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Analysis of cross-country differences in the shape of the age-wage relationship with an attempt to tackle age-productivity differences within the EU

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Contents

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Abstract

As the process of population ageing in Europe carries on and the retirement age increases, the relationship between age and productivity becomes more and more important. One can be afraid that as the average age of the working individual goes up, the average level of productivity growth will go down, resulting in decreasing competitiveness of European economies. Our expectation is that due to serious differences in labor market structures between New Member States (NMS) (including current candidates) and the EU15, the former are the first order candidates to experience higher than average productivity costs of ageing in the near future. In this paper, one tries to examine this hypothesis.

The research strategy in this study has been based on the assumption that, in general, wages are correlated with productivity on the individual level and, as such, can be used as a proxy for productivity. Such an assumption is quite risky and can be easily criticized. Hence, based on the results of earlier studies, our main empirical analysis is limited to groups of workers for which one can expect that correlation between productivity and wages is still substantial.

It seems, that taking all the caveats in mind, the results of our analysis show that the relative productivity of older workers in the NMS is lower than in EU15.

1. Introduction

As the process of population ageing in Europe carries on and the retirement age goes up, the relationship between age and productivity becomes more and more important, see Carone et al (2005). One may be afraid that as the average age of the working individual goes up, the average level of productivity growth will go down, resulting in decreasing competitiveness of European economies. There exist a number of papers trying to assess the shape of the relationship between age and productivity, see for example Skirbekk (2003). In this paper, on the other hand, one does not try to answer questions concerning the existence or the extent of the productivity decline with age. What one tries to do is to show that the process, as such, may be not homogenous across Europe.

Our expectation is that EU New Member States (NMS)[1] are the first order candidates to experience higher than average productivity costs of ageing in the nearest future. It may stem from serious differences in labor market structures between these countries (including current candidates) and the EU15. On the one hand, the convergence process results in fast restructuring and technological change leading to more and more human capital intensive jobs, yet the current education level and continuous learning participation of the older labor force is much lower in NMS than in the EU15. It can be suspected that lower (on average) employment rates of the elderly in NMS are the manifestation of these processes.

The aim of this research is twofold. At first we examine the hypothesis that older workers in NMS are currently less productive (in relation to their younger counterparts) than in other EU states. Second, we try to find evidence that this productivity gap, if present, influences the current employment rates of the elderly workers in NMS. If both are true, and if structural differences between labor markets of the NMS and EU15 last for the next several years, it can have serious consequences for these countries with respect to their ability to meet Lisbon Strategy employment targets. It may equally result in lower overall productivity gains limiting the GDP growth potential of these countries and therefore of the EU as a whole.

[1] We will refer here to the ten countries that joined the European Union on 1st May 2004, and especially to eight of them (excluding Malta and Cyprus). The EU15 refers to fifteen EU member states before this date.

The research strategy in this study has been based on the assumption that, in general, wages are correlated with productivity on the individual level and, as such, can be used as a proxy for productivity. Such an assumption is quite risky and can be easily criticized. Hence, based on the results of earlier studies, our main empirical analysis is limited to groups of workers for which one can expect that correlation between productivity and wages is still substantial.

It seems that taking all the caveats in mind, the results of our analysis show that relative productivity of older workers in the NMS is lower than in the EU15. We also find some evidence that lower employment rates of the elderly in the NMS are related to these productivity differences. On the other hand however, employment rate differences within the NMS and EU15 can be supposed to depend on wage arrangements.

The paper is organized as follows: in section 2 we present some theoretical consideration concerning the age-productivity relationship, in section 3 we try to explain why we expect NMS countries to suffer from a lower relative productivity of older workers than the EU15, sections 4 to 7 present results of the empirical analysis, in section 8 we try to relate age-productivity differences of the elderly to the employment rate, and section 9 concludes.

2. Some theory

This study is devoted to the widely discussed issue of productivity decline of older persons and its consequences for total productivity dynamics in the face of an ageing population. This issue is still widely discussed in economic literature.

Productivity can decline with age for numerous reasons. The economic (and also medical) literature has devoted the majority of its attention to the two most distinct phenomena: falling physical abilities (see Kleemeier (1954), Shephard (1999) and Ilmarinen (1997)) and falling cognitive abilities (see Greller and Simpson (1999), Park (1994)). Both lack of physical abilities but, to an even larger extent, lack of cognitive abilities, can be easily overcome by accumulated working experience resulting often in better quality of work performed, (see Czaja and Sharit (1998)), but also, as Keyfitz (1984) suggested, that in an era of rapid changes, less depends on the accumulation of experience than on its discard and replacement.

In general, therefore, one can expect, as suggested by Skirbekk (2003), that loss of productivity with age will be more pronounced in jobs where performance depends more on physical power, speed of working, learning and problem solving, and less so in jobs where experience and verbal abilities are more important. It means that productivity decline with age is not homogeneous. It can depend on numerous factors such as: level, quality and adequacy of education, specific characteristics of industries and jobs, and the pace of technological change. Since countries differ with respect to all of these factors, the ageing effect on productivity will not be homogeneous across countries.

For example, current and future education levels depend on previous/current schooling participation; while education quality and adequacy depend on the quality of education curricula. The productivity decline will probably be more acute in countries with more developed or with currently more rapidly developing "high-tech" industries (see Daveri and Meliranta 2006), since the pace of technological change depends on numerous country specific factors such as: dynamics of the industrial structure, level of openness of the economy and its changes, the current level of technological progress (due to technological convergence) and possibly many others.

In order to better illustrate the possible mechanics behind the age-productivity relationship let us consider the simple human capital wage/productivity model based on that applied in Neumark&Taubman (1994).

$$w_t = -k_t + \beta(H_t - \delta_t) \qquad (1)$$

where w_t stands for wage at time t being in this model equal to productivity, k_t is effort put into acquiring new knowledge instead of working, i.e. value of human capital investment in time t and comes into the model with negative sign, H_t is human capital accumulated till time "t" (knowledge and experience) positively influencing performance and δ_t depreciation of human capital in time "t".

Now let us assume that:

$$k_t = k(t) \text{ and } k'(t) \leq 0 \text{ and } k''(t) > 0 \text{ and } lim_{\infty} k(t) = 0 \qquad (2)$$

$$H_t = \int k_t dt \Rightarrow dH_t/dt = k_t \qquad (3)$$

$$\delta_t = \delta(t) \text{ and } \delta'(t) \geq 0 \text{ and } \delta''(t) > 0 \text{ and } lim_{\infty}\, \delta(t) = \infty \qquad (4)$$

Differentiating (1) in respect to (t) we will obtain:

$$dw_t/dt = -dk_t/dt + \beta(k_t - d\delta/dt) \quad (5)$$

The shape of the age-productivity profile as described by (5) depends, in this simple model, on the relation between k_t, $k'(t)$ and $\delta'(t)$. In the special case, with constant (or zero) depreciation of knowledge/human capital, the age-productivity profile is strictly increasing as in the original version of this model used in Neumark&Taubman (1994). In other cases, the age-productivity profile is increasing at the beginning of the career and it depends mainly on how much we learn (k_t) and how quickly we switch from learning to working (dk_t/dt), since knowledge depreciation at the beginning of the career is expected to be rather slow.

