Retirement Age Across Countries: The Role of Occupations*

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Abstract

Cross-country variation in effective retirement age is usually attributed to institutional differences that affect individuals' incentives to retire. This paper suggests a different approach to explain this variation. Since working individuals in different occupations naturally retire at different ages, the composition of occupations within an economy matters for its average effective retirement age. Using U.S. Census data we infer the average retirement age by occupation, which we then use to predict the retirement age of 38 countries, using the occupational distribution of these countries. Our findings suggest that the differences in occupational composition explain up to 38% of the observed cross-country variation in retirement age.

Keywords: Retirement Age, Occupational Distribution, Cross-Country Analysis.

JEL Classifications: J14, J24, J26, J82.

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1 Introduction

The importance of retirement decisions for macroeconomics is widely recognized. The long-standing trends towards earlier retirement and higher life expectancy, in particular, put the sustainability of existing pension systems into question and fuel the academic and political discourse. Rising debt levels in the wake of the Great Recession have intensified the debate.

Lifting the age of retirement by a year or two is often proposed as a tool for curbing public expenditures. While such proposals face strong political resistance, they appear rather modest when comparing them with cross-country differences in the effective average retirement age. Figure 1 shows that the retirement age of male working populations exhibits huge cross-country differences. The numbers vary widely between Mexico (75) and Bulgaria (58.2).

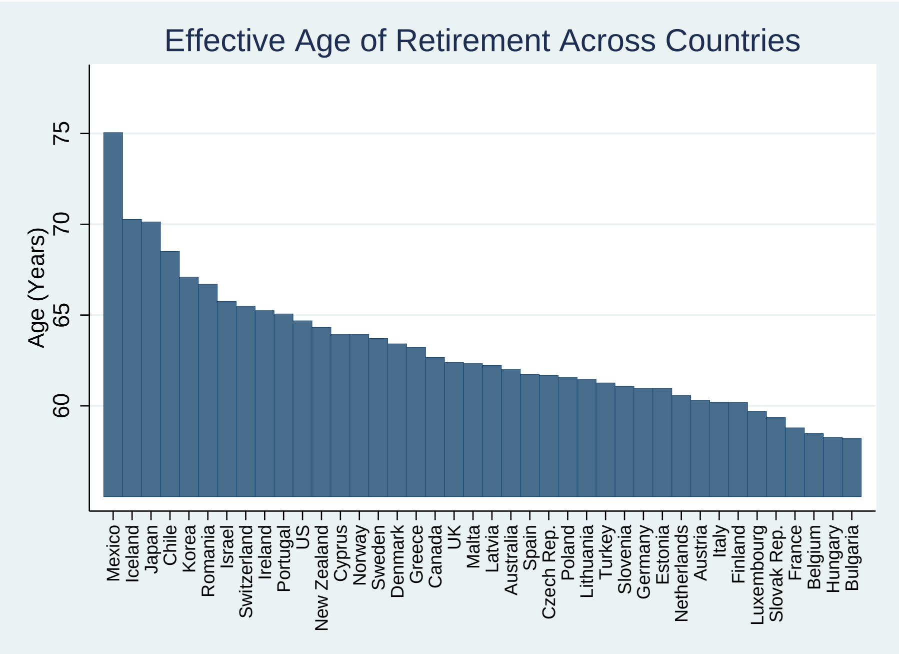

Figure 1: The effective age of retirement of male working populations across 40 countries for the year 2000. Source: OECD, based on national labor force surveys.

Existing research has used this cross-country variation to shed light on the determinants of retirement decisions, commonly highlighting individual incentives related

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to Social Security and pension systems. E.g., Gruber and Wise (1998) argue that Social Security programs provide the prime determinants for retirement decisions, writing that

> The collective evidence for all countries combined shows that statutory social-security eligibility ages contribute importantly to early departure from the labor force.

In the present paper we propose a new explanation for the cross-country variation in the age of retirement. Our explanation relies on the observation that individuals in different occupations retire at different ages. Based on this observation, we argue that an economy's composition of occupations matters for its average effective retirement age. Starting from this simple idea, we build a predictor of an economy's average retirement age solely from its occupational composition. It turns out that this predictor performs rather well in explaining the cross-country differences in the effective retirement age.

