

**NEW 1980 AND 1990 ESTIMATES  
OF ACTIVITY RATES BY AGE AND SECTORAL DISTRIBUTION FOR SOME  
COUNTRIES OF EASTERN AND SOUTHERN EUROPE**

Bojan Popovi'3c<sup>1</sup>

A. Introduction (1) There are several reasons to initiate a new edition of ILO's estimates and projections of the economically active population of countries of the world. Since the previous (third) edition (called the 1986 ILO programme)<sup>2</sup> new sets of data (mainly population censuses taken during last ten years) have become available, new states (mainly in Eastern Europe) have appeared, the process of population aging has spread, need for and possibility to present more detailed sectoral distribution (e.g. manufacturing part of industry) have become reality. In addition, newer United Nations' estimates and projections of total population for countries of the world, on which ILO produced activity rates are applied, have been issued.

(2) As a first stage, new estimates for 1980 and 1990 (in the latter case in place of the projection available in the third edition) of activity rates by sex for age groups 10-14, 15-19, ..., 65+ and of sectoral distribution of the economically active population by sex into agriculture, industry and services<sup>3</sup> are to

---

<sup>1</sup> Bojan Popovi'3c, Economics Institute, Belgrade (Yugoslavia)

<sup>2</sup> ILO, Economically active population: estimates and projections 1950-2025; Volume I-VI (1986).

<sup>3</sup> ISIC-88 (Rev.3) categories: A and B, C through F (including

be produced and compared with those of the third edition. In addition, new activity rates by sex for age groups 65-69 and 70+ (consistent with the activity rate for age group 65+ above) and the manufacturing shares by sex of the economically active population are to be produced as well. These estimates for newly emerging states ought to be consistent with previously obtained values for (former) states of which they formed part earlier.

(3) On the basis of these estimates, once they are verified, new sets of projections for dates after 1990 could be made and UN estimates and

---

manufacturing - category D), and G through O.

projections of population applied to produce estimates and projections of the economically active population by sex, age group and sectors for each country and regional aggregates of the world.

(4) This article presents the outcome of the first stage together with some verification procedures and results for seven of the countries of Eastern and Southern Europe that appeared in the third edition, two of which were split into seven new entities. Thus the estimates are produced for 12 existing and two former states, namely: Albania, Bulgaria, Czech Republic, Slovak Republic, Hungary, Poland, Romania, Bosnia and Herzegovina, Croatia, Former Yugoslav Republic of Macedonia, Slovenia, Federal Republic of Yugoslavia (Serbia and Montenegro), and (former) Czechoslovakia and (former) Yugoslavia.

B. General methodology (5) Estimation for each country is based primarily on data from national population censuses in the 1980 and 1990 rounds (in some cases unpublished but obtained by a specific ILO inquiry), supplemented by other relevant data (population, employment) from country-specific official sources and as well as from UN population and ILO activity rate estimates and projections - occasionally reaching back to the 1970s.

(6) Totals by sex (population, economically active population) in the original data are distributed completely and proportionately to required groups (by age or sector), and activity rates and sectoral distribution are calculated from these

values. Thus, the total activity rate (proportion of economically active population in total population) for males and for females, and sectoral distribution for males and females together or activity rates for age group 65+, are coherent with those by age groups and/or by sex.

(7) Estimated mid-year (i.e. 1.7.) 1980 and 1990 absolute values of population and economically active population for each age group or sector are obtained by linear inter/extrapolation from the corresponding original data values, taking into account the exact dates of the pair. Restrictions on unimodal activity rate profiles bounded between 0 and 100%, and on the manufacturing share being a proper part of the industrial sector share are applied. All totals are then obtained by summation and for each sex the smaller (if not equal due to restrictions) is taken as the correct one for proportional distribution to required groups.

(8) Aggregated multiple age groups in the original data were split: (a) for population by using proportions from the same year UN medium variant as assessed in 1984, or, if missing (e.g. for 65-69 and 70+ groups), from the closest available year in the original data; (b) for economically active population by (i) applying to population values the activity rates obtained by linear inter/extrapolation from the pair of original data (with the above-mentioned restrictions) or directly from a single such existing year, and (ii) adjusting obtained values to obtain the correct aggregated age group economically active population

proportionately unless restrictions had to be applied again in increasing/decreasing order of obtained activity rates.