However, from the point of view of this paper it is much more interesting to consider what is going on at the end of the career. If, at this stage of the career, both k_t and (dk_t/dt) are already small, the speed of knowledge depreciation ($d\delta/dt$) plays a decisive role inshaping the age-productivity curve. The quicker knowledge depreciates, the faster one's productivity declines. The only way to overcome this accelerating knowledge depreciation is to keep learning i.e. keep k_t big and consequently, keep dk_t/dt small[2]. If that is not the case, the incentives to retire are increased by lower chances to have a well paid job at older ages.

3. Why productivity of older workers can be lower in NMS?

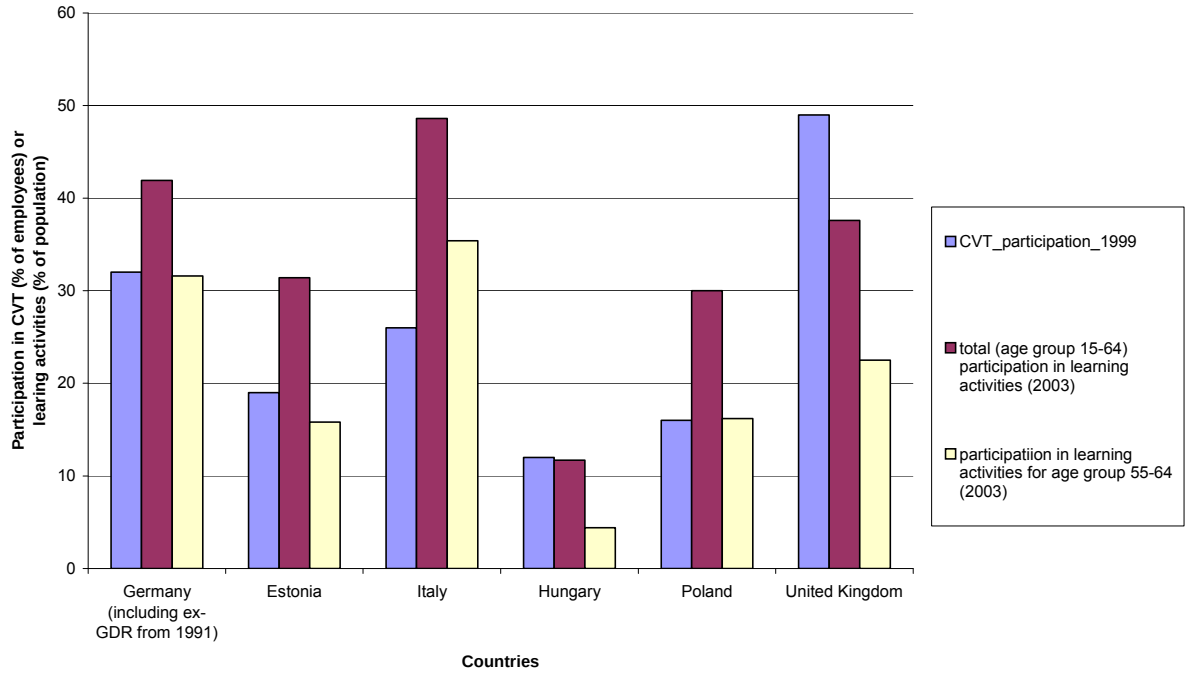
Taking the above into account, it seems that EU New Member States (NMS)[3] are the first order candidates to experience a higher than average productivity cost of ageing in the near future.

During the last several years, the NMS have been experiencing the rapid structural reforms of their economies accompanied by the resulting (supposedly more rapid than in other EU countries) technological change i.e. ($d\delta/dt$) is relatively large there. These processes are not likely to fade out in the near future since the structure of NMS economies and their technological advancement still differ from EU and OECD averages.

[2] For the sake of simplicity, we abstract here from real effectiveness of the learning process which, at first, depends on the quality of education curricula and also tends to decrease with age (decreasing cognitive abilities).
[3] We will refer here to the ten countries that joined the European Union on 1st May 2004, and especially to eight of them (excluding Malta and Cyprus). EU15 refers to fifteen EU member states before this date.

NMS do not seem to be able to overcome this problem by increased k_t either. The participation rates in continuous education in these countries are much lower than in the EU15. Only about 10% to 20% of employees participate in Continuous Vocational Training activities in Estonia, Poland and Hungary, and the lowest number analyzed for the EU15 is 26% in Italy. Similar proportions can be observed if we take into account the share of the working age population participating in any educational activity. All the numbers are the smallest in Hungary where only 4.4% of population aged 55-64 continues learning;, whereas, in the EU15, this share varies from 22% (in UK) to 35% (in Italy).

Figure 1. Participation in education activities in selected NMS and EU15 countries.



Source: Eurostat

Not only is participation in continuous learning below average, but also the average level of acquired formal education of the labor force is slightly below the OECD average in some NMS (OECD 2005). But it is not only the level of education that determines the resulting productivity of a worker. It is also (if not mainly) the quality of the education curricula. Comparative studies of education quality seem to suggest that, currently, there exist quality deficiencies in the educational systems of some NMS (see OECD 2005). One can suspect, although due to the lack of data it is impossible to verify the hypothesis, similar differences could be also observed in the past and they have to result in lower relative productivity of older workers.

The labor market statistics in NMS suggest also that the productivity of the older labor force in these countries might be lower than in the EU15. In most of the NMS, one observes systematically lower labor market participation rates of the older population than the OECD average, (OECD 2006). It may be the static effect of the relatively low level of productivity of older workers there due to all of the abovementioned reasons. If this is true, we should be able to observe it in the data. Moreover, one can also expect that this productivity gap stays lower in the future as well, and, as a result, the participation rates will not converge, or will converge very slowly, to the OECD average.

4. Basic empirical results

The research strategy in this study has been based on the assumption that in general, wages are correlated with productivity on the individual level and, as such, can be used as a proxy for productivity. Obviously, such an assumption is quite bold and may be criticized based on the results of numerous studies proving that wages of older workers in general tend to exceed their respective productivity levels (see for example Lazear (1981), Hallerstein&Neumark (2004) and other studies cited by the OECD (2006).

However, there is also evidence that wages are well correlated with productivity for some specific categories of workers, mainly those working in basic industries and jobs requiring less skill (Daveri&Meliranta 2006, Hellerstein&Neumark 1995). It also seems that wages are rising more steeply with age for highly-educated staff (OECD 2006), which suggests that the problem of a seniority premium is less pronounced among those with lower qualifications. Some earlier studies indicate that high wages for older workers are related to their longer working tenures for a single employer, therefore, wages can be better proxies for productivity decline related to ageing if working tenure is controlled for.