If the occupational distribution is to impact a country's average retirement age, retirement age must differ across occupation. Figure 2 shows that within the U.S. the average effective age of retirement varies indeed over 179 occupations.[1] E.g. the average age of retirement of *Psychologists* is 71, while *Airplane pilots* retire around the age of 60.2 (see Table A1 in the Appendix). These differences are partly due to intrinsic characteristics of the corresponding occupation such as physical requirements or the pace at which job-specific knowledge depreciates.

Clearly, a country whose working population is mostly engaged in occupations with a low retirement age can be expected to have a lower average retirement age than a country whose working population is more concentrated at the other end of the occupational spectrum. By a simple composition effect, the occupational distribution potentially impacts a country's average effective retirement age.

This compositional effect of occupations can be relevant for cross-country differences in the retirement age only if the underlying occupational distribution varies across

[1] We use CPS data from IPUMS (see King, Ruggles, Alexander, Flood, Genadek, Schroeder, Trampe and Vick (2010)). The method used to compute the average retirement age by occupation is described below. We obtain observations for 179 of the 263 occupation classes defined by the Census Bureau.

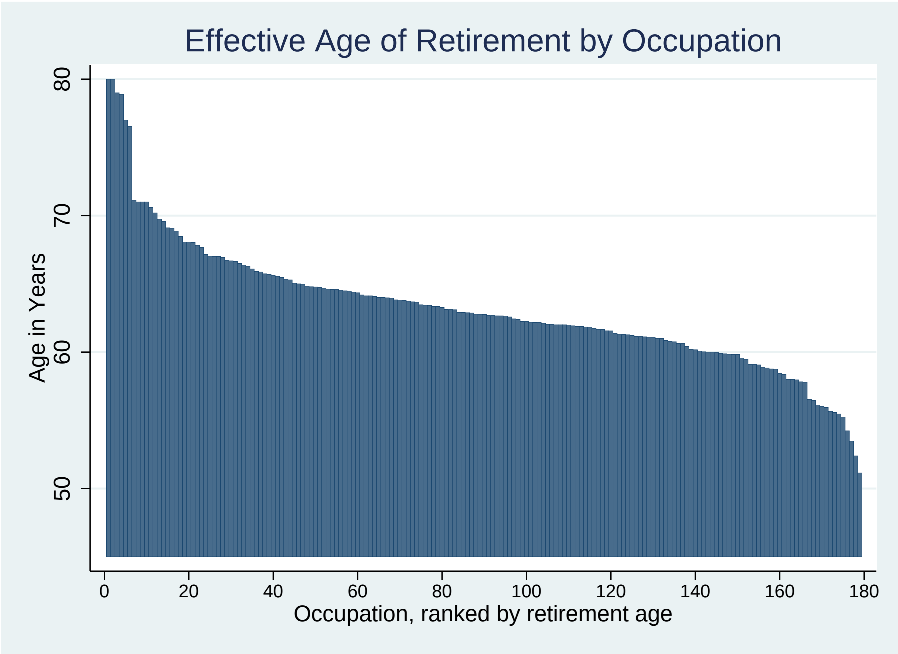

Figure 2: The effective age of retirement of male working populations in the U.S. across 179 occupations during the period $1990 - 2010$. Data are based on census classification scheme (3 digit). Source: authors' calculations from IPUMS-CPS.

countries. Figure 3 shows that, in fact, the cross-country differences of the occupational distribution are large within a sample of 34 countries. For 9 broad 1-digit ISCO occupation classifications, the figure plots the share of employment for male working population in these countries.[2] Each of the small dots represents the employment share of a country in the respective occupation; the fat dots represent unweighted country averages. While the cross-country average employment share is highest for *Craft and related* and lowest for *Clerical support workers*, the figure shows that occupation shares are widely dispersed across countries.[3]

We argue that the average age of retirement of an economy is affected by its oc-

[2]The countries for which occupation data with ISCO-88 classification exist are: Aruba, Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Ecuador, Egypt, Estonia, Finland, France, Gabon, Germany, Greece, Hong Kong, China, Hungary, Iceland, Iran, Ireland, Italy, Latvia, Lithuania, Luxembourg, Mauritius, Mongolia, Netherlands, Pakistan, Philippines, Poland, Portugal, Seychelles, Slovakia, Slovenia, Spain, South Korea, Sweden, Switzerland, Thailand, Uganda, Ukraine, United Kingdom.