(9) Manufacturing share by sex, if missing in the original data, is obtained by applying the proportion of manufacturing in industry, either from linear inter/extrapolation from the (if available) pair of census data (with the above-mentioned restriction) or directly from a single such existing year, to the industrial sector value.

(10) The estimates for former states are produced, for the 1980 and 1990 comparisons and the confrontation with 1950-1970 estimates as obtained by the 1986 ILO programme wherever possible, by aggregating first the estimated mid-year values of 1980 and 1990 population and economically active population for all entities that earlier constituted a particular state.

(11) Wherever specific solutions are used to supplement other types of missing or inadequate original census data, they are enumerated in country notes below.

(12) All new estimates for 1980 and 1990 of activity rates and sectoral distribution are presented with two decimals although a small number among them may have only one to three significant digits and thus be reliable up to the first decimal.

C. Comparison and confrontation (13) The comparisons for 1980 and 1990 of new estimates (n) and the "third edition (old)" values (v) are effected by the relative difference between the two for the same date. This measure is calculated by the antisymmetric

formula  $2*(n-v)/(n+v)$  in percentages, hence its range is from 0 (equal values) to +3\_200% (only one zero value),<sup>4</sup> and in tables it is presented with one reliable decimal.

(14) Country-sex specific minimum and maximum of ratios of new activity rate estimates for 1990 and 1980 by age group are determined in table A and confronted, whenever possible, with overall minima and maxima of four groups of consecutive ratios (up to age 65+) for 1950-1990 estimates and projections from the 1986 ILO programme.

(15) Estimated 1980 and 1990 sectoral distributions into agriculture, industry and services of economically active population are confronted wherever possible with 1950-1970 estimates as obtained by the 1986 ILO programme by presenting for each sex and both sexes together the angle measure of change (derived by analogy from the Pearson's similarity coefficient for two zero-mean stochastic variables) in every decade.<sup>5</sup> It is given

---

<sup>4</sup> Being 100% when the new estimate is three times larger than the corresponding value from the 1986 ILO programme. This measure is undefined only when both are equal to zero.

<sup>5</sup> For  $X=[x(1),x(2),x(3)]$  and  $Y=[y(1),y(2),y(3)]$  with  $x(i),y(i) \geq 0$ ;  $i=1,2,3$  and  $x(1)+x(2)+x(3)=y(1)+y(2)+y(3)=1$  this measure is given by formula: ARCCOS of

$$x(1)*y(1)+x(2)*y(2)+x(3)*y(3)$$

-----  
-----

in percentages in table B and it ranges theoretically from 0 (no change in the structure over a decade) to 100% (complete change, e.g. a shift from one to another single-sector distribution). The manufacturing proportion of economically active population (new estimate for 1980 and 1990) is assessed by presenting the difference of manufacturing percentage shares in industry over the 1980s for each sex and both sexes together in the last column of table B.<sup>6</sup>

D. Country notes (16) The general methodology [Section B] is applied, if possible, for each set of estimates based on the original national data for each country and entities formerly forming part of them. These data come from population censuses taken in each country at the following dates: Albania (7.1.1979 and 2.4.1989), Bulgaria (2.12.1975 and 4.12.1985), Czechoslovakia (1.11.1980 and 3.3.1991), Hungary (1.1.1980 and 1.1.1990), Poland

---


$$\text{SQRT}\{(x(1)*x(1)+x(2)*x(2)+x(3)*x(3))*(y(1)*y(1)+y(2)*y(2)+y(3)*y(3))\}$$

divided by the measure of the first quadrant size angle.

<sup>6</sup> If  $z(t)=100*M(t)/I(t)$ , where  $M(t)$  is manufacturing and  $I(t)$  is industrial proportion of economically active population of the same sex at date (1.7.)  $t$ , than the formula is given by  $z(1990)-z(1980)$  of new estimates. This measure and the angle measure are presented also for both sexes together ("Total") since sex shifts exist in sectoral employment.