Based on this evidence, apart from estimating the age-wage curves for the general population of employees, we estimate also the age-wage curves for employees characterized by low education level (general secondary at maximum), performing simpler tasks (ISCO 5 and above) and working in competitive sectors of the economy (construction, manufacturing and market services). We assume that for these categories of workers age-wage profiles closely reproduce unobservable age-productivity profiles.

Using these estimated proxies for age-productivity profiles we show that in NMS the productivity of unskilled workers begins to fall earlier than in the EU15. And, despite in all

NMS the age-productivity profiles are flatter than in EU15, the lower age of maximum earnings results also in lower average relative productivity of older workers in comparison to prime age and young earners. We find also preliminary evidence that lower relative productivity of the older unskilled workers results in a lower relative employment rate of this group in NMS.

In our study we have analyzed micro data from 6 European countries, 3 from the EU15 (Germany, Italy and the United Kingdom) and 3 from NMS (Estonia, Hungary and Poland). One of the EU15 countries analyzed, Italy, belongs also to the SEC group. The set of countries analyzed has been strictly dependent on the availability of data, (please look at Table 1 for details of the data-sets used).

Table 1. Data used and their characteristics

Country	Name of data-set	Year	Number of observations available for modeling (full time employees willing to disclose their earnings)	Wage variable used (ln of)
Estonia (NMS)	Labor Force Survey	2004	5158	Net wage in main job
Germany (EU15)	German Socio-Economic Panel	2005	6050	Net income last month in the main job
Hungary (NMS)	Labor Force Survey	2004	5323	Net monthly income in the main job
Italy (EU15)	IPSOS survey of Italian households' income and wealth	2004	4821	Annual net income from main employment in 2004
Poland (NMS)	Labor Force Survey	2004	34197	Net monthly income in the main job
United Kingdom (EU15)	Labor Force Survey	2005	13102	Gross hourly pay in the main job

Source: Author

Estimation of the wage model for each country using age and age square as explanatory variables has been the central point of the analysis. Then, the resulting age-wage profiles have been estimated. If coefficients on age were insignificant, the resulting age-wage curve has been set horizontal. Such an estimated age-wage profile has obviously one very important advantage in comparison with a simple bivariate age-wage curve; it enables us to control for important characteristics correlated with age and significantly influencing wages such as: tenure (to control for the seniority effect), education level (higher

on average in younger cohorts), profession (with older workers occupying higher positions) and gender (with women finishing their careers on average earlier than men).

The model specifications across countries hardly differ, with minor differences resulting primarily from variations in definitions and coding between data sets. In all cases, the log-linear empirical wage model of the following form has been estimated.

$$ln(w) = \alpha_1 + \alpha_2(a) + \alpha_3(a^2) + \alpha_4(t) + \alpha_5(e) + \alpha_6(g) + \alpha_7(p) + \alpha_8(s) + e$$

where "*w*" stands for wage, "*a*" for age, "*t*" for tenure, "*e*" for the highest level of education obtained, "*g*" for gender, "*p*" for ISCO profession (at one digit level) and "*s*" for sector of economy of the current employer, "*e*" stands for error term. All variables with the exception of age and tenure were expressed as dummies.

The model has been estimated only for full-time employees and (log of) net wage in the main job has been used as the dependent variable. The UK was the only country where gross, rather than net wage, has been used due to data limitations.

Table 2. Selected parameters of age-wage profiles in analysed countries for selected groups of employees.

		ISCO codes (professions)							
Column	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
	Basic_perc_cut	ISCO1	ISCO2	ISCO3	ISCO4	ISCO5	ISCO7	ISCO8	ISCO9
Age of maximum earnings									
Estonia	31.7	dec.	na.	na.	na.	na.	33.3	36.0	dec
Hungary	46.5	inc.	na.	na.	na.	41.6	na.	37.4	na.
Poland	46.6	64.5	54.7	54.1	46.3	38.6	44.9	41.9	38.6
NMS (analyzed) average	**41.6**	**64.5**	**54.7**	**54.1**	**46.3**	**40.1**	**39.1**	**38.4**	**38.6**
Germany	45.3	48.2	49.1	43.7	46.1	41.9	43.1	41.5	41.0
Italy	46.2	*57.2*	*43.4*	*nd.*	*43.5*	*nd.*	*nd.*	*47.1*	*nd.*
UK	45.1	*47.0*	*47.3*	*43.1*	*46.0*	*46.4*	*44.6*	*43.4*	*43.6*
EU15 (analyzed) average	**45.5**	**50.8**	**46.6**	**43.4**	**45.2**	**44.1**	**43.9**	**44.0**	**42.3**
Age when earnings are the same as at 30 (Point of return)									
Estonia	33.3	dec.	na.	na.	na.	na.	36.6	42.1	Dec
Hungary	63.1	inc.	na.	na.	na.	53.3	na.	44.8	na.
Poland	63.2	99.1	79.5	78.3	62.6	47.2	59.7	53.9	47.2
NMS (analyzed) average	**53.2**	**99.1**	**79.5**	**78.3**	**62.6**	**50.2**	**48.1**	**46.9**	**47.2**
Germany	60.6	66.5	68.3	57.4	62.1	53.8	56.2	53.0	52.1
Italy	62.4	*84.4*	*56.8*	*nd.*	*57.0*	*nd.*	*nd.*	*64.1*	*nd.*
UK	60.2	*64.1*	*64.5*	*56.1*	*62.0*	*62.7*	*59.3*	*56.8*	*57.3*
EU15 (analyzed) average	**61.1**	**71.7**	**63.2**	**56.8**	**60.4**	**58.3**	**57.7**	**58.0**	**54.7**
Value of earnings at the maximum when earnings at the age of 30=1 (Earnings Distance)									
Estonia	1.00	dec.	na.	na.	na.	na.	1.00	1.01	Dec
Hungary	1.03	inc.	na.	na.	na.	1.03	na.	1.01	na.
Poland	1.09	1.25	1.33	1.22	1.17	1.03	1.07	1.05	1.02
NMS (analyzed) average	**1.04**	**1.25**	**1.33**	**1.22**	**1.17**	**1.03**	**1.04**	**1.02**	**1.02**
Germany	1.13	1.33	1.37	1.11	1.17	1.07	1.07	1.07	1.08
Italy	1.13	*1.58*	*1.14*	*nd.*	*1.10*	*nd.*	*nd.*	*1.14*	*nd.*
UK	1.15	*1.27*	*1.27*	*1.13*	*1.11*	*1.20*	*1.10*	*1.07*	*1.10*
EU15 (analyzed) average	**1.13**	**1.39**	**1.26**	**1.12**	**1.13**	**1.14**	**1.09**	**1.09**	**1.09**

