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ARGO 2005 population and labour force forecast[1]

Background and Assumptions

0. Forecast horizon, geographical scope, data sources and population dynamics model

The forecast is prepared for the period **2005–2054** (with 2004 as the base year), in five-year intervals 2005–2009, … , 2050–2054. Population and demographic events are considered in five-year age groups, with the last (open-ended) group concerning persons aged 85+ for population and 75+ for the labour force. The geographical scope covers **nine** ARGO 2005-related European countries (hereafter: ARGO-9): the Czech Republic (CZ), Hungary (HU), Italy (IT), Poland (PL), Portugal (PT), Romania (RO), Slovakia (SK), Ukraine (UA) and the United Kingdom (UK).

Data on demographic variables (base population size and structure, fertility, mortality, and migration) come from two main sources, treated as complementary: the NewCronos database of Eurostat (epp.eurostat.ec.europa.eu, downloaded in February 2007), and yearbooks *"Recent Demographic Developments in Europe"* of the Council of Europe (in particular, the 2005 edition). Labour force participation data come from the ILO estimates available from the Laborsta database (laborsta.ilo.org, downloaded in February 2007), and consider only persons aged 15+. Wherever necessary, the missing values have been supplemented by the data from national statistical offices, or estimated on the basis of the available information. All data sources and potential modifications are documented in relevant data spreadsheets.

Subsequent sections of this document present assumptions made with respect to the future developments of: **1.** fertility, expressed in terms of total fertility rates (TFR); **2.** mortality, in terms of life expectancies; **3.** international migration flows, both within the system of nine countries under study (emigration rates per 1,000 population of a sending country), and net 'external' migration flows; as well as **4.** age-specific labour force participation rates.

As the current study uses wherever possible the 2002-based CEFMR population and labour force forecast, detailed qualitative and quantitative arguments on the assumptions concerning particular components of demographic and labour supply changes to a large extent reproduce the ones presented in the aforementioned research (Bijak, 2004; Bijak et al., 2004; Saczuk, 2004). The exceptions concern the addition of Ukraine, for which new scenarios have been

[1] Being perfectly aware of the distinction between the terms 'forecast' and 'projection', in the current study we universally use the former one, as it reflects our beliefs in the future developments of the components under study. We nonetheless agree that any forecast beyond the horizon of, say, 20 years is in fact a projection.

developed, and a whole set of new assumptions concerning international migration flows. Current document specifies the assumptions for the 2004 forecast with special attention paid to these ones which differ in comparison to the assumptions made for the 2002 forecast.

The forecast was prepared using MULTIPOLES (MULTIstate POpulation model for multiLEvel Systems) model of population dynamics (for detailed description of the model itself, see Kupiszewska and Kupiszewski, 2005).

1. Fertility

Assumptions on target total fertility rates (TFR; children born per women aged 15–49) for 2054 are knowledge-based and as consistent as possible with other similar forecasts or projections (Eurostat, 2005; United Nations, 2007; national studies; see Table 1.1 for detailed comparisons). The whole methodology and target values roughly follow the ones proposed in Bijak (2004), the only exceptions being Portugal (target TFR value modified downwards by 0.1 due to recent fertility decline in that country) and Ukraine (new addition). For the purpose of the current study, four clusters of countries have been identified, according to the common past TFR development patterns or to the cultural and geographical proximity. The following cluster-specific target TFRs have been assumed:

- **1.4** for South-Eastern and Eastern European countries (Romania, Ukraine);
- **1.5** for Central Europe (Czech Republic, Hungary, Poland, Slovakia), and for Italy;
- **1.6** for Portugal;
- **1.8** for the United Kingdom.

In addition, an alternative high-fertility scenario has been prepared, where the values derived using the methodology described below have been additionally cumulatively increased by 0.01 a year, so as to reach the targets higher from the base ones by 0.5 child per woman.

Table 1.1. Target TFR values for 2050: various forecasts / projections

TFR assumed for 2050	Current study: Base TFR	Current study: High TFR	Bijak (2004)	Eurostat (2005)	National forecasts	United Nations (2007)
Czech Republic	1.50	2.00	1.50	1.50	1.62	1.65
Hungary	1.50	2.00	1.50	1.60	1.90	1.81
Italy	1.50	2.00	1.50	1.40	1.43	1.74
Poland *	1.50	2.00	1.50	1.60	1.20	1.60
Portugal	1.60	2.10	1.70	1.60	1.70	1.83
Romania	1.40	1.90	1.40	1.50	1.30	1.67
Slovakia	1.50	2.00	1.50	1.60	1.70	1.63
Ukraine	1.40	1.90	na	na	na	1.59
United Kingdom	1.80	2.30	1.80	1.75	1.80	1.85

* National forecast target for 2030; na – data not available.

Source: Eurostat (2005); United Nations (2007); NSI websites; own elaboration

The baseline 2004 TFR values and the 2054 targets have been bridged in the following way. Initially, until 2024, a polynomial Hermite interpolation was used, ensuring a smooth passage from the initial values to the target ones decreased by 0.05, as well as from the initial slope ($\alpha = TFR_{2004} – TFR_{2003}$) to the default zero. Afterwards, the 2024 and 2054 values have been bridged linearly. The matrix formula for the Hermite interpolation is $TFR_t = \mathbf{s}_t' \cdot \mathbf{H} \cdot \mathbf{b}$, where $t = 2005, \ldots, 2024$, $s_t = (t–2004)/20$, $\mathbf{s}_t' = [s_t^3\ s_t^2\ s_t\ 1]$, $\mathbf{b}' = [TFR_{2004}\ TFR_{2054}–0.05\ \alpha\ 0]$, and the Hermite coefficient matrix **H** is equal:

$$\mathbf{H} = \begin{vmatrix} 2 & -2 & 1 & 1 \\ -3 & 3 & -2 & -1 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \end{vmatrix}$$

The assumed TFR trajectories are illustrated in Figure 1.1. The 2004 sex and age-of-mother structures of births have been simplistically assumed constant throughout the forecast horizon.