(7.12.1978 and 6.12.1988), Romania (5.1.1977 and 7.1.1992), Yugoslavia (31.3.1981 and 31.3.1991). However, this methodology had to be supplemented in some cases by specific procedures due to other types of missing or inadequate data. These are listed below together with detailed data sources for each entity only if in addition to those available in ILO's data base (LABORSTA) or obtained from inquiry responses.<sup>7</sup>

(17) Some available country data had to be rejected as unreliable, either by (a) being in direct conflict with another piece of information of the same phenomenon judged more reliable, or (b) not being within the limits of expected trend in a series of data retained, or (c) being incorrectly defined. Thus, in view of inquiry responses from the Czech and Slovak Republics, data on Czechoslovakia's 1991 census population and economically active population totals published in Statistical Yearbook of the Czech and Slovak Federal Republic 1991 (Table 29-1) were rejected (case (a)). Also, LABORSTA data base Table 2C for Hungary in 1980 was rejected for sectoral distribution when compared with Table 2A for the same date and the corresponding inquiry response from Hungary for 1990 (case (b)). Since economically active population in the services sector as given in the inquiry response from Slovak

---

<sup>7</sup> From Statistical Offices of Czech Republic (dated 29.3.1993), Slovak Republic (10.3.1993), Hungary (19.3.1993), Poland (13.4.1993), Romania (15.3.1993), Federal Republic of Yugoslavia (Serbia and Montenegro) (15.4.1993).

Republic covered only housing and communal services it could not be used (case (c)).

(18) Neither the age distribution of population nor the total economically active population figure (except for 2.10.1960) are available from censuses in Albania; and there is no manufacturing sector employment data to be found in published sources. Thus, age profile of activity rates in 1980 and 1990 had to be taken as obtained by the 1986 ILO programme, and separate rates for age groups 65-69 and 70+ are missing as well as the manufacturing share. All other relevant data from Statistical Yearbook of Albania 1991 are used to improve previous estimates. Thus, population by sex and age group is obtained from the totals in the two most recent censuses (Table 245), official yearly estimates of (under/above/of working age) age distribution (Table 22) and the previous population-by-age estimates. Sectoral distribution of economically active population by sex is produced by applying the linear trends in the end-of-the-year sectoral employment (Table 57) to 1989 census figures. The same total data, having a sex ratio of 1.2, and the 1960 census figures with a sex ratio of above 1.5, in addition to estimates of economically active population as obtained by the 1986 ILO programme with approximately the same ratios in 1980 and 1990, on one hand, and the comparison by sex of linearly interpolated employment totals to 1989 census data, on the other, lead to the adjustment of the total economically active population

in 1990 by sixty thousand (+120 for males, -60 for females) and in 1980 by thirty thousand (+110 for males, -80 for females).

(19) Both population and economically active population census data available from Bulgaria date from 1975 and 1985 and thus the performed inter/extrapolations are less reliable (e.g. restrictions had to be applied for 1990 young-age activity rates with the peak at 30-34). Only preliminary population data by aggregated multiple age-group and sex were available from the most recent census carried out on 4.12.1992 in Statistical Handbook of Bulgaria 1993 (Table III.3). These data are used to adjust 1990 estimates by interpolation of 1985 and 1992 ten-year population age groups and then applying the correspondingly aggregated activity rate estimates obtained by 1975-1985 extrapolation.

(20) For (former) Czechoslovakia, i.e. Czech Republic and Slovak Republic which formed one country in the 1986 ILO programme, several specific procedures are used based on the availability of any two of three linearly dependent data. Hence, all Czech Republic data from the 1980 census (except the manufacturing share) are obtained as differences, as well as the economically active population of age 65-69 and 70+ and in services for the Slovak Republic in both the 1980 and 1991 censuses. The manufacturing share of the economically active population in the Czech Republic being known in 1991, the same is obtained in the other entity by assuming the Slovak Republic's proportion of such population in Czechoslovakia equal to the corresponding manufacturing employment proportion from the

Statistical Yearbook of the Czech and Slovak Federal Republic 1991

(Table 7-3). A linear trend for proportions of manufacturing in industry by sex from Czechoslovakia's employment 1981-1989 time-series (annual regression percentage values of -0.101 for males/-0.092 for females) is used for both states to obtain manufacturing shares in 1980.