Definitions of ISCO codes: 1: LEGISLATORS, SENIOR OFFICIALS AND MANAGERS 2: PROFESSIONALS
3: TECHNICIANS AND ASSOCIATE PROFESSIONALS 4: CLERKS 5: SERVICE WORKERS AND SHOP AND MARKET SALES WORKERS 6: SKILLED AGRICULTURAL AND FISHERY WORKERS 7: CRAFT AND RELATED TRADES WORKERS 8: PLANT AND MACHINE OPERATORS AND ASSEMBLERS 9: ELEMENTARY OCCUPATIONS

	Education					Sector of employment (except agriculture)			
Column	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
	Tertiary	Secondary Vocational	General Secondary	Basic Vocational	Primary or below	Construction	Manufacturing	Market Services	Non-market services
Age of maximum earnings									
Estonia	na.	dec.	dec.	36.3	34.4	na.	32.4	27.5	na.
Hungary	na.	45.8	na.	39.1	dec	na.	37.9	43.5	58.0
Poland	51.2	49.0	44.0	41.9	39.1	43.5	50.9	43.6	50.0
NMS (analyzed) average	**51.2**	**47.4**	**44.0**	**39.1**	**36.7**	**43.5**	**40.4**	**38.2**	**54.0**
Germany	46.5	43.1	nd.	*45.2*	42.9	43.3	45.8	44.3	47.4
Italy	*49.8*	*44.5*	*45.0*	*nd.*	*na.*	*45.0*	*50.4*	*45.9*	*40.8*
UK	45.9	42.4	44.9	46.2	44.1	44.9	45.7	44.6	46.3
EU15 (analyzed) average	**47.4**	**43.3**	**45.0**	**45.7**	**43.5**	**44.4**	**47.3**	**44.9**	**44.8**
Age when earnings are the same as at 30 (Point of return)									
Estonia	na.	dec.	dec.	42.6	38.7	na.	34.8	30.0	na.
Hungary	na.	61.5	na.	48.3	dec	na.	45.8	56.9	86.0
Poland	72.4	68.1	58.1	53.9	48.2	57.0	71.7	57.2	70.1
NMS (analyzed) average	**72.4**	**64.8**	**58.1**	**48.3**	**43.5**	**57.0**	**50.8**	**48.0**	**78.0**
Germany	63.1	56.2	nd.	*60.4*	55.9	56.7	61.6	58.5	64.9
Italy	*69.7*	*59.0*	*59.9*	*nd.*	*na.*	*60.0*	*70.8*	*61.8*	*51.6*
UK	61.8	54.8	59.9	62.4	58.3	59.8	61.5	59.2	62.6
EU15 (analyzed) average	**64.9**	**56.6**	**59.9**	**61.4**	**57.1**	**58.8**	**64.6**	**59.9**	**59.7**
Value of earnings at the maximum when earnings at the age of 30=1 (Earnings Distance)									
Estonia	na.	dec.	dec.	1.01	1.01	na.	1.00	1.00	na.
Hungary	na.	1.05	na.	1.01	dec	na.	1.01	1.04	1.07
Poland	1.29	1.12	1.08	1.05	1.02	1.07	1.08	1.07	1.20
NMS (analyzed) average	**1.29**	**1.08**	**1.08**	**1.02**	**1.01**	**1.07**	**1.03**	**1.04**	**1.14**
Germany	1.21	1.14	nd.	*1.10*	1.11	1.10	1.16	1.10	1.19
Italy	*1.21*	*1.11*	*1.12*	*nd.*	*na.*	*1.12*	*1.19*	*1.13*	*1.04*
UK	1.21	1.09	1.20	1.14	1.10	1.13	1.22	1.16	1.12
EU15 (analyzed) average	**1.21**	**1.11**	**1.16**	**1.12**	**1.11**	**1.12**	**1.19**	**1.13**	**1.12**

Italics: data are not fully comparable across countries; na.: not applicable (insignificant age coefficients in wage models); nd. No data, such aggregation impossible, dec.: estimated age-wage profile was strictly decreasing with age, inc. means that estimated age-wage profile was strictly increasing with age.
The general base category for estimations is: male, vocational education, ISCO7, working in manufacturing.

Apart from estimating the wage model for the full sample, we have also run estimations for various groups of employees, grouped by their profession, education and sector of employment. The most interesting results from our point of view are the resulting shapes of the age-wage curves (as described by parameters α_2 and α_3) in each country and for cases analyzed. The summary of results of these estimations is presented in Table 2. It compares selected characteristics/parameters of age-wage curves for various groups of workers in the analyzed countries.

- 1. The age when the maximum wage is recorded indicates the general "location" of the wage-age curves on the age scale. The lower the maximum is, the more younger workers are demanded on the given market. Later we will refer to it as **"the age of maximum earnings".**
- 2. Age when earnings are the same as at the age of 30 (baseline age) illustrates the relative position of older workers on the labor market in comparison to younger ones. The lower this age is, the more older workers are discriminated against. This parameter depends both on the age of maximum earnings and the slope of the curve after the maximum. Later, we will refer to it as **"the point of return".**
- 3. The last parameter is the relation of the maximum wage to the wage at the age of 30. It illustrates the slope of the curve between the age of 30 and the maximum, i.e. what is the difference in earnings between someone who just finished their apprenticeship and an experienced worker at the top of their career. Later in the text we will refer to it as **"the earnings distance".**

The age of 30 has been selected as the baseline point of our analysis. We assume it is an average kick-off point of a career. Obviously, the choice of this point is strictly arbitrary. For example, in the OECD (2006), the age group 25-29 had been selected as the baseline. Changing this point will obviously alter the absolute values of parameters 2 and 3, but it will not change the shape of age-wage curves as such, i.e. will not change the results of the analysis.

5. Looking for EU15-NMS differences.

Unweighted averages for a full-sample suggest that age-wage curves do not differ significantly between the analyzed NMS and EU15 countries. The age of maximum earnings in Poland and in Hungary is similar to the EU15 average. The point of return in these two countries is even later than in any of the EU15. Only the earnings distance for all NMS is lower than in any EU15 country, indicating much flatter age-wage profiles (see also Figure 2).

The only NMS country where results for the full sample significantly differ from the EU15 is Estonia. In general, maximum earnings in this country are reached almost at the beginning of their career at the age of 32. It indicates a very "dynamic" labor market being practically dominated by young workers. The Hungarian case is also very interesting but from another point of view. The estimated age-wage profile for this country is the flattest of all countries. The expected maximum career wage is only 3% higher than the wage at the age of 30. The pace it decreases afterwards is also extremely slow.