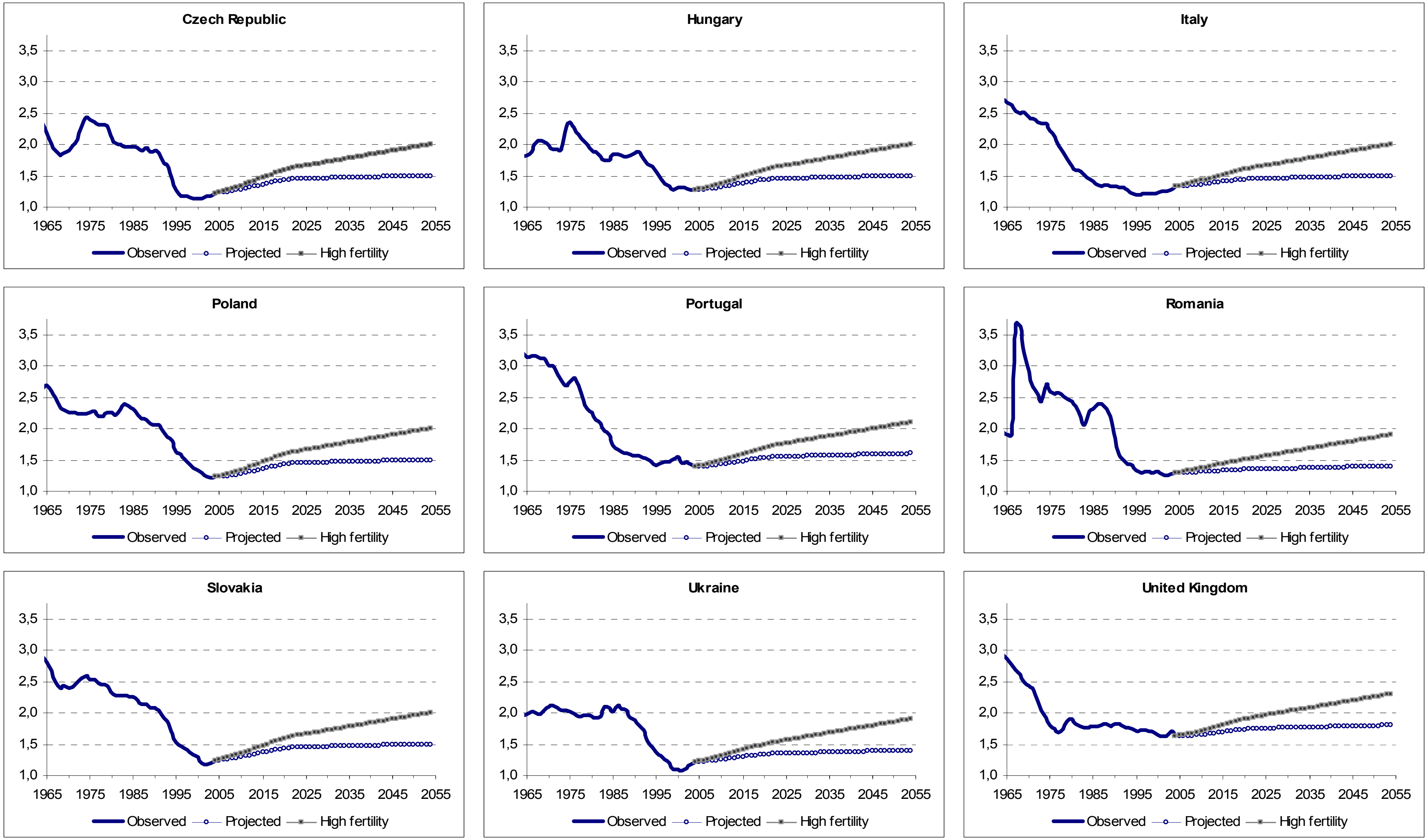
2. Mortality

The assumptions are based on the life expectancy at birth (e_0, *LE*). In all countries under study mortality improvements are envisaged, resulting in an increase of *LE* for both sexes. We assume that in relatively high-mortality regimes these improvements can be mainly attributed to the reduction of age-specific mortality rates in the age group 0–19, in the first place concerning infant mortality. For most cases under study, however, mortality reductions are assumed to be equally distributed among all age groups. Only in lowest-mortality countries, where due to technological life-saving developments infant mortality is reduced to the levels close to the “biological minimum”, leaving hardly any place for further improvements, mortality decreases are assumed primarily for the adults (persons aged 20 years or more).

Historical data series on life expectancy have been collected from the Council of Europe (2005) yearbook, supplemented with the Eurostat data for the lowest-mortality (highest-life expectancy) countries, including Japan. The 1960–2004 series have been examined in order to estimate the linear trend of the maximum *LE*, following the proposition of Oeppen and Vaupel (2002). The trends for both sexes ($LE_t = 0.170\ t – 262.88$ for males and $LE_t = 0.216\ t – 347.97$ for females) have been used to extrapolate maximum life expectancy until about 80 (males) and 85 years (females).

Afterwards, the increase in maximum life expectancy is assumed to slow down. Contrary to Oeppen and Vaupel (2002), it can be argued that the linear increase of life expectancy in the 20th century was due to the decline in infant and child mortality, where currently there is not much left to improve (E. Tabeau, personal communication). Therefore, for the longer period the trend slope for males was reduced by 20%. For females the initial trend slope was reduced by 20% for 7 further years, by 40% for the next 10 years and by 60% for the remainder of the forecast period. The differentiation was made between the sexes, as the slow convergence of life expectancies for males and females was assumed, while the initial trend slope for females was greater than for males, what would cause the opposite effect.

Figure 1.1. Total Fertility Rates (TFR): observed values for 1965–2004 and assumed for 2005–2054



Source: Eurostat/NewCronos; Council of Europe (2005: Tables 3); own elaboration

For 2004, the following differences have been calculated: $d_{2004} = LE_{2004} - LE_{2002}^{MAX}$. For subsequent years this difference between country-specific life expectancy and the maximum is assumed to diminish exponentially, according to the formula:

$$d_t = d_{2004} \cdot \exp(c \cdot (t - 2004) / d_{2004}),$$

where c is a constant equal 0.1 for males and 0.05 for females, reflecting the assumption of a slower convergence to the maximum life expectancy patterns for females. Moreover, the formula assumes that the higher the initial difference between the life expectancy for a particular country and the maximum one, the slower the convergence.

For t = 2005, …, 2054, life expectancy assumed for a particular country was calculated the following way: $LE_t = LE_t^{MAX} + d_t$. The final maximum life expectancy values for 2054 calculated in this way equal slightly over 85 years for males and 90 years for females, the former one being higher, yet the latter slightly lower than the values projected by the UN for Japan within a similar forecast horizon (83.7 and 92.5 years). A comparison of the assumptions with other studies, made in terms of life expectancy at birth envisaged for 2050, is presented in Table 2.1.

Table 2.1. Target life expectancies at birth for 2050: various forecasts / projections

Target e_0 assumed for 2050	Current study	Eurostat (2005)	National forecasts	United Nations (2007)
Males				
Czech Republic	82.1	79.7	78.9	79.1
Hungary	78.7	78.1	77.0	76.3
Italy	84.8	83.6	81.4	82.1
Poland *	80.4	79.1	80.6 *	77.4
Portugal	83.8	80.4	79.0	79.9
Romania	77.9	77.6	na	76.1
Slovakia	80.2	77.7	77.7	77.1
Ukraine	72.3	na	na	71.0
United Kingdom	84.6	82.9	81.0	81.9
Japan (max)	84.8	na	81.0	83.3
Females				
Czech Republic	85.8	84.1	84.5	84.9
Hungary	83.9	83.4	83.0	82.8
Italy	89.7	88.8	88.1	87.9
Poland *	85.8	84.4	85.4 *	84.3
Portugal	87.8	86.6	84.7	85.7
Romania	81.8	82.0	na	82.1
Slovakia	84.7	83.4	83.4	83.5
Ukraine	80.4	na	na	79.1
United Kingdom	87.5	86.6	85.0	86.4
Japan (max)	90.1	na	89.2	90.9

* For national forecasts, numbers extrapolated from target values for 2030; na – data not available.

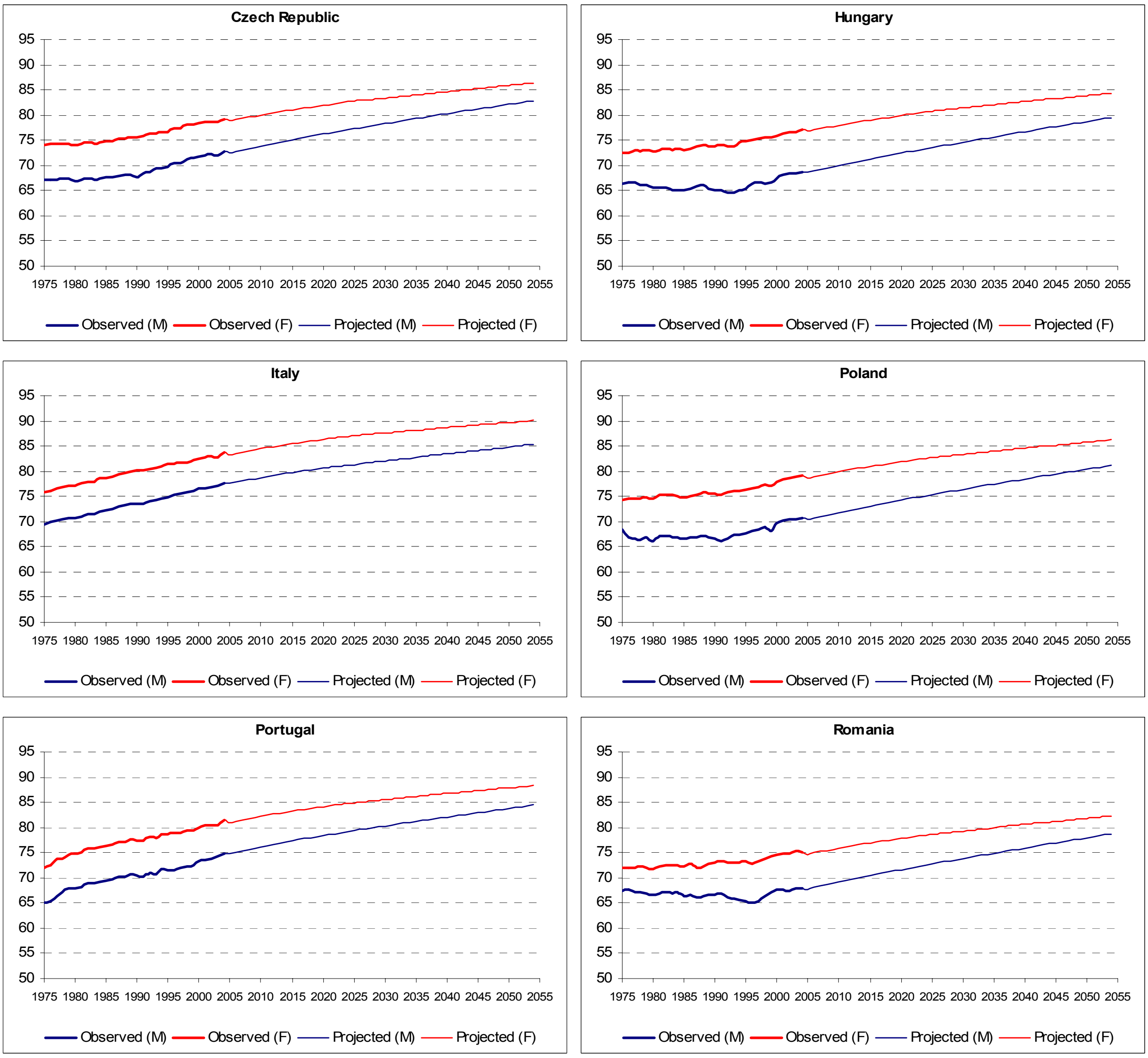
Source: Eurostat (2005); United Nations (2007); NSI websites; own elaboration