(21) Romania's data on economically active population in 1977 census do not include persons seeking first employment, and they had to be estimated by comparing given activity rates by age group to the linearly interpolated at 5.1.1977 activity rates by age group from those obtained by the 1986 ILO programme. Thus, the total figure is augmented by 175 thousand (males/females aged 15-19: 95/65 thousand, males/females aged 20-24: 10/5 thousand).

(22) Data for (former) Yugoslavia, i.e. new entities named Bosnia and Herzegovina, Croatia, Former Yugoslav Republic of Macedonia, Slovenia and Federal Republic of Yugoslavia (Serbia and Montenegro) which encompass exactly six former republics within Yugoslavia, were almost complete from the 1981 census (Population, households and housing census in 1981 tables). Only in two instances for each sex and entity some estimation was necessary. Economically active population (including those residing, i.e. working temporarily outside Yugoslavia) for age groups 65-69 and 70+ from aggregated group 65+ were obtained from exact distributions of those residing outside Yugoslavia<sup>8</sup> and of active

---

<sup>8</sup> Note that this definition is retained in both 1981 and 1991

earners only residing within Yugoslavia. Active earners at work place (and not residence)<sup>9</sup> within Yugoslavia had to be used to estimate the proportion of manufacturing in industry (using weights of two constitutive industrial activities from active earners' distribution by residence). On the other hand, due to decentralized data processing and political events just before and following the 1991 census, a very uneven amount of data were available for estimation from this source.<sup>10</sup> However, official population and economically active population projections for mid-

---

censuses, and thus the population within Yugoslavia for each entity does not mean "within entity's proper area" except for the sum of all five, i.e. (former) Yugoslavia. Activity rates are estimated for de iure population including those residing (working and accompanying family members) temporarily outside Yugoslavia.

<sup>9</sup> Again they coincide only for (former) Yugoslavia as a whole - positive or negative discrepancy for totals in five entities was: -7.5% in Bosnia and Herzegovina, 2.4% in Croatia, -1.0% in Former Yugoslav Republic of Macedonia, 6.7% in Slovenia and 0.1% in Federal Republic of Yugoslavia (Serbia and Montenegro).

<sup>10</sup> From a single number - preliminary size of total population for Bosnia and Herzegovina to almost complete sets for Slovenia and Federal Republic of Yugoslavia (Serbia and Montenegro), all from Population, households, housing and farm census in 1991. These were issued in various publications of Statistical Offices of each entity, or were obtained from their final documentation tables.

year 1991 have been previously published in Population No.23 (1989) and 33 (1991) of Federal Statistical Office of Yugoslavia (Tables 6 and 2.1; respectively) and they were used "as if" 1.7.1991 data wherever needed, notably for Bosnia and Herzegovina and for the Former Yugoslav Republic of Macedonia. Thus the missing elements at the 1991 census date were interpolated, with zero restriction (by definition) on activity rate of age group 10-14. In two entities census count was not complete, and it was assumed that activity rates for enumerated population (79.5% in the Former Yugoslav Republic of Macedonia and 84.0% in the Federal Republic of Yugoslavia (Serbia and Montenegro)) are representative of the total population (officially estimated in both cases). The general methodology [Section B] was otherwise applied for each entity, in particular to estimate the 1991 size of the economically active population by sex in agriculture for Bosnia and Herzegovina and for Slovenia,<sup>11</sup> and by sex and age residing (i.e. working) temporarily outside Yugoslavia for Croatia; all 1980 and 1990 values for all entities and finally (former) Yugoslavia by summation, once data explained below were used to determine sectoral distributions in 1991. The manufacturing share for the Federal Republic of Yugoslavia (Serbia and Montenegro) was