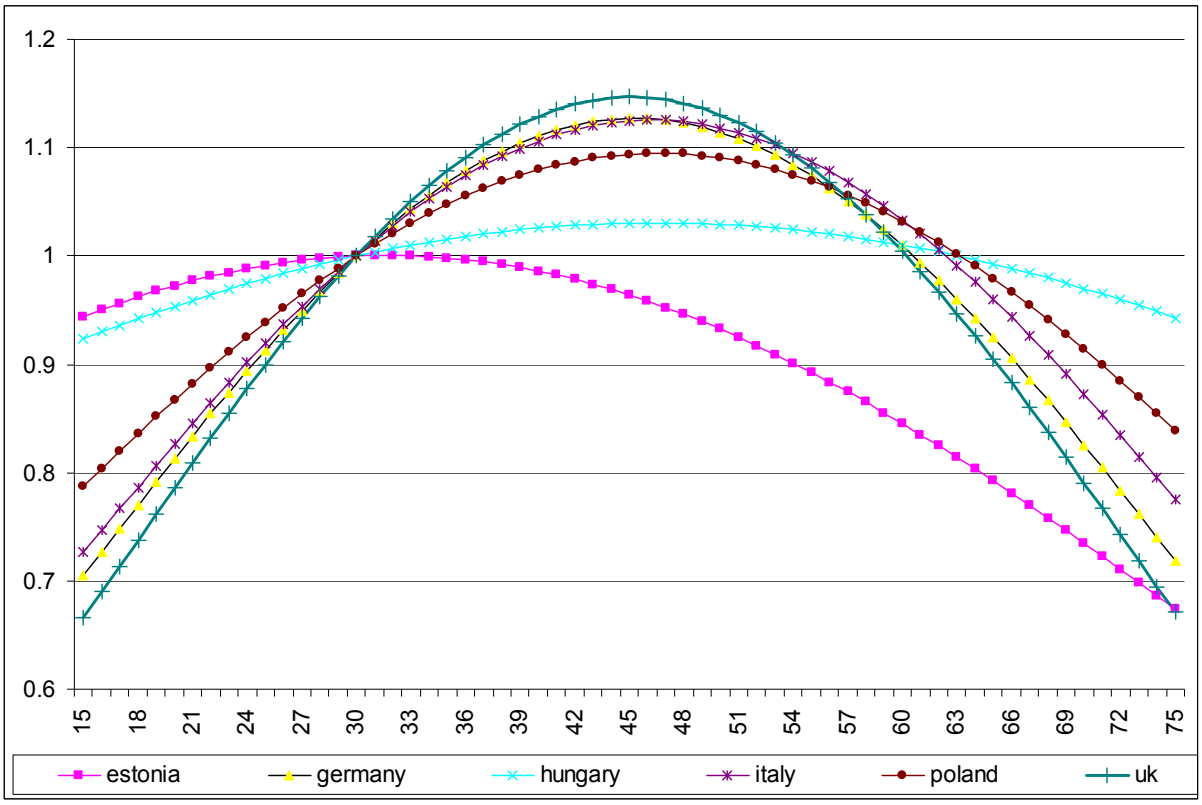
One can suspect that age-wage profiles summarized in column 1 of Table 2 and in Figure 2, except those for Estonia, can be strongly influenced by the Lazear Effect[4] and therefore, do not mimic age-productivity profiles. It is, however, also widely suggested that these disturbances are especially strong for specific groups of workers and industries: mainly highly educated workers employed in skill-intensive and managerial positions, (see OECD 2006). One can also suspect that such a wage premium is much stronger in the non-market sector (mainly public), characterized by a hierarchical wage structure where the career path and the pay ladder are strictly related to work experience and not to observed productivity.

Therefore, we decided to estimate the age-wage profiles for specific groups of workers grouped according to:

- profession (columns 2-9 of Table 2)
- education levels (columns 10-14 of Table 2)
- sector of employment (columns 15-18 of Table 2)

[4] Lazear (1981) demonstrated that it might be efficient from the point of view of employers too keep wages growing with age even if productivity does not increase.

Figure 2. The estimated age-wage profiles for full-time dependent employees in Germany, Italy, UK, Hungary, Estonia and Poland in 2004. Earnings at the age of 30 are normalized to 1.



Source: Own calculations based on datasets as in Table 2.

Applying such a breakdown enables us to observe some more clear differences between the NMS and EU15; although it seems that the differences within groups are still much clearer.

For the four highest ISCO groups (executives, professionals, technicians and clerks – columns 2-5 in Table 2), the results for NMS are, unfortunately, far from complete. In Hungary, the age-wage profiles are horizontal for most groups (insignificant coefficients). For executives (ISCO 1), the profile is strictly increasing, suggesting especially strong wage premiums for older workers. In Estonia, on the other hand, the profiles are also horizontal for all ISCO levels except ISCO 1, where the estimated age-wage curve is strictly decreasing(!).

Although some more systematic differences in age-wage profiles between the NMS and EU15 start to be visible for professions requiring lower skills – ISCO 5 (sales and service workers) and below, they do not seem to be clear by any means either. Age-wage profiles for ISCO 7 and 9 in Hungary are horizontal. Once again, in Estonia the age-wage relationship for ISCO 9 is strictly negative.

In general, results for Poland are quite similar to those of Germany, as well as, other EU15 countries. One can notice, however, that in the case of Poland, both the age of maximum earnings and the point of return continue to decrease as we move from more complex to more elementary occupations – they are significantly higher than in Germany for ISCO 1-3 and similar or lower for ISCO 4 and below. The results for (all) EU15 are much more stable in this respect and this is the most visible difference between NMS and the EU15 for this breakdown.

One obtains a very similar picture disaggregating the total employment with respect to the education level of employees (see columns 10-14 of Table 2). The lower the education level analysed, the more youth-oriented and flat are NMS age-wage curves. In Hungary, for the primary education level, the age-wage curve is strictly negative even. This tendency is not so clear in any of the EU15.

Interesting results can also be obtained by analyzing the shape of the age-wage curve, disaggregated by sectors of the economy. We have performed the analysis for 6 sectors: agriculture and fishery, mining, construction, manufacturing, market services and non-market services. The latter includes public administration and public services, such as education and healthcare, (see columns 15-18 in Table 2).

For all countries, both EU15 and NMS age-wage curves for agriculture and mining were horizontal and therefore, these sectors do not appear in Table 2. Horizontal age-wage curves were also obtained for the construction sector in Hungary and Estonia, and for non-market services in the latter. For the remaining sectors, there exist concave age-wage curves in all analyzed countries and they seem to give us additional insight into the characteristics of the age-wage relationship.

One can distinguish among three groups of countries for the industrial sector: for Italy and for Poland the age of maximum earnings and the point of return are the highest – respectively above 50 and 70 for Germany, and in the UK they are about 45 and 61. For Estonia and Hungary, the age of maximum earnings is similar and clearly below 40, but the points of return already differ significantly between these two countries[5].