Additional assumptions on mortality developments for Ukraine have been considered, taking into account a possible spread of the HIV/AIDS epidemics. Under such scenario, life expectancy would deviate downwards from the trend in the period 2005–2009, stagnate until

2014, and slowly recover and ultimately return to the base trend by 2024. The size of the downward adjustment has been assumed as –2.75 years of life for males and –3.75 years for females, in order to be consistent with the World Bank (2006) forecasts of the impact of HIV/AIDS on the Ukrainian society and economy. The latter study assumed that in 2014, the life expectancy in Ukraine in the presence of HIV/AIDS epidemics would range between 61.6 and 63.4 for males, and 71.0 and 72.9 for females, which encompasses the values assumed in the current study, equaling 61.8 and 71.8 years, respectively.

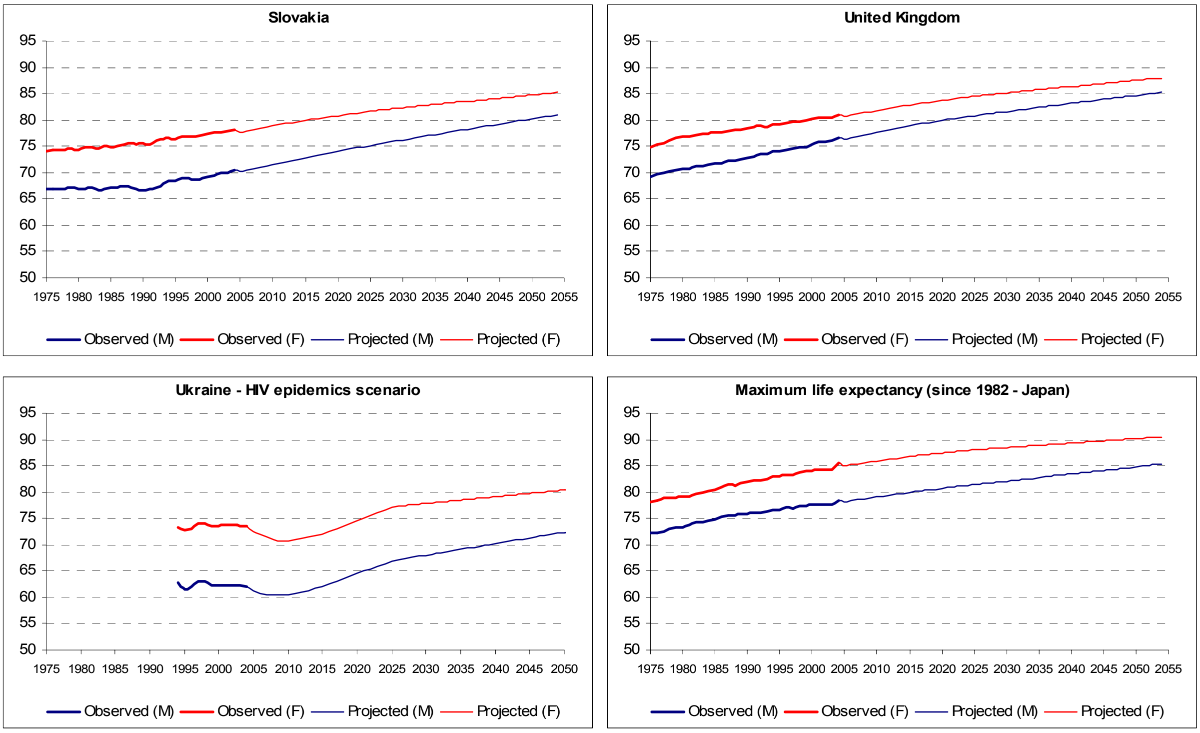
For the period 1975–2054, the observed (until 2004) and assumed (thereafter) values of life expectancy at birth for all countries under study, as well as the 'maximum' trajectories (from early 1980s onwards – Japanese), are illustrated for both sexes in Figure 2.1. For Ukraine, both variants, without and with HIV/AIDS epidemics, are shown. In all countries, the gap between life expectancy of males and females is expected to decrease by the end of the forecast horizon, as shown in Figure 2.2.

Figure 2.1. Life expectancy at birth: observed for 1975–2004 and assumed for 2005–2054



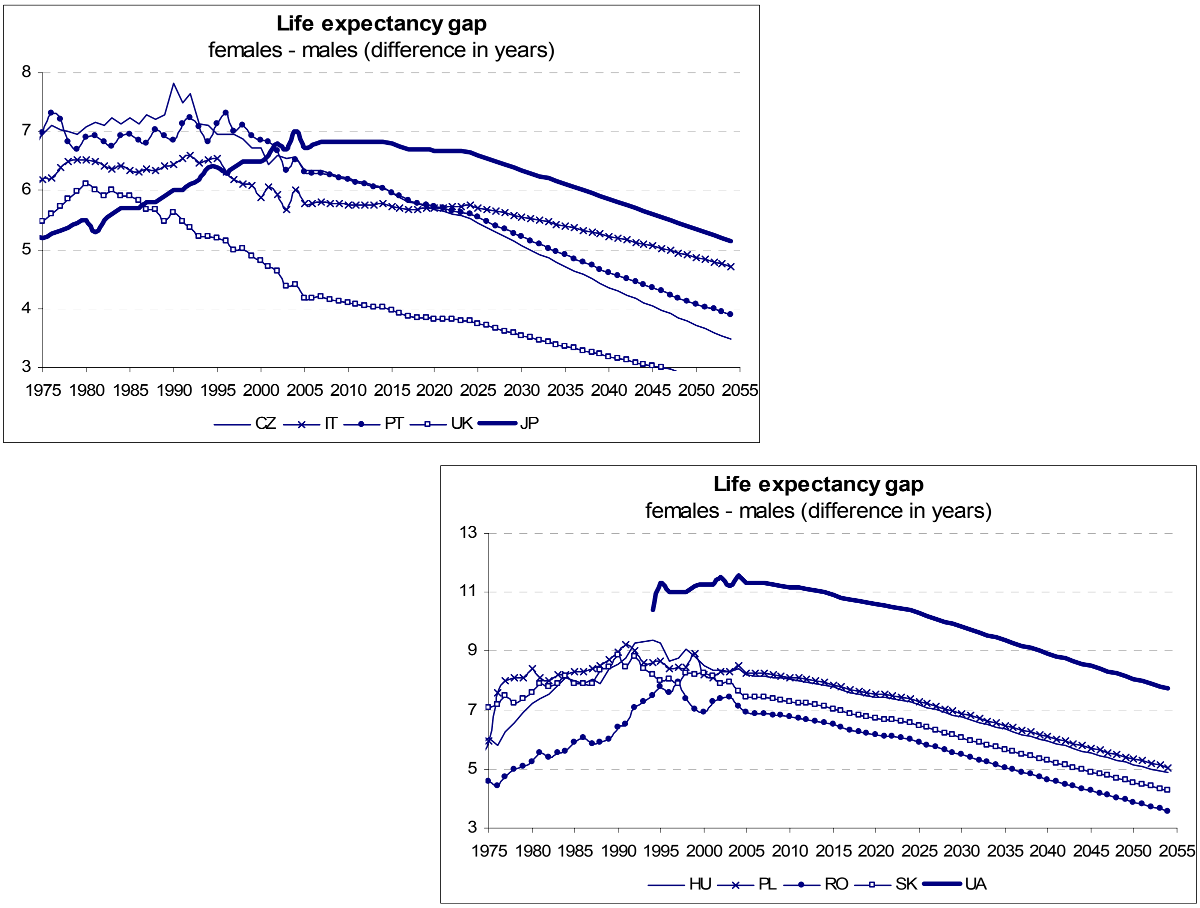
Source: Eurostat/NewCronos; Council of Europe (2005: Tables 10); own elaboration

Figure 2.1. (cont.)