---

<sup>11</sup> Using 1971 and 1981 values. Only the old national classification corresponding to ISIC-58 is available for 31.3.1971 census as published in Population and housing census in 1971 (Book III) of Federal Statistical Office of Yugoslavia (1974) (Table 4).

estimated by the same procedure as in 1981 and for others by applying to the 1981 values the 1980-1990 change in proportion by sex of manufacturing in industry from employment only in socialized establishments. The 1980-1990 change in ratio by sex of employment in industry and in services was applied to estimate the same ratios (and eventually sizes) of the economically active population by sex in industry and services (agriculture already being known) for Bosnia and Herzegovina and for Slovenia.<sup>12</sup> Only for the distribution by age of each sex of enumerated economically active population residing (i.e. working) temporarily outside Yugoslavia for the Federal Republic of Yugoslavia (Serbia and Montenegro) the dynamic age-shift in 1971-1981 change was applied for 1991.<sup>13</sup> Clearly no separate data on (former) Yugoslavia were

---

<sup>12</sup> Employment data (average of 31.3. and 30.9. establishment reports) are published in Federal Statistical Office of Yugoslavia's Statistical Bulletin No.1250 (1981) and 1892 (1991) (Tables 2-7, 14 and 1-2, 5; respectively).

<sup>13</sup> Selection of this procedure was dictated by its verification in the case of Slovenia, where the corresponding 1991 data exist, after observing the permanency of those "temporarily working outside Yugoslavia" from ten-year age shift between 1971 and 1981 censuses. Since there were no data for distributional proportions of those aged less than 35 (in 1991) the average of 1971 and 1981 proportions was used; scaling was applied to the obtained distribution for each sex. The 1971 census data are taken from Federal Statistical Office of Yugoslavia's Statistical

needed, and the minor differences in individual age group and sectoral values (but not totals) from published census data at this aggregated level are the consequence of the general methodology distribution of unknown elements (cf.(6)) which is present in various proportions in each of five aggregating entities for each sex.

Table A

**Activity rate decade ratios1**

	3rd edition2			New	
estimates3	minimum	min154	maximum	minimum	min154
ALBANIA					
Males	0.58	0.80	1.00	0.58	0.83
	1.00				
Females	0.42	0.42	1.10	0.47	0.81
	1.04				
BULGARIA					
Males	0.00	0.39	1.00	0.00	0.66
	1.39				
Females	0.35	0.42	1.09	0.00	0.94
	1.84				
(FORMER) CZECHOSLOVAKIA					
Males	0.00	0.74	1.01	0.53	0.53
	1.23				
Females	0.00	0.50	1.39	0.60	0.60
	1.12				

CZECH REPUBLIC

Males	...	...	...	0.62	0.62
1.28					

Females	...	...	...	0.69	0.69
1.13					

SLOVAK REPUBLIC

Males	...	...	...	0.37	0.37
1.17					

Females	...	...	...	0.43	0.43
1.11					

HUNGARY

Males	0.07	0.07	1.00	0.18	0.18
0.99					

Females	0.17	0.17	1.79	0.04	0.04
1.08					

POLAND

Males	0.00	0.54	1.01	0.73	0.73
0.99					

Females	0.00	0.53	1.22	1.04	1.04
0.99					

ROMANIA

Males	0.22	0.22	1.00	0.49	0.49
1.00					

Females	0.29	0.53	1.08	0.52	0.52
0.98					

(FORMER) YUGOSLAVIA

Males	0.14	0.53	1.01	0.06	0.67
	1.02				
Females	0.29	0.47	1.33	0.06	0.81
	1.32				

BOSNIA AND HERZEGOVINA

Males	...	...	...	0.07	0.71
	1.06				
Females	...	...	...	0.07	0.86
	1.60				

CROATIA

Males	...	...	...	0.06	0.62
	1.07				
Females	...	...	...	0.06	0.73
	1.29				

FORMER YUGOSLAV REPUBLIC OF MACEDONIA

Males	...	...	...	0.07	0.65
	1.05				
Females	...	...	...	0.07	0.79
	1.40				

SLOVENIA

Males	...	...	...	0.06	0.75
	1.04				
Females	...	...	...	0.06	0.75
	1.12				

FEDERAL REPUBLIC OF YUGOSLAVIA (SERBIA AND  
MONTENEGRO)