[3]The two outliers for 'Skilled agricultural, forestry and fishery workers' (Agriculture in the figure) are Mongolia (with a share of 47.9%) and Thailand (38%); South Korea has the highest share for 'Plant and machine operators, and assemblers' (39.8%).

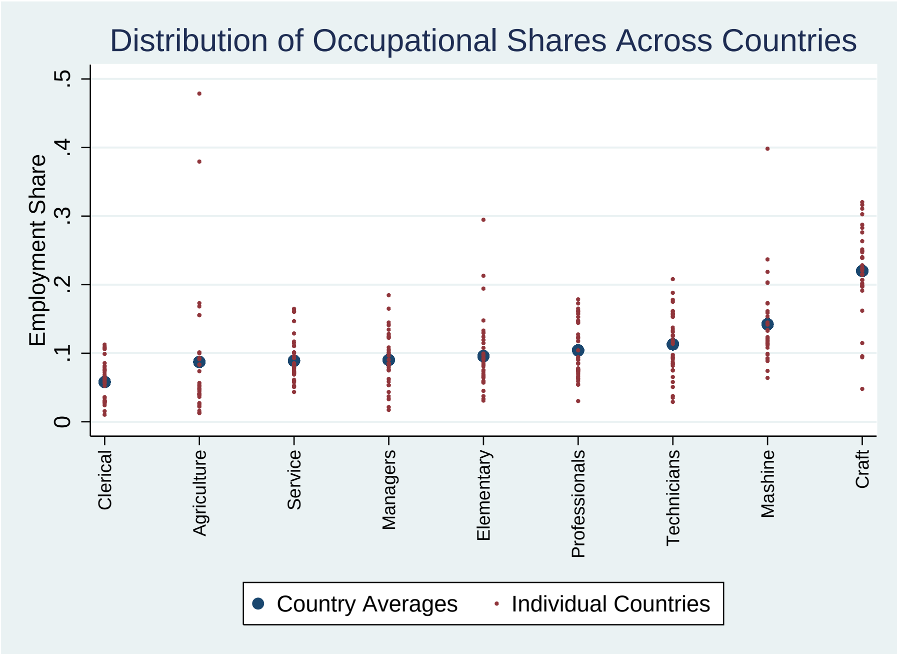

Figure 3: The share of employment of male working population across 34 countries. Data are based on ISCO-88 classification scheme. Source: ILO.

cupational distribution. To put forward our argument, we construct a measure of the retirement age by occupation and, for a given economy, we predict its average retirement age by the weighted average of retirement age across occupations; the weights are the occupation shares of the economy. The result of this computation will be called the *raw predictor*.

In the former step we use the rich U.S. data to infer the average retirement age by occupation. We thereby control for state dummies, which capture Social Security and pension incentives that are state specific. We also control for marital status, the level of education and a year trend. Thus, our occupation dummies extract the relevant information for the retirement age, which is purely related to the occupations themselves and not to secondary factors. We then weight this 'pure' measure of retirement age, with occupational employment shares to construct our raw predictor.

As a first test, we compare the raw predictor with the actual age of retirement for the fifty U.S. states. A variance decomposition exercise shows that our within sample prediction of the age of retirement explains about 13% of the variation in the actual age of retirement.

However, the within sample predictions might suffer from an endogeneity problem since U.S. national averages of retirement age per occupation can be expected to be affected by the occupation composition of the individual states. From a more general perspective, explaining differences across U.S. states by U.S. occupational data is not a big surprise as the American population shares the same legal system, technology and financial incentives. We therefore turn to an out of sample predictions.