Source: Eurostat/NewCronos; Council of Europe (2005: Tables 10); own elaboration

Figure 2.2. Life expectancy (e_0) gap: observed for 1975–2004 and assumed for 2005–2054



Source: Eurostat/NewCronos; Council of Europe (2005: Tables 10); own elaboration

3. International migration

The MULTIPOLES model, which is *de-facto* a multiregional model (Kupiszewska, Kupiszewski 2005) requires for a multinational forecast preparation of migration assumptions for two classes of migration: origin-destination intra-system international migration for flows between modelled countries (in case of the ARGO 2005 project – a 9 x 8 matrix) and for each country, the net migration gain/loss resulting from the exchange of population between this country and the rest of world. These two types of flows are treated differently in the model.

We specify below the migration scenarios. It should be, however, noted, that designing such scenarios is highly hypothetical and arbitrary. Theoretically, we could have applied a much better methodology for forecasting migration flows, however, due to the restricted time and resources of the project were unable to do that.

3.1. Migration within the system of ARGO-9 countries

The scenarios for origin-destination migration are defined as a set of matrices with multipliers which are applied to the matrix of crude origin-destination specific emigration rates (ER) per 1,000 inhabitants of the sending country for the benchmark year (rationale: Kupiszewska and Kupiszewski, 2005). The sequential multipliers are defined for each 5-year forecast period and applied to the rates estimated for immediately preceding period: initially derived from the values in Table 3.1 and modified at each step to account for the calculated changing population size. Table 3.1 presents the estimated origin-destination flows for 2004, taken as maximum values from the ones reported by the origin and destination countries (Kupiszewski, 2002: 109), and adjusted proportionally, whenever data were available by citizenship of migrants and not by origin / destination.

Table 3.1. Estimated intra-system migration matrix for 2004

From => To	CZ	HU	IT	PL	PT	RO	SK	UA	UK
CZ	-	45	915	1 011	31	114	21 152	4 933	7 266
HU	68	-	784	23	24	1 444	100	260	4 101
IT	337	162	-	450	302	727	82	129	3 839
PL	1 806	69	10 973	-	66	4	216	77	16 985
PT	22	5	475	7	-	5	4	5	5 750
RO	361	9 642	74 916	20	327	-	325	14	2 548
SK	15 788	392	757	22	16	15	-	9	5 834
UA	16 436	2 625	41 257	1 196	694	19	335	-	268
UK	635	4 163	4 970	872	3 262	1 243	86	21	-

Sources: Eurostat/NewCronos; Council of Europe (2005); own elaboration

In order to address the issue of uncertainty immanent in international migration forecasting, we consider two scenarios. The first one, labelled 'Development and Liberalisation', foresees economic development and deregulation of international migration, and is characterised by an assumption of a reasonable economic growth (2–5% GDP increase *per annum*). Socio-economic development in different parts of the world, would imply strong pull factors in the developed economies, and the associated liberalisation of migration control measures. On the contrary, the second scenario, labelled 'Stagnation and Control', assumes flagging economy and restrictive migration policies, coupled with strong push factors in the worse-off countries.

3.1.1. 'Development and Liberalisation' scenario

For the EU members states 'Development and Liberalisation' assumptions usually result in higher intra-union migration and increase in net migration from the outside of the EU. However, within the EU there are two groups of countries, rich "old" migrants and mid income "new" member states. The former group of countries have in general a positive migration balance of exchanges with other EU member states and the "new" countries are loosing migrants. After the last two rounds of EU enlargement this phenomenon increased.

It is difficult to assess, how the economic development will impact the "new" to "old" migration flows, as there will be two processes ongoing in parallel: economic development creates jobs and stimulates flows from poorer "new" to richer "old" countries. At the same time it reduces unemployment and increases salaries, diminishing therefore two important push factors in the "new" countries: unemployment and low salaries. In consequence we assumed that the economic development-related increase in migration will be moderate, starting at 5% in 2005–2009 and reducing over time by 0.5% per each five-year forecast period, ultimately stabilising after 2029. The reduction is justified by the assumption that over time the economies of "new" countries will grow faster than economies of "old" countries, reducing therefore the incentive to migrate.

We also assume no increase in migration within "old" and within "new" countries. Migration from Ukraine to "old" EU member states will be growing moderately until 2029 (by 2.5% per each forecast step), destinations slowly be shifting from "new" to "old" countries. We also assumed that migration to Ukraine and Romania will remain unchanged, despite growing emigration from these countries. Return migration from EU-8 to EU-15 countries will initially grow slowly, to account for increased return migration, but will stabilise after 20 years.

In short term, the key factor controlling migration will be the regime of opening labour markets of "old" member states to migrants from "new" member states. Within the first forecast step (2005–2009) there will be the end of the 3–year period of the "2 – 3 – 2 years" scheme of restrictions. We assume that all countries except Germany and Austria will lift restrictions in 2009. However, we think that most of those who wanted to emigrate from the "old" to "new" (2004 enlargement) countries have already done so in the period 2004–2006 and that the increase in outflow will occur predominantly in the first forecast period. We assumed the increase to be 4–5-fold, not taking into account short-term migration. In the second forecast period we assumed a moderate increase in flows to Germany which will have to lift restrictions in 2011, associated with relative decrease in the flows to the UK. Later, it is assumed that the lack of legal restrictions will have no impact on flows.

Among the ARGO-9 EU countries, Czech Republic, Poland and Slovakia did not impose any restrictions for labour migration of Romanian citizens, while Hungary and Italy liberalized only few sectors of the economy. We assumed that the increase in emigration from Romania will concern all destination countries except Ukraine. This is to express our belief that lifting administrative restrictions by poorer EU countries will have a similar effect as the attraction of rich countries, and acknowledge the existence of a sizable Hungarian minority in Romania. It is also assumed that most of the "old" EU member states will lift restrictions on labour migration of Romanian citizens after 5 years. Similar scenarios as in the case of migration from EU-8 to EU-15 are envisaged, however the expected short-term increase will be smaller than in the former case, mostly because a lot of Romanian migrants either already emigrated or will emigrate before the lifting of restrictions takes place. An increase in migration to the "old" EU member states will be at the expense in migration to the EU-8. Emigration from Romania will also decrease faster than in the case of the EU-8 countries, to express our belief that it is unlikely that very high outflow could be maintained for a long time.

In all cases it is assumed that after 2029 the flows will stabilise. This is due to difficulties in reasonable predicting of changes of such volatile variable as international migration.

3.1.2. 'Stagnation and control' scenario

In the "Stagnation and control" scenario we assumed that in general the direction of flows will remain unchanged, but the *changes* in their intensity will decrease by half. This reduction will be much smaller for the changes of outflows of migrants from "new" to "old" EU member states, pending the removal of restriction on mobility of labour: only to 70–80% as compared with values assumed for "Development and liberalization" scenario. Return flows of migrants from will remain unchanged, as they are less dependent on the economic cycle (a silent assumption in the scenario setting is that the economic growth and decline occurs with the same intensity in all countries simultaneously).