Males	...	...	...	0.06	0.71
1.16					
Females	...	...	...	0.06	0.85
1.34					

---

Notes: 1 From previous decade, ratios with 0 in denominator excluded

2 Among 1950-1990 values

3 Only 1980-1990, but including age groups 65-69 and 70+ (except for Albania)

4 Minimum excluding age group 10-14

Table B Change (%) in: Sectoral distribution (agriculture, Manufacturing

industry, services) /angle measure/1 share of  
the  
----- industrial  
sector

Decade                    1950s            1960s            1970s            1980s            1980s  
-----  
-----

ALBANIA

Males	6.23	7.07	4.58	6.20	...
Females	1.83	2.14	14.55	2.96	...
Total	4.39	4.63	9.23	3.66	...

BULGARIA

Males	18.88	24.79	13.13	5.96	5.50
Females	12.38	29.40	26.62	10.86	-0.74
Total	15.74	27.37	19.11	8.11	3.10

(FORMER) CZECHOSLOVAKIA

Males	13.96	6.42	3.06	14.19	-0.54
Females	28.58	18.37	6.59	10.44	-0.92
Total	18.65	11.42	4.36	13.03	-0.49

CZECH REPUBLIC

Males	...	...	...	17.67	-0.99
Females	...	...	...	12.14	-0.90
Total	...	...	...	16.22	-0.72

SLOVAK REPUBLIC

Males	...	...	...	3.12	-1.01
Females	...	...	...	6.55	-0.92
Total	...	...	...	4.88	-0.95

HUNGARY

Males	20.04	14.44	9.07	9.41	8.31
Females	16.73	24.42	12.59	12.27	4.32
Total	18.49	17.99	11.15	11.20	6.65

POLAND

Males	12.99	9.67	5.97	1.75	-2.48
Females	9.85	14.79	19.52	9.73	-1.28
Total	11.25	11.85	12.39	5.59	-2.62

ROMANIA

Males	10.67	20.91	14.99	6.14	3.04
Females	3.86	12.21	20.95	23.48	0.04
Total	7.09	17.59	18.51	14.10	3.00

(FORMER) YUGOSLAVIA

Males	13.43	13.09	22.97	11.37	7.08
Females	8.56	18.46	26.14	20.33	0.21
Total	10.67	14.99	24.35	14.84	6.54

BOSNIA AND HERZEGOVINA

Males	...	...	...	19.89	7.74
Females	...	...	...	28.45	2.72
Total	...	...	...	22.51	9.27

CROATIA

Males	...	...	...	9.69	7.06
Females	...	...	...	16.66	0.13

Total	...	...	...	12.81	5.31
-------	-----	-----	-----	-------	------

FORMER YUGOSLAV REPUBLIC OF MACEDONIA

Males	...	...	...	12.58	7.30
-------	-----	-----	-----	-------	------

Females	...	...	...	33.31	0.13
---------	-----	-----	-----	-------	------

Total	...	...	...	18.12	28.02
-------	-----	-----	-----	-------	-------

SLOVENIA

Males	...	...	...	9.68	6.83
-------	-----	-----	-----	------	------

Females	...	...	...	12.66	0.97
---------	-----	-----	-----	-------	------

Total	...	...	...	11.10	4.52
-------	-----	-----	-----	-------	------

FEDERAL REPUBLIC OF YUGOSLAVIA (SERBIA AND

MONTENEGRO)

Males	...	...	...	8.12	8.12
-------	-----	-----	-----	------	------

Females	...	...	...	19.55	-0.13
---------	-----	-----	-----	-------	-------

Total	...	...	...	12.55	7.51
-------	-----	-----	-----	-------	------

-----

Note: 1 See explanation in (15)