Next, we take the age of retirement on the occupational level inferred form the U.S. data and examine to what extent this information can explain the variation in the age of retirement across the globe. Conceptually, we try to explain differences across countries using differences across Americans. More specifically, we use retirement data for male workers per country, provided by the OECD and employment shares of occupations provided by the International Labor Organization (ILO). Restricting our cross-country analysis to the year 2000, we are left with 28 advanced countries (excluding the U.S.). A variance decomposition shows that our raw predictor explains 10.3% of the variation of the actual age of retirement.

We then extend the range of countries for which we compare our raw predictor with the actual retirement age. Again we use data for employment shares of occupations from the ILO and extend the sample of countries by following the OECD method for calculating the actual retirement age. Our calculations increase the set of countries for which we have predicted and actual retirement ages to 38 countries. In this extended sample of countries we find that our predicted age of retirement is a strong predictor of the actual age of retirement and a variance decomposition shows that it explains about 17% of the variation in the actual age of retirement across countries.

We next surmise that our raw predictor might be improved by accounting for the fact that some factors such as Social Security programs may influence differences in the age of retirement across occupations. Also, the inevitable loss of information in the crosswalk of occupation classifications we use tends to blur the differences in the according retirement ages and to compress the distribution of retirement ages. To correct for these effects, we conduct a linear transformation of our raw predictor. Thus, we run a regression to estimate the way our raw predictor correlates with the actual age of retirement. In these regressions we obtain an R^2 of 27.4% for the sample of OECD countries and an impressive 37.9% for the extended sample.

We read these numbers as a strong support to our approach. Our results indicate that occupational distribution is an important determinant of the differences in the age of retirement across countries.

We cannot, however, ignore that the literature on retirement decisions typically focuses on financial incentives, in particular those connected to Social Security and pension systems. We therefore examine whether the predictive power of occupational compositions is affected by these policy variables. In particular, we run simple multivariate OLS regressions of the observed average retirement age on our raw predictor and a number of policy variables related to retirement incentives. Within our two samples of countries, the coefficient on our raw predictor of retirement is highly significant and positive. The inclusion of the policy variables increases the R^2 from 45.5% to up to 83.3% in our OECD sample and from 37.7% to 74.8% in our extended sample. Thus, financial incentives and occupational compositions jointly explain the major part of the variation in the actual age of retirement. In all specifications, the significance of our raw predictor is unchanged.

Finally we follow the literature and control for additional variables that might affect the age of retirement such as per-capita GDP, life expectancy, the share of urban population and average schooling and find that the coefficient on our raw predictor is intact in terms of magnitude and statistical significance.

We now give a short overview over the three broad literatures our paper relates to. These are, first, the retirement incentives and decisions, second, the differences in retirement age across occupations and third, the determinants of a country's distribution of occupations.

1.1 Social Security Program Incentives

Most of the existing literature attributes the variation in the age of retirement to cross-country differences in the incentives that individuals face when deciding on their retirement age. In explaining the effective age of retirement, Gruber and Wise (2004) argue that differences in Social Security regulations lead to large incentive effects that significantly influence retirement decisions. Mitchell and Fields (1984) have shown that the trend toward earlier retirement in the United States is due to the incentives created by both Social Security benefit rules and private pension benefit rules. Using a large degree of variation in pension incentives for retirement due to the mix of state and private pension provision in the UK, Blundell, Meghir and Smith (2002) found that incentive and wealth significantly affect retirement. In analyzing eleven countries, Gruber and Wise (1998) argue that Social Security provisions themselves provide enormous incentive to leave the labor force early. The authors write:

Coile and Gruber (2007) implement forward-looking models whereby individuals consider the incentives to work in all future years and find that forward looking incentive measures for Social Security are significant determinants of retirement. Moving to the examination of retirement decision in a household framework, Coile (2004) found that men and women are similarly responsive to their own financial incentives and that men are very responsive to their wives' financial incentives. Based on longitudinal personnel records from the firm, Stock and Wise (1990) estimate the effects of pension plan provisions on the departure rates of older salesmen and found that firm pension plan presents very large incentives to retire from the firm at an early age. In line with this literature, retirement peaks at both ages 62 an 64 are attributed to Social Security rules (Rust and Phelan 1997, Gustman and Steinmeier 2005).[4]