3.2. Net external migration scenarios from other countries of the world

The second migratory variable, for which assumptions are made, is net 'external' migration (*NM*) of particular countries, concerning population exchange with all countries outside the ARGO-9 area ('rest of the world'). Due to the design of the MULTIPOLES, the assumptions are set in terms of the crude *numbers of migrants*, not migration rates (see Kupiszewska and Kupiszewski, 2005). For the purpose of scenario-setting, the *NM* aggregate was de-composed into two additive components: migration balance with non-ARGO countries of the EU and EFTA (NM^{Eur}), and net migration from the other parts of the world (NM^{Oth}).

The forecast steps are five-year, with time index t = 0, 1, …, 10 for the periods 2000–2004, 2005–2009, …, 2050–2054, respectively. The projected NM_t values are yearly arithmetic averages for the particular periods. The initial values for 2004 have been estimated as total net migration, as reported by the countries themselves, less net migration within the ARGO-9 system. The methodology of initial data estimation follows thus Kupiszewski (2002: 109). As the forecast is based on the five-year averages, the values for the 'zero' period of the forecast, i.e. 2000–2004 (NM_0), are calculated as weighted averages of respective yearly values, with weights w_t for particular years t equaling: w_{2000} = 0.10, w_{2001} = 0.15, w_{2002} = 0.20, w_{2003} = 0.25, and w_{2004} = 0.30 (exceptions: Italy and Ukraine – countries with several missing observations, for which the weights w_t have been proportionally adjusted, and Portugal, for which an arithmetic average for 2003–2005 has been used, calculated from the national data).

Assumptions on target values of migration balance with the outside world for the period are knowledge-based and follow the rationale presented below, both for migration within the EU and EFTA (NM^{Eur}), and for flows from the other parts of the world (NM^{Oth}). Also here, two scenarios are considered: 'Development and Liberalisation', and 'Stagnation and Control'.

3.2.1. 'Development and Liberalisation' scenario

a) 'External' migration within the EU and EFTA, NM^{Eur}

- **Czech Republic, Hungary and Italy.** A moderate increase (25%) in net migration throughout the forecast horizon is assumed, due to an increasing intra-European mobility following the favourable socio-economic developments.
- **Poland and Slovakia.** It is expected that almost all EU and EFTA countries will lift restriction on mobility of labour in 2009, with the exception of Germany and Austria, which will likely do so in 2011, and Switzerland – in 2014. This would result in increasing net emigration two first forecast periods (2005–2009 and 2010–2014) by a factor of 1.25, followed by a decline to a zero balance by 2024, and a subsequent increase of net migration gains, due to growing return migration, ultimately reaching the levels from the initial period (2000–2004), only with an opposite (plus) sign.
- **Portugal.** Portuguese positive migration balance is to some extent fuelled by return migration. It is assumed that favourable economic condition will increase this category of migrants. Another factor is retirement migration, which may increase as Portugal will be a competing destination in comparison to France and Spain. For that reason, we assume a 50% increase as compared to the initial level for 2000–2004.
- **Romania.** Strong demand for labour in the EU countries and income gap will drive emigration from Romania. As most of EU member states decided to keep restrictions on labour migration for Romanian citizens, and it will last most likely until 2012, in the first forecast period (2005–2009) only moderate increase by 50% in migration loss is expected, mostly fuelled by unrestricted forms of labour migration (i.e. delivery of services and self-employment). In the second forecast period (2010–2014) a very

substantial outflow, by a factor of three is expected, as all restrictions will be most likely lifted in this period. The target value is assumed to equal 1.5 of the initial value.

- **Ukraine.** Uncertain economic prospects of Ukraine, in particular with respect to the economic reforms, and a strong demand for labour in the EU countries will result in a pertaining net migration loss, for which we assume no change in magnitude by the end of the forecast horizon.
- **United Kingdom.** Negative net migration in the UK is mainly fuelled by retirement emigration to France and Spain. Financial resources of migrants have been gathered prior to migration, however the development over 50 years period may increase the number of persons who could afford migration. We assume an increase of the target by 50%, as compared to the initial value.

b) 'External' migration outside the EU and EFTA, NM^{Oth}

Population ageing and strong demand for labour will result in an increase of net migration *gain* by 50% in the **Czech Republic**, **Hungary**, **Romania** and **Slovakia**, and a decrease in net migration *loss* by 50% in **Ukraine** – an emigration country. Keeping the migration balance of Ukraine below zero even under the assumption of economic development can be justified by an ever more important role of Russia as a growing petrodollar-fuelled economy with a strong demand for labour. For **Italy** and the **United Kingdom** we assumed the same target values of net immigration gains as at the beginning of the forecast period, while for **Portugal** – target values equal half of the initial values. The rationale for all three cases is a very high magnitude of net yearly inflows observed already at the beginning of the 21st century. In turn for **Poland** the initial net value of NM^{Oth} = 942 people is likely heavily underestimated – in the Development scenario we therefore expect a 15-fold increase by 2054.

3.2.2. 'Stagnation and control' scenario

a) 'External' migration within the EU and EFTA, NM^{Eur}

- **Czech Republic, Hungary, Italy and Portugal.** No changes assumed.
- **Poland ad Slovakia.** The expected schedule of lifting restrictions on mobility is the same, as in the previous scenario, yet we assume that although the demand for migrants will be weaker due to flagging economies of Western Europe, the negative push factors at source will prevail. This will result in a doubling net emigration loss by in two first forecast periods (2005–2009 and 2010–2015). Later on we expect a slow increase to zero by the end of the forecast horizon, due to return migration, though smaller than in the previous scenario.
- **Romania.** A moderate demand for labour in the EU countries will be compensated by an increasing pressure to leave the country due to unfavourable economic situation, which will drive larger migration from Romania, in comparison to the previous scenario. Hence, we assume a double increase in migration loss in the first forecast

period (2005–2009), a very substantial increase, by a factor of 3.5 in the subsequent one (2010–2014), especially, as all political restrictions are likely to be lifted. The increases will be followed by a slow return to the trajectory aiming towards the target value, set to equal the initial value.

- **Ukraine.** Stagnating economic situation of Ukraine is expected to be a key push migration factor, doubling the net migration loss by the end of the forecast horizon.
- **United Kingdom.** In this scenario, we assume that the stagnation over 50 years will not lead to the increase of the number of persons who could afford retirement or similar migration. Therefore, we assume no change in net migration figures.

b) 'External' migration outside the EU and EFTA, NM^{Oth}

In this scenario we expect a *decline* in net migration gain by 50% in **all countries** with positive NM^{Oth}, with the exceptions of **Portugal** (decline by 80%) and **Romania** (decline by 65%), due to relatively high initial levels of immigration in two latter countries, unlikely to persist in a longer future. For **Ukraine**, a net migration *loss* is expected to increase by 50%, as compared to the initial values from 2000–2004, due to the continuing presence of unfavourable push factors fuelling emigration.

The assumed values of particular net 'external' migration components achieved by the end of the forecast horizon are presented in Table 3.2. With the exception of post-enlargement deviations for NM^{Eur} described above (for Poland, Romania and Slovakia), the initial and target NM values have been bridged by the means of an exponential interpolation, according to the following formulae:

$$NM^{Eur}_t = NM^{Eur}_{10} + (NM^{Eur}_0 - NM^{Eur}_{10}) \cdot \exp(-r \cdot t), \text{ and}$$
$$NM^{Oth}_t = NM^{Oth}_{10} + (NM^{Oth}_0 - NM^{Oth}_{10}) \cdot \exp(-r \cdot t).$$

In the above equations, r denotes the growth rate of the exponential function, here assumed 0.25. This solution ensures a smooth passage from NM_0 to NM_{10} and the asymptotic stabilisation on the target level. The trajectories of the total NM (equal to $NM^{Eur} + NM^{Oth}$) for particular countries are illustrated in Figure 3.2.