For market services, the differences are slightly more in line with our main countries' grouping. For all NMS the age of maximum earnings is lower than for any EU15, but the

[5] Similar groupings of countries' characteristics can be done for the ISCO 8 group primarily composed of industrial workers.

difference between Hungary and Poland, and Germany and UK is rather small. The age of maximum earnings is clearly the highest for Italy and the lowest for Estonia, where it falls below 30.

For non-market services the observed differences are also in line with country groupings, but they are opposite to what one would expect. Both the age of maximum earnings and the point of return are, in this case, much higher for NMS (excluding Estonia recording the horizontal curve) than for the EU15. Even the earnings distance in this case is the highest in Poland. It is the only case where old-age wage premiums in NMS are clearly higher than in the EU15.

To summarize, we have been able to identify some differences between the NMS and EU15 countries. First, for the majority of cases, NMS age-wage profiles are much flatter than in the EU15 (earnings distance is lower). Our results suggest that for qualified workers performing complex tasks, particularly in non-competitive sectors, the age premium is higher in NMS (excluding Estonia) than in the EU15. On the other hand, the age-wage profiles in NMS clearly become more youth-oriented as one moves from more complex to more elementary occupations and from higher to lower education of workers, as well as from less competitive (non-market services) to more competitive (market services) sectors. It means that the lower the suspected old-age wage premium, the lower are the relative wages of elderly workers in the NMS. This effect is hardly visible for the EU15 which seems to be in line with the main hypothesis of this paper.

6. Analyzing individual countries.

Thus far we have been looking for systematic differences between the EU15 and NMS groups and we mentioned the age-wage curve characteristics in individual countries only as far as they were representing one of the groups. Below we would like to take a closer look at cases of individual countries that are particularly interesting.

Estonia is definitely the country with the most youth-oriented labor market. One reaches the maximum earnings point at the age of 31 and for market services, even below age 30. The age-wage profile is strictly decreasing not only for elementary occupations and for those with secondary education; it is decreasing even for the ISCO 1 group, i.e. legislators, senior officials and managers. This is the only country with a strictly negative (although insignificant) bivariate correlation between age and wage of employees. It seems

that Estonia is the country where the phenomenon of the old-age wage premium simply does not exist and the observed age-wage relationships can be supposed to be very well correlated with age-productivity profiles.

Hungary is the country with the flattest general age-wage profile. The maximum difference for the total age spectrum observed, between the expected earnings at the age of 15 and at the age of maximum earnings, is 12%, which seems extremely low compared with the country with the largest difference, the UK with an earnings differential of 72%, and even the second lowest (for Poland) of 39%. In Hungary, one records the only case with strictly increasing age-wage profile for the ISCO 1 group. It is also the country with the most differentiated age-wage profiles across groups of employees. One can observe there, and it is the only such case, both strictly increasing and strictly decreasing age-wage profiles. The age of maximum earnings for the non-market services sector is the highest of all countries, whereas for all other groups the results are closer to Estonia than to the EU15.

Poland is the NMS country with the general age-wage profile most closely mimicking the average profile for the EU15. Significant differences appear however as one analyzes specific groups of employees. For complex professions associated with higher education levels, the age-wage profiles in Poland indicate a very strong old-age premium, much stronger than in any EU15 country. The same applies to profiles in the non-market services sector, and to some extent also in the industrial sector. On the other hand, for jobs requiring lower education and for the most competitive sectors of market services, age-wage profiles in Poland indicate a weak old-age premia – significantly weaker than in the EU15.

The general age-wage profiles in Germany and the UK are quite similar. Some variability of results appears for specific groups of workers, but even taking those into account the results in the UK and Germany are rather stable across all groups analyzed. The age of maximum earnings in Germany varies from 41 to 49.1 and in the UK from 43.1 to 47.3, whereas in Poland, for example, it varies from 38.6 to 64.5.

The Italian case seems to be closest to the NMS as it is also characterized by large differences in age-wage profiles between various groups of workers, although they are still much weaker than in Poland or even in Hungary. The general age-wage profile in Italy indicates a relatively strong old-age premium; both the age of maximum earnings and the point of return are the highest in Italy. This result primarily applies to extremely elderly-

oriented age-wage profiles for ISCO 1 workers and those with tertiary education. It seems that age premiums for this kind of worker in Italy are especially high.

7. Analysis for the selected group of employees

As earlier literature on the subject suggests and as indicated by our results thus far, the age-wage profiles for various groups of workers might differ significantly. It may result from the difference in the strength of old-age wage premia and also from the different shape of actual age-productivity profiles. It is also suggested that old-age wage premia can be especially strong in the case of better educated employees occupying either more complex jobs and/or higher (managerial) positions. This applies in the case of employees working in public or more general non-market sectors characterized by a rigid wage ladder strictly related to the total acquired working experience.

The primary aim of our analysis is to search for differences in age-productivity profiles between the EU15 and NMS. Thus, our analysis should be limited to those groups of workers for which we suspect that age-wage profiles are strictly correlated with age-productivity profiles. Hence, the next stage of the analysis was to estimate the age-wage profile for such a group of workers. We limited samples in each country to contain only workers characterized by maximum general secondary education, occupying jobs from elementary (ISCO 9) to service workers (ISCO 5) and working in manufacturing, construction and market-services sectors.

Table 3.
The estimated characteristics of age-wage profiles for workers with maximum general-secondary education, working in manufacturing, construction and market services, and occupying positions from ISCO 9 to ISCO 5 (columns 2-4). Relative average productivities of the 50-64 age group in comparison to the 25-50 age group (column 5).

Row.	Country	Age of Maximum Wage	Point of return	Earnings Distance	Relative productivity P_{old}/P_{prime}
	(1)	(2)	(3)	(4)	(5)
1	Estonia	33.9	37.7	1.00	84.8%
2	Hungary	40.3	50.6	1.02	96.6%
3	Poland	40.8	51.6	1.04	92.4%
4	**NMS (analyzed) Average**	**38.3**	**46.7**	**1.02**	**91.3%**
5	Germany	42.5	55.1	1.07	93.5%
6	Italy	46.7	63.4	1.15	100.3%
7	UK	45.1	60.2	1.13	97.1%
8	**EU15 (analyzed) Average**	**44.8**	**59.6**	**1.12**	**96.9%**
9	*Germany East*	*38.9*	*47.7*	*1.03*	*90.5%*
10	*Germany West*	*45.5*	*61.1*	*1.11*	*98.3%*

