100.00
Mean Age	35.63	37.01	38.45	39.35	41.69
Median Age	32.80	35.15	37.00	37.94	41.40
Δ (mean-median)	2.83	1.86	1.45	1.41	0.29
Ageing index	56.13	63.46	73.72	87.29	111.45
Young dependency ratio	104.68	77.01	77.04	79.89	70.88
Elderly dependency ratio	58.76	48.87	56.79	69.74	78.99

Cluster 1: Mature structure, shrinking base, 2 out of 10 belong to 0-14 age group, 1 out of 10 belong to 65+ age group, Δ(mean - median) 2,83 years - Dispersed geography, all directions.
Cluster 2: Ageing, shrinking base, 2 out of 10 belong to 0-14 age group, 1 out of 10 belong to 65+ age group, Δ(mean - median) 1,86 years - Main urban centers Attica & Thessaloniki.
Cluster 3: Ageing, shrinking base, 2 out of 10 belong to 0-14 age group, 1 out of 10 belong to 65+ age group, Δ(mean - median) 1,45 years - Majority of mainland departments and Crete (53%).

Cluster 4: Ageing, shrinking base, 2 out of 10 belong to 0-14 age group, 2 out of 10 belong to 65+ age group, Δ(mean - median) 1,41 years - Geographical cluster, northwest.
Cluster 5: Old, shrinking base, 2 out of 10 belong to 0-14 age group, 2 out of 10 belong to 65+ age group, Δ(mean - median) 0,29 years - Mostly mountainous departments including islands.

Figure 5: Classification of population structures 2001



Map 3: Clusters of population structures 2001

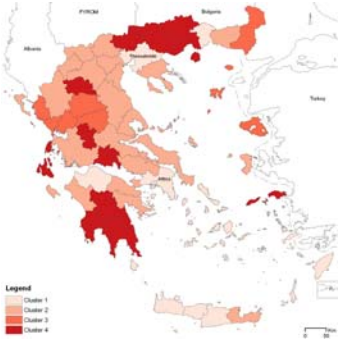


Table 3: Clusters 2001

	1	2	3	4	5
#	17	65	43	14	11
(%)	17.65	43.14	13.73	25.48	
Population	936,281	467,531	101,291	155,796	
0-14	2,866,468	1,256,967	1,702,259	422,464	
15-44	1,472,369	704,129	1,704,446	254,105	
45-64	4,267,717	1,959,169	4,462,755	676,529	
65+	913,487	533,235	143,894	238,304	
75+	331,948	190,895	53,462	82,516	
85+	69,866	41,527	11,327	19,251	
Total	6,217,865	2,889,962	688,890	1,066,779	
Mean Age	46.87	42.40	36.40	39.53	
Median Age	79.25	65.19	64.26	63.31	
Δ (mean-median)	14.89	18.01	20.98	22.11	
15-44	5.34	6.45	7.79	7.72	
65+	1.52	4.01	1.96	1.80	
Total	58.87	62.78	39.99	100.00	
Mean Age	38.90	40.34	42.10	42.54	
Median Age	37.17	39.13	41.79	41.90	
Δ (mean-median)	1.73	1.21	0.31	0.64	
Ageing index	97.87	114.05	142.06	151.68	
Young dependency ratio	21.44	23.86	22.98	23.03	
Elderly dependency ratio	20.81	27.22	32.85	34.92	

Cluster 1: Ageing, narrow base, 2 out of 10 belong to 0-14 age group, 1 out of 10 belong to 65+ age group, Δ(mean - median) 1,73 years - Main urban centers including south Aegean islands.
Cluster 2: Ageing, narrow base, 2 out of 10 belong to 0-14 age group, 2 out of 10 belong to 65+ age group, Δ(mean - median) 1,21 years - Dispersed geography, majority of the departments (43%).
Cluster 3: Old, narrow base, 2 out of 10 belong to 0-14 age group, 2 out of 10 belong to 65+ age group, Δ(mean - median) 0,31 years - Two geographical clusters east-west.
Cluster 4: Old, narrow base, 2 out of 10 belong to 0-14 age group, 2 out of 10 belong to 65+ age group, Δ(mean - median) 0,64 years - Dispersed mostly located to northern Greece.