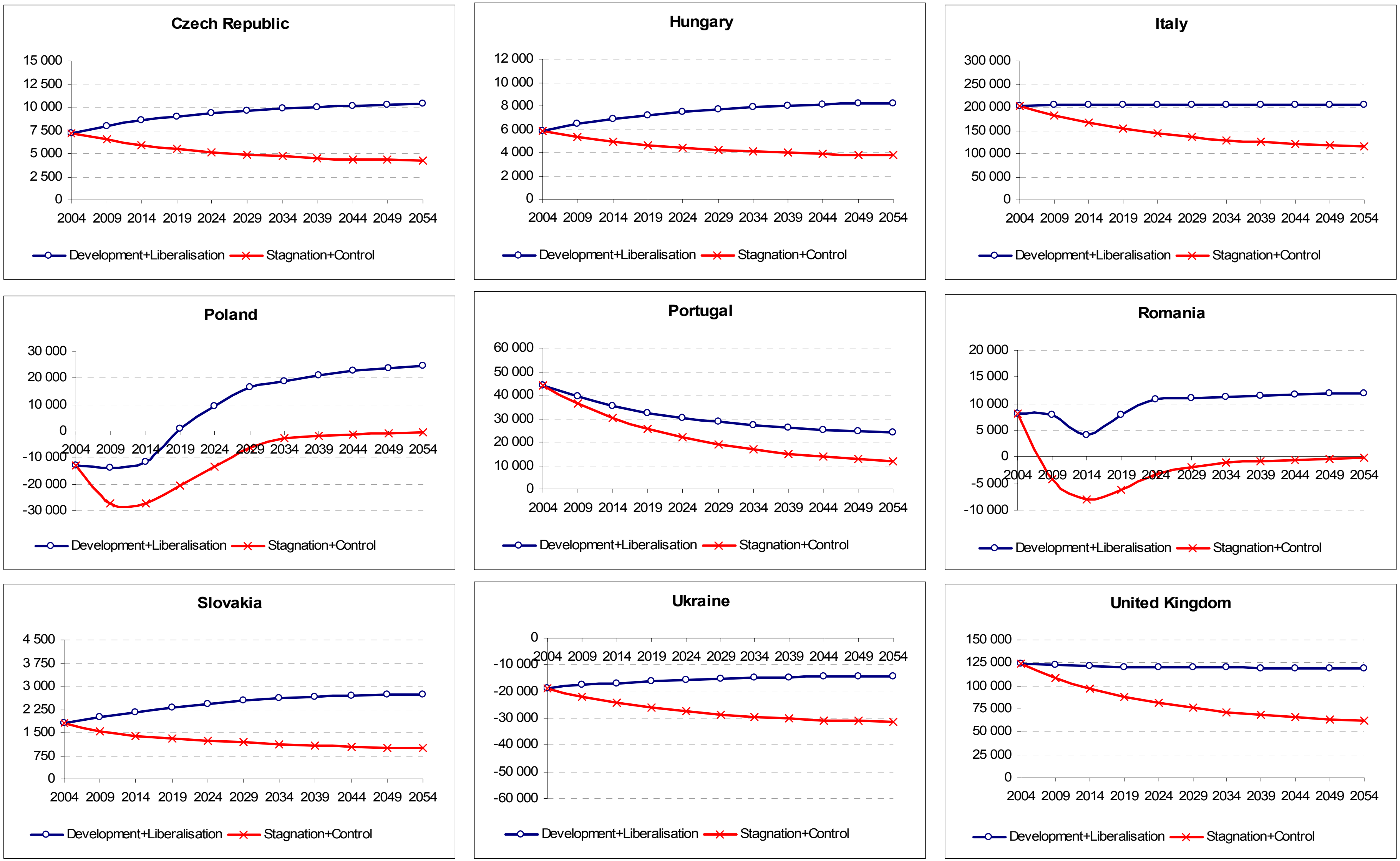
Table 3.2. Net 'external' migration exchange with non-ARGO-9 countries: 2004 and 2054

Country	Average *NM* 2000–2004	'Development and Liberalisation', 2054			'Stagnation and Control', 2054		
		Europe: NM^{Eur}	Other: NM^{Oth}	Total *NM*	Europe: NM^{Eur}	Other: NM^{Oth}	Total *NM*
Czech Rep.	7 191	894	9 431	10 324	727	3 497	4 224
Hungary	5 855	1 623	6 617	8 240	1 320	2 454	3 774
Italy	203 520	15 300	191 075	206 376	12 445	103 380	115 824
Poland	–13 148	11 778	13 054	24 832	–1 157	510	–647
Portugal *	43 915	260	23 760	24 020	178	11 667	11 845
Romania	8 179	–4 589	16 522	11 933	–3 145	3 068	–77
Slovakia	1 803	42	2 703	2 746	–4	1 003	998
Ukraine	–18 739	–8 936	–5 304	–14 240	–17 138	–14 303	–31 441
United King.	123 571	–14 754	133 684	118 930	–10 112	72 329	62 216

* For Portugal, an average for 2003–2005 was used as a baseline value of *NM*.

Sources: Eurostat/NewCronos; Council of Europe (2005); Portugal: www.ine.pt; own elaboration

Figure 3.2. Net 'external' migration exchange with non-ARGO-9 countries: trajectories 2004–2054 (5-year averages)



Sources: Eurostat/NewCronos; Council of Europe (2005); own elaboration

For all migration scenarios, age and sex structures from 2004 (or latest available year) have been assumed constant throughout the forecast horizon. For migratory flows among the ARGO-9 countries (intra-system), eight 'model' age schedules have been applied, depending on largely-defined regions of origin and destination of migrants, in all cases separately for males and females. We distinguished three such regions: Central and Eastern Europe (Czech Republic, Hungary, Poland, Romania, Slovakia and Ukraine), Southern Europe (Italy and Portugal), and the United Kingdom as a separate, one-country region. The age schedules for flows, marked with numbers 1 through 8, are averaged between all origins and destinations belonging to particular regions, as schematically presented in Table 3.3. The distributions have been defined in terms of age-specific migration rates per 1,000 population of the sending country in a given age group.

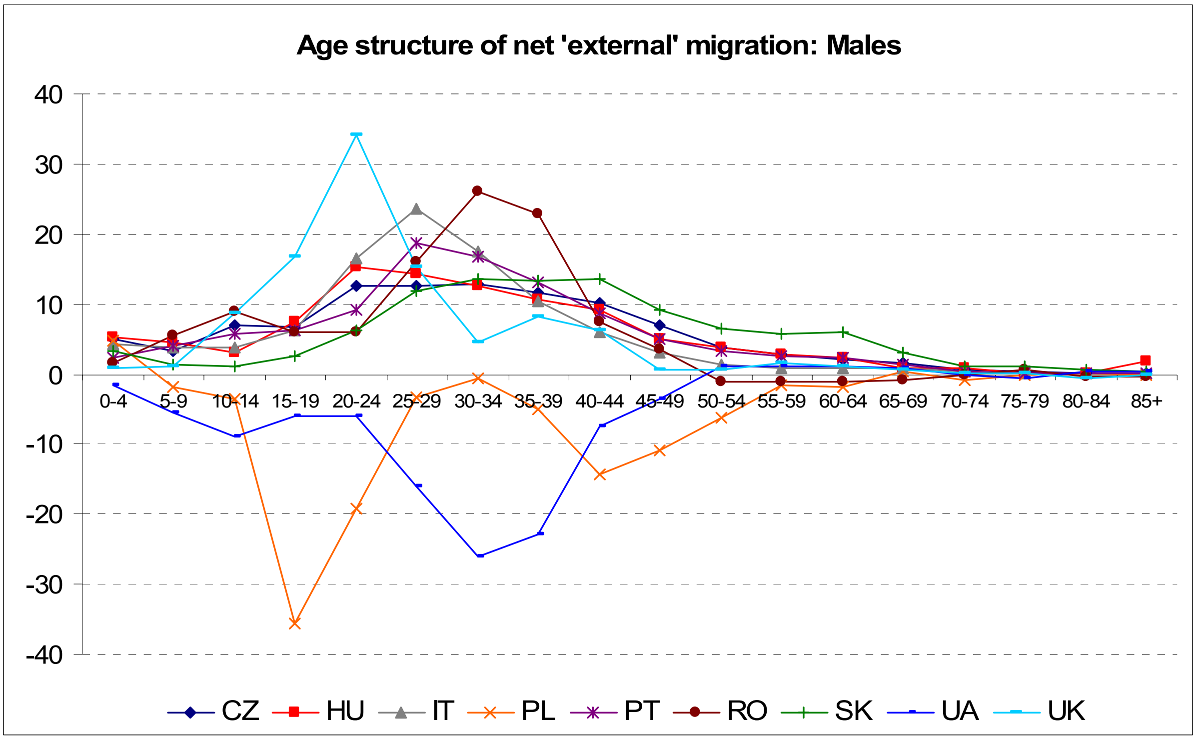
Table 3.3. Scheme of assumptions on age schedules for intra-ARGO-9 area migration