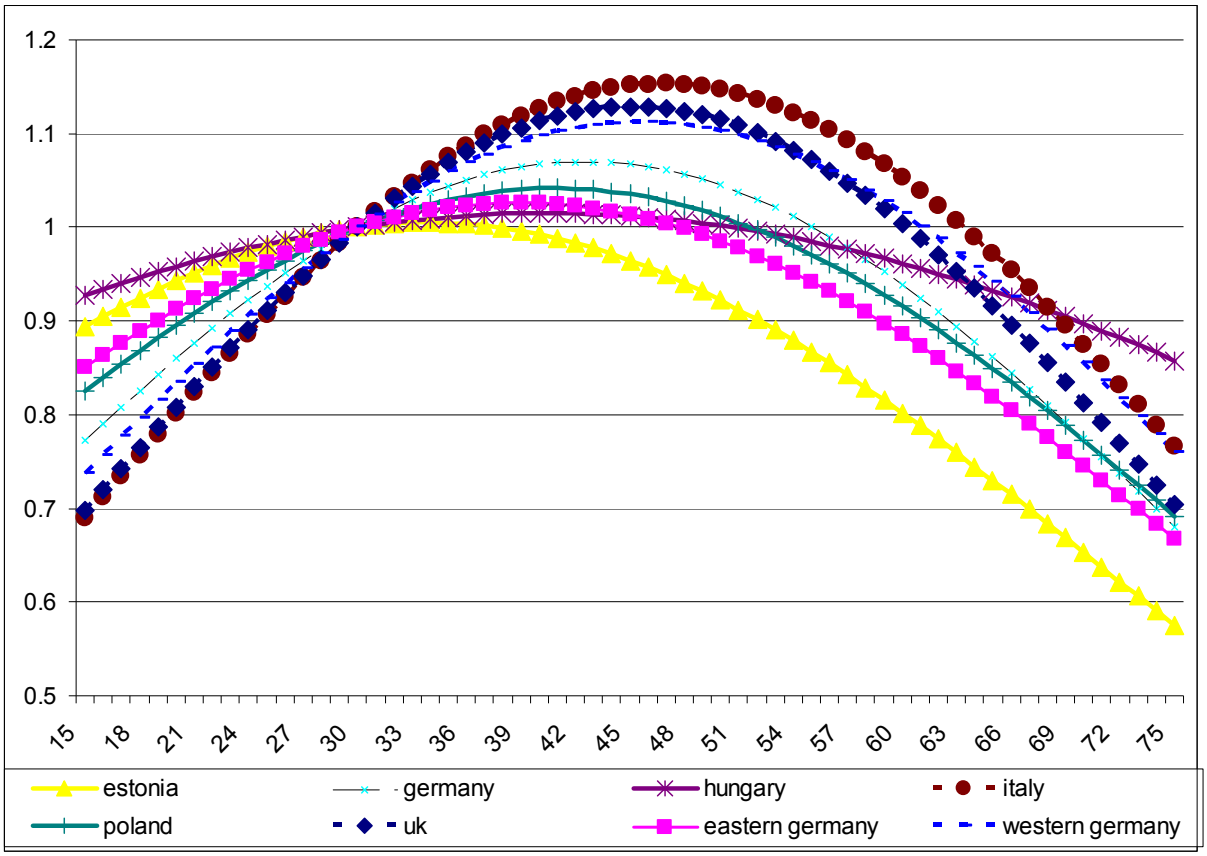
Source: Own calculation based on data as in Table 1.

All the characteristics of age-wage profiles indicate systematic differences between the EU15 and NMS and these differences are in line with the main hypothesis of this research, (see Table 3 and Figure 3). The age of maximum earnings in all NMS countries is lower than in any of the EU15; the same applies to the point of returns. For all NMS, the age-wage profiles are also (similarly as for the full sample) flatter than in the EU15.

The other general characteristics of age-wage profiles in individual countries have been preserved. The Estonian labor market is definitely the most youth-oriented, although in this case, the differences between Estonia and other NMS are much smaller than for the full sample. The German age-wage profiles are the most similar to those in NMS, however, all the characteristics still indicate higher relative wages for older workers.

The similarity of German profiles with those for the NMS can be explained by the heterogeneity of the German labor market. The Eastern part of Germany is in fact a transition economy, and so is the labor force, (see rows 9-10 of Table 3). The characteristics of age-wage profiles in former West Germany are very similar to those in the UK and Italy, while the age-wage profiles in the former East Germany are similar to those in NMS.

Figure 3.
The estimated age-wage profiles for workers with maximum general-secondary education, working in manufacturing, construction and market services and occupying position from ISCO 9 to ISCO 5.



Source: Authors calculations based on data as in Table XX

Our results, particularly the difference between the former East and West Germany, suggest that the systematic difference in age-wage profiles between the NMS and EU15 cannot result from the variability in institutional settings. First, labor market institutions differ significantly within groups analyzed (see for example Riboud et.al 2002) and second, labor market institutions do not differ between the Eastern and Western parts of Germany.

One can also argue that the earlier age of maximum earning and the earlier point of return do not necessarily mean that the relative productivity of old-age workers in NMS is lower than in the EU15. It could result from much flatter age-productivity profiles in these countries.

Hence, applying the results of our estimations, we have calculated the unweighted average productivities of workers in the age-group 25-49 (P_{prime}) and 50-64 (P_{old}). Column 5 of Table 3 presents the relation of "P_{old}" to "P_{prime}" (P_{old}/P_{prime}) in each country. It is clear that (taking into account differences between former East and West Germany) the relative

productivity of older workers in the NMS is lower than in the EU15. This result is slightly weaker, although still holds, for Hungary, where the estimated age-productivity profile was the flattest.

Assuming that our results for this selected group of workers (unskilled) are not strongly influenced by the old-age wage premium, we conclude that they result from real differences in relative productivities of older workers in the NMS and EU15. If our conclusion is true, it should influence the relative employment rates of the older population. In general, employment rates for this group in the NMS should be lower than in the EU15. We analyze this issue below.