3. Pace of ageing process

In order to examine the pace of population ageing among regions, a second typology for the whole period (1981-2001) based upon the aforementioned yearly profiles were derived. The results of our typology revealed the following types of age structure, *figure 6*:

(i) **Relative young:** Despite the median age which reaches 31 years, this type of pyramid can be characterized as relative young, met only in 1981 (**Cluster 1**). Presenting a "triangle" shape, its broad base indicates high proportions of young ages (0-14) which result from high fertility rates while the death rates remain quite high. Deficits at ages 35-39 and 60-64 could be considered as World War II and I losses respectively.

(ii) **Mature:** Turning gradually from triangular-shaped to rectangular-shaped, this type of pyramid corresponds to a mature structure with median age at 32,62 years old and ageing index 47,95% while birth and death rates start declining (1981: **Cluster 2**, 1991: **Cluster 1**). Additionally, *mature irregular* pyramid structure with median age close to 34 years old and ageing index 53,34%, appeared only in 1981, presents deficits in ages 15-39 due to war losses in one hand and migration flows on the other. Slight surpluses in ages 40-54 arose from the postwar high birth rates (1981: **Cluster 3 & 4**).

(iii) **Ageing:** Restrained proportions of young age groups (0-14), amplified distribution at middle ages combined with 15%-20% of 65+, compose rapid ageing structure as older cohorts age (move upwards) effected by higher life expectancy and low death rates. Weighted to the 15-44 age groups, *Ageing 1* structure presents a median age of 36 years and ageing index 69,18% (1991: **Cluster 2, 3 & 4**), while in *Ageing 2* (2001: **Cluster 1 & 2**), the median age reaches =38 years but ageing index climbs up to 103% as the number of population above 65 years exceeds the number of 0-14. Losses in 45-49 age group for *Ageing 1* (in 1991) and respectively in 55-59 group for *Ageing 2* (in 2001) reflect the consequences of World War II. *Ageing 1 irregular* (1981: **Cluster 5**) constitutes a distinct profile, in which deficits in 15-49 age groups due to war and migration losses, contribute in median age elevation to 39,48 years while ageing index reaches 86,29%.

(iv) **Old:** With median age above 40 years, the old structured v-shaped pyramids reveal low death rates and long-run persistence of low birth rates which led to percentages of 65+ over 20% and ageing indexes above 100. In *Old 1* structure (1991: **Cluster 5**) the significant proportions of 50-69, figuring higher fertility between the two world wars, puts the weight on the top of the pyramid followed by the lower fertility of next decades, hence the deficit at the 20-49 age groups. Insisting low fertility and low death rates in *Old 2* (2001: **Cluster 3 & 4**) noting an ageing index of 147,89%, while the surplus of male population observed in ages 15-19 is attributed to the presence of military.

By reviewing our results, we identify the successive phases 2 to 3 that all age pyramids go through, namely ageing principally at the bottom of the pyramid and ageing at the centre and then at the top as described by Chesnais (1992:286). Different pathways of population ageing process between 1981-1991, 1991-2001 and 1981-2001 are shown in *table 4* and represented to *Map 4*.

Figure 6: Population structure profiles 1981-2001

Departments	Age structure profile		Pace of ageing process		
	1981	1991	1981-1991	1991-2001	1981-2001
Rodopi	Relative young	Ageing young	Rapid	Stagnating	Rapid
Artas	Mature	Ageing	Rapid	Stagnating	Rapid
Karditsa	Mature (irregular)	Old 1	Rapid	Stagnating	Rapid
Thessaloniki	Mature	Ageing	Moderate	Moderate	Rapid
Trikala	Mature (irregular)	Old 2	Moderate	Moderate	Rapid
Drmas	Mature	Ageing	Moderate	Moderate	Rapid
Kavala	Mature	Ageing	Moderate	Moderate	Rapid
Kilkis	Mature	Ageing	Moderate	Moderate	Rapid
Sarvas	Mature	Ageing	Moderate	Moderate	Rapid
Evros	Mature	Ageing	Moderate	Moderate	Rapid
Achaia	Relative young	Mature	Moderate	Moderate	Rapid
Xanthi	Relative young	Mature	Moderate	Moderate	Rapid
Dodekanisos	Relative young	Mature	Moderate	Moderate	Rapid
Kastoria	Relative young	Mature	Moderate	Moderate	Rapid
Kozani	Relative young	Mature	Moderate		