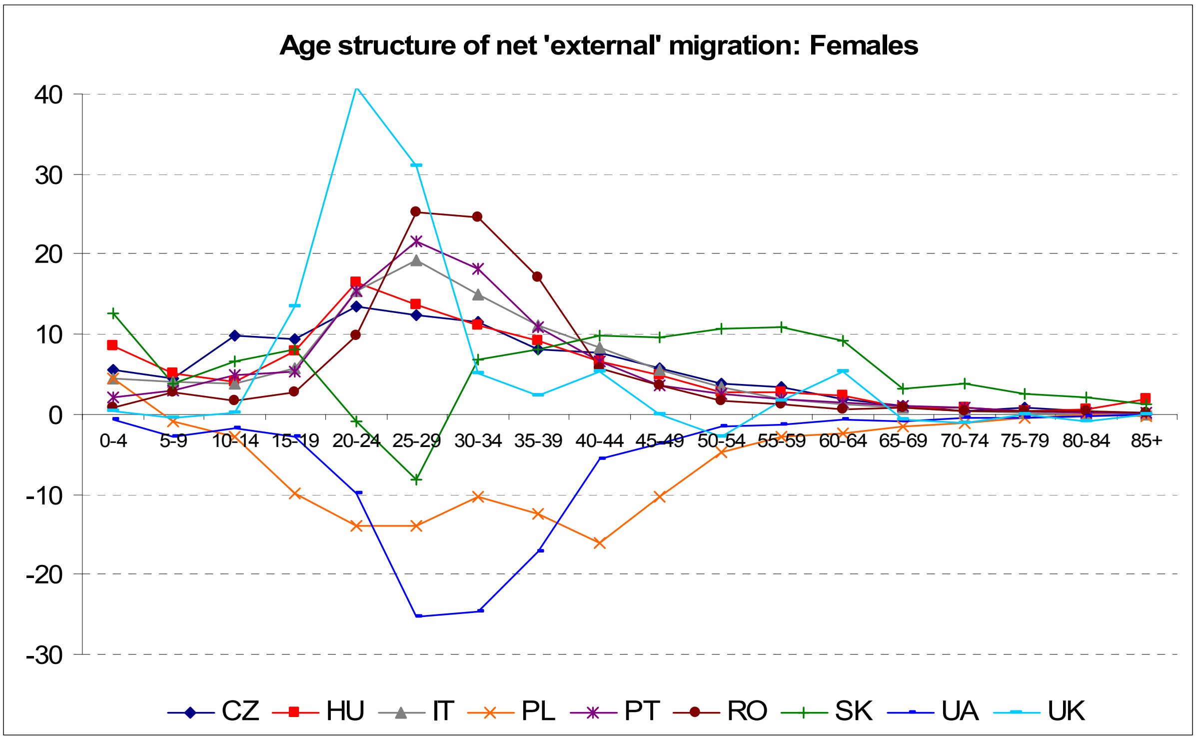
Regions	- of destination:	Central and Eastern Europe						Southern Europe		UK
- of origin:	Countries	CZ	HU	PL	RO	SK	UA	IT	PT	UK
Central and Eastern Europe	CZ	-	1	1	1	1	1	2	2	3
	HU	1	-	1	1	1	1	2	2	3
	PL	1	1	-	1	1	1	2	2	3
	RO	1	1	1	-	1	1	2	2	3
	SK	1	1	1	1	-	1	2	2	3
	UA	1	1	1	1	1	-	2	2	3
Southern Europe	IT	4	4	4	4	4	4	-	5	6
	PT	4	4	4	4	4	4	5	-	6
UK	UK	7	7	7	7	7	7	8	8	-

Sources: Eurostat/NewCronos; own elaboration

For net 'external' migration, country-specific age schedules have been defined in terms of percentages, summing up either to 100.0 for migration gains, or to –100.0 for loses. Such schedules have been estimated from the 2004 Eurostat data on migration by age, separately for males and females. In case no structures were available in the dataset for a given country, the ones from an ARGO-9 country with similar migration patterns have been used instead (for Ukraine, Romanian age schedules were applied, with a minus sign). For Poland, the turn from negative to positive net migration under the Development scenario in the period 2015–2019 has been associated with a change from Polish to Romanian age schedule. The respective country-specific age schedules for net external flows, calculated separately for males and females, are shown in Figure 3.3.

Figure 3.3. Net 'external' migration exchange with non-ARGO-9 countries: age schedules





Sources: Eurostat/NewCronos; own elaboration

4. Labour force participation

Assumptions on the economic activity (interchangeably: labour force participation) concern gross labour supply, including the unemployed and employed in any type of paid occupation, whether full-time or part-time. We expect that in the coming 50 years part-time and temporary jobs will become increasingly popular among younger people, including students, to some extent independently from the future increase of rates of enrolment in higher education. Population ageing will cause shortages of younger labour and gradually enforce more flexible employment conditions, and on the other hand, lead to raising of retirement age in order to prevent pension systems from bankruptcy, in both cases increasing participation rates.

Assumptions on target economic activity rates for 2054, generally following the discussion in Saczuk (2004), albeit with slightly modified values, are presented in Table 4.1. For males (**M**), a common target has been assumed, while for females (**F**) the assumptions for Italy are different from those for the remaining countries under study (lower by 10 percentage points for the 20–64 years age groups, and by 5 points for the 65–74 ones), due to very low female labour participation in the former case. For the United Kingdom, the target values for 15–19-year-olds has been exceptionally set as 60.0 percent, due to country-specific trends observed in the past. Additionally, Table 4.1 presents the 'maximum activity' (max) patterns, obtained from cross-country and cross-time (1985–2002) age-specific maxima for 27 European countries analysed in Saczuk (2004), slightly corrected downwards for groups 70–74 and 75+.

Table 4.1. Target age patterns of economic activity assumed for 2054 (percent of population)

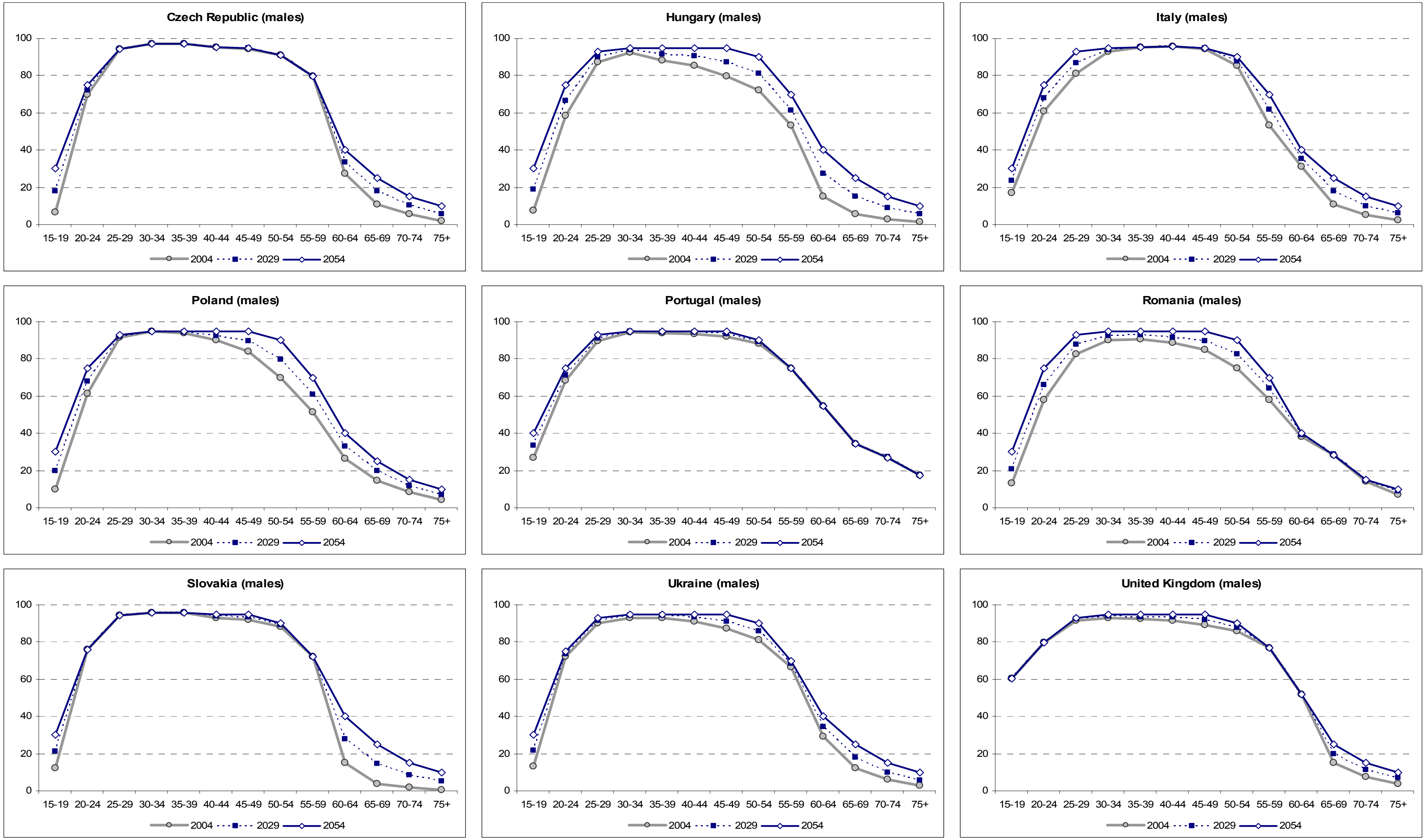
Pattern	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75+
M	30.0*	75.0	93.0	95.0	95.0	95.0	95.0	90.0	70.0	40.0	25.0	15.0	10.0
M (max)	70.3	88.6	97.0	99.1	98.4	97.6	96.7	93.9	87.6	71.4	46.1	23.1	11.5
F	20.0*	65.0	80.0	85.0	85.0	85.0	85.0	75.0	60.0	40.0	25.0	15.0	5.0
F (Italy)	20.0	55.0	70.0	75.0	75.0	75.0	75.0	65.0	50.0	30.0	20.0	10.0	5.0
F (max)	65.6	91.0	94.5	96.4	95.9	96.5	94.9	89.9	79.0	53.4	39.5	19.8	9.9