8. Relative supply and employment rates of the older labor force.

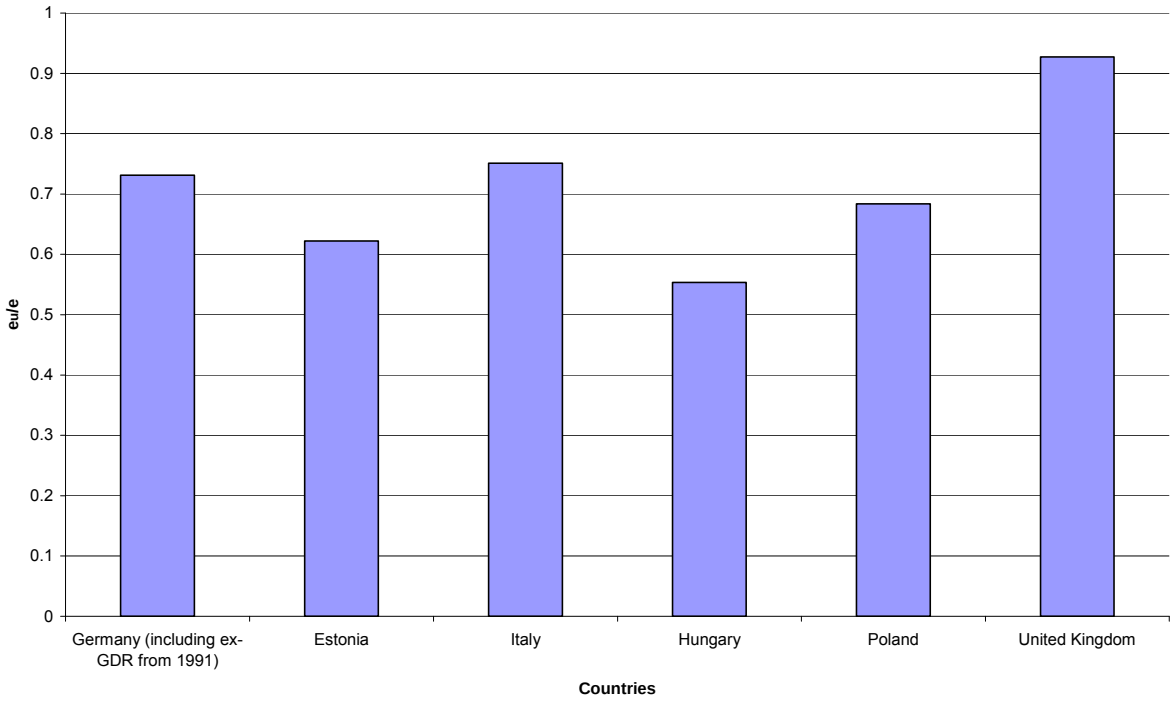
In order to examine the relationship between the relative productivity of the older, unskilled labor force, and the relative employment rate of this group, one can not simply calculate employment rates and correlate them with relative productivities as in Table 3. The general employment level of the elderly does not depend only on relative productivity levels. It is influenced by other exogenous (from our point of view) factors such as cultural attitudes, features of the pension system, and the general education structure of the older labor force.

It can be suspected that in countries characterized by strong family ties, such as Italy or Poland, the activity level of the older population can be limited due to numerous not necessarily economic reasons, for example, a long tradition of grandparents caring for children. A defined benefit pension system encouraging early retirement will also negatively influence the employment rate of the elderly. A high share of the unskilled in the total elderly population will also limit the total employment rates of this age group, disregarding relative productivities.

Therefore, what we are interested in is the relative employment rate of the unskilled old population as compared with the total employment rate for the same cohort. If e equals the employment rate for the 50-64 age group and e_u equals the employment rate for the unskilled (ISCED 0-2) belonging to the same age group, than the “relative employment rate” equals e_u/e. Figure 4 presents such relative employment rates for analyzed countries. It is clearly visible that for all NMS the relative employment rates are lower than for the EU15. It seems to indicate that there is a relationship between relative productivity differences and

employment rates of the elderly and it coincides with observed lower employment rates of the elderly in NMS.

Figure 4. Relative employment rate of the unskilled belonging to the 50-64 age group.



Source: Author's calculations based on EUROSTAT data
Note: If e equals employment rate for 50-64 age group and e_u equals the employment rate for the unskilled (ISCED 0-2) belonging to the same age group, than "relative employment rate" equals e_u/e.

One can also observe however that relative productivity differences and relative employment rate differences do not coincide if we compare individual countries inside the NMS and EU15 groups. It may stem from the fact that the age-wage curve we have estimated is only a proxy for the age-productivity relationship even for our selected group of workers.

If the observed relative wages of the elderly are higher than their respective relative productivities, it will obviously decrease the employment rate. It may explain why the relative employment rate in Hungary is lower than in Estonia. In the latter case, the age-wage curve indicates a much lower relative productivity of the elderly and it may reflect the actual age-productivity relationship much more closely than the flat Hungarian age-wage profile. The same applies to the relatively high employment rate of the unskilled elderly in the UK[6]. A high

[6] Obviously, the high wages of older workers can decrease employment due to demand since they have the opposite effect on labor supply. Here, much depends on the characteristics of the pension system. And here the Estonian system is also one of the most rigid in the EU with only 6.3% of GDP spent on total pensions in 2003 (EU25 average is 12.6%). (Data from EUROSTAT).

relative employment rate of the unskilled elderly in Poland (higher than in Estonia) can be explained by the large share of employment in agriculture in this country.

9. Conclusions

The main aim of this paper was to examine differences in older workers' productivity in selected EU countries.

Our initial expectation was that older workers' productivity should be lower in NMS. The faster productivity decline with age in these countries may stem from two main factors: fast technological change related to rapid economic transition resulting in faster human capital depreciation, and lower participation in continuous learning, additionally strengthening the negative results of the former. The NMS, similarly as in the entire EU, is facing faster age-related productivity decline. Thus,, the process of labor force ageing may result either in lower employment rates of the elderly and/or it may negatively influence overall productivity, and consequently, GDP growth.

In order to compare the relationship between age and productivity in the NMS and the EU15 we have estimated a series of wage models for six countries: three belonging to the NMS and three to the EU15. Although there exist a lot of arguments, based on the Lazear

Effect, that wages can not be used as a proxy for productivity, there exist also arguments that this effect tends to be weaker for some specific groups of employees: mainly those occupying more elementary jobs and characterized by lower education. One can also expect that this effect will be weaker as the economic environment becomes more competitive. Based on this observation, we have selected groups of employees matching the above characteristics and then treated the age-wage relationships estimated for this group as a proxy for the age-productivity relationship.

We have been able to show that the shape of the age-productivity relationship in the analyzed NMS countries differs (at least for the unskilled) from that observed in the analyzed EU15 countries. On average, an unskilled worker in the NMS reaches maximum productivity earlier than in the EU15. His/her productivity also tends to return earlier to its level at the beginning of the career. The average relative productivity level of elderly unskilled workers (aged 50-64) is also lower (as compared to the productivity of prime-aged (25-49) workers) in the NMS than in the EU15.

We have also been able to show, though the argument here is rather weak, that low relative productivity of unskilled old workers in the NMS negatively influences their relative employment rates.

If our results are correct, it means that in NMS countries with a large number of the unskilled (or mis-skilled) among the older or middle-aged labor force may not expect employment rates for these groups to significantly increase in the near feature. Besides its direct negative influence on total employment rates, it has important negative consequences for fiscal tensions increasing spending needs, either through unemployment and/or social benefits and decreasing incomes, since they are financed mainly from labor taxes.

Obviously this perverse characteristic of the labor supply structure in NMS will be naturally weakening due to socio-demographic processes (cohort effect) and also because of the convergence process slowing down. It will, however, influence the labor market prospects of these countries for at least the next several years. One could limit its negative effects by developing an efficient and widespread system of life-long learning and vocational training for those currently in their 30's and 40's, and increasing the quality of the general education system. It seems that from the point of view of the labor market this should be the main priority of public spending in the near future. It seems that the only solution to this problem in the short run is to lower the labor costs of endangered groups of workers.

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