*For the United Kingdom, 60.0 percent.

Source: Saczuk (2005), own computations

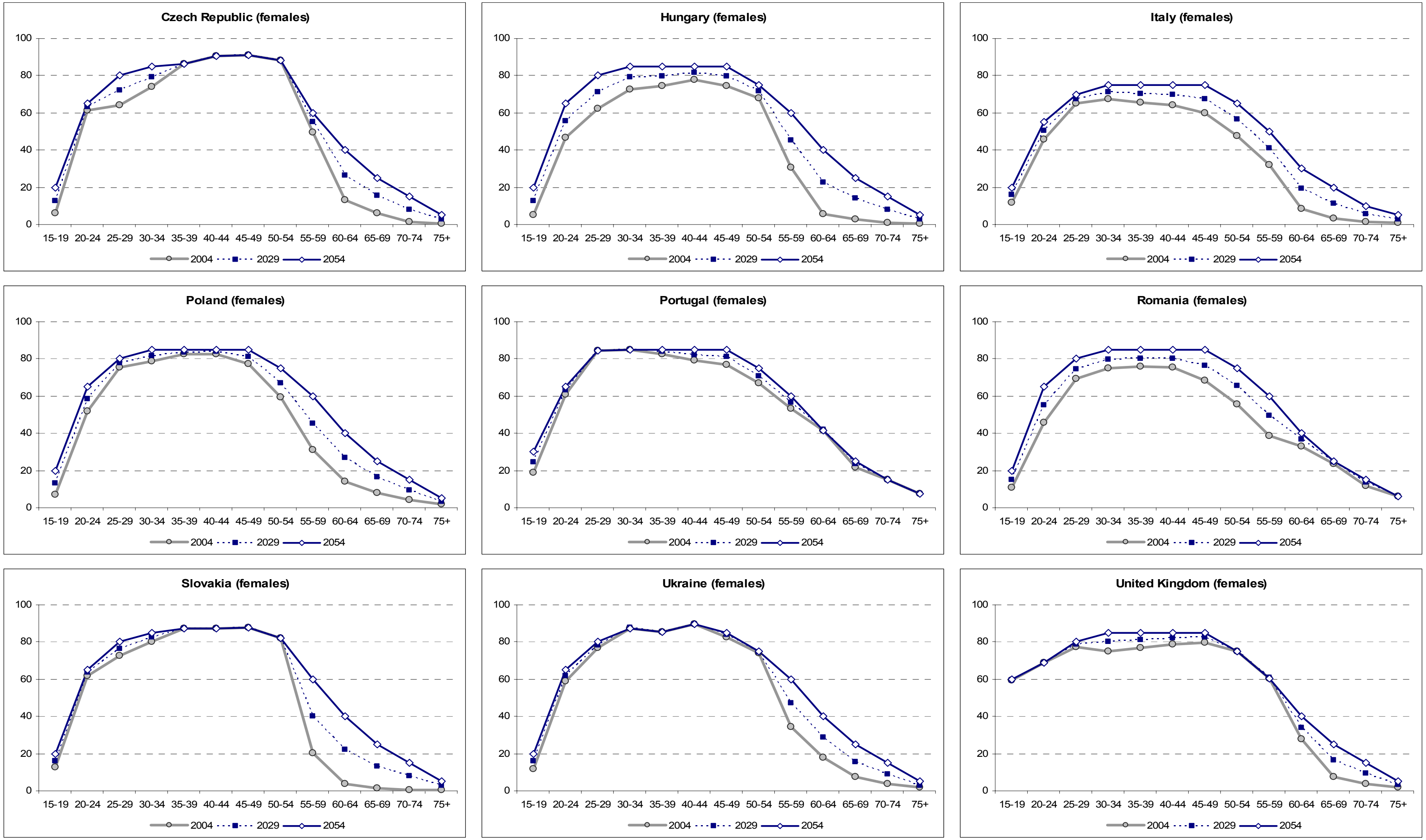
The initial values of age-specific rates observed for 2004 are bridged with the target ones using a Hermite interpolation with the same coefficients as for fertility (see Section 1), in this case for the whole 50-year period. Additionally, we made an assumption of non-decreasing age-specific economic activity rates. The resulting changes in the country-specific patterns of labour force participation are indicated in Figures 4.1 for males and 4.2 for females, while the age patterns of 'maximum economic activity' are presented in Figure 4.3.

Figure 4.1. Country-specific age patterns of economic activity: Males



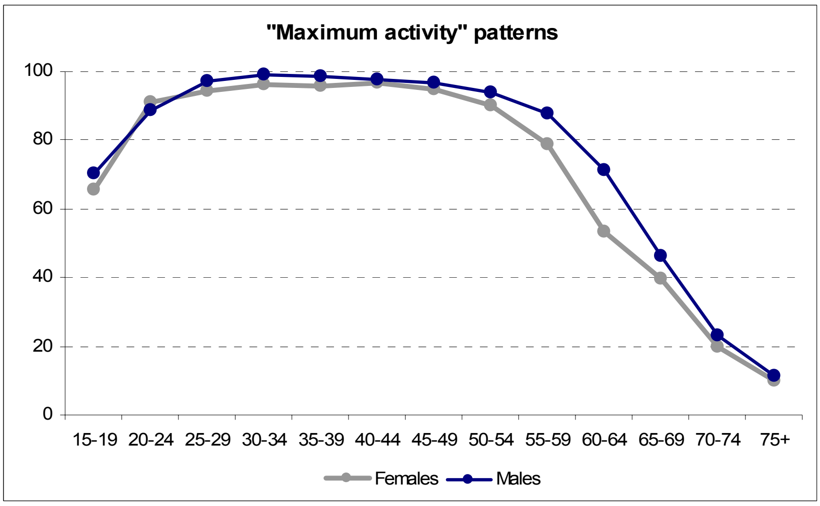
Source: ILO (Laborsta estimates) and own elaboration

Figure 4.2. Country-specific age patterns of economic activity: Females



Source: ILO (Laborsta estimates) and own elaboration

Figure 4.3. Age patterns of 'maximum economic activity' (percentages)



Source: ILO (Laborsta estimates); Saczuk (2004) and own elaboration

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