Regarding cross-countries analyzes, the literature also attributes variation in the age of retirement to the institutional differences that affect individuals' incentives to retire. In an international comparison, Gruber and Wise (1999, 2004) examine the effect of Social Security systems on male retirement, and find that in each country retirement peaks at

[4]The literature proposes other determinants for the age of retirement. In explaining the rise of retirement during the 20th century, Kalemli-Ozcan and Weil (2010) argue that the reduction in mortality induces individuals to plan and save for retirement as the risk of dying before enjoying the planned leisure declines.

exactly the ages at which the retirement incentives are strongest. Bloom, Canning, Fink and Finlay (2009) analyze panel data for 40 countries over the period 1970-2000 and find that Social Security reforms have substantially increased the labor supply of older men.[5]

Finally, in explaining the determinants of the effective age of retirement, Coile and Gruber (2007) find that industry and occupation – the main variables of our interest – do not show a particularly strong pattern with the exception of higher retirement rates in the armed forces and the cleaning and building services occupation. In their regressions Coile and Gruber (2007) control for thirteen major industry dummies and seventeen major occupation dummies. These aggregated data, however, hide differences in the age of retirement across finely defined industries and occupations. Table A1 in the Appendix shows, as an example, that while farm foremen retire at age 61.7, farm laborers retire at age 68.5. Contrary to Coile and Gruber (2007) we use highly detailed occupation data and find that the age of retirement significantly varies across occupations. However, to verify that our results are not driven by the armed forces, we exclude this occupation and find that all of our results are intact.

1.2 Differences in the Age of Retirement Across Occupations

Workers may retire at different ages due to different rates of human capital depreciation of their respective occupations. Rosen (1975) made the first attempt to distinguish between two types of human capital deterioration. The first is knowledge obsolescence. This aspect of human capital refers to the fact that stocks of productive knowledge available to society change over time. Thus, innovations may negatively affect older workers as their knowledge becomes obsolete. Second, general health deterioration. This aspect of human capital depreciation is related to the general deterioration of mental and physical capacities due to physiological factors such as ageing, injuries or illnesses.

The economic literature abounds on knowledge obsolescence. The Growth literature employs this mechanism to explain the transition from stagnation to growth (Galor and Weil 2000, Galor 2005). However, knowledge obsolescence can differ across industries or occupations and can affect older workers differently from younger ones. Allen

[5] It is important to note that the literature does not unanimously suggest that Social Security has a significant impact on retirement (Krueger and Pischke 1992, Burtless 1986).

(2001) reports a direct evidence on how technological change differently affects wage structure in different industries. Ahituv and Zeira (2000) argue that technical progress induces early retirement of older workers as technical progress erodes technology specific human capital. In a sample of French firms, Aubert, Caroli and Roger (2006) find evidence that the wage bill share of older workers is lower in innovative firms. Using occupational data, Bartel and Sicherman (1993) find support to the hypothesis that an unexpected change in the rate of technological change will induce older workers to retire sooner because the required amount of retraining will be an unattractive investment.[6] Bartel and Sicherman (1993) showed how the introduction of new technology increases the demand for individuals who are more able learners. Mincer and Higuchi (1988) showed that differences in rates of technological change across industries or countries can explain differences in on-the-job training, wage structures, and seniority. Finally, Friedberg (2003) finds that, for workers close to retirement, technological changes in a worker's environment have a negative impact on computer use. Given that the pace of technological progress varies across occupations, the evidence just described imply that the age of retirement differs across occupations.

The economic literature focuses on health depreciation as well. Besides financial characteristics and labor market conditions, Quinn (1977, 1978) analyzed the impact of job characteristics such as undesirable working conditions, physical demands, and required aptitudes on the decision to retire and found that health status and working conditions are important determinants of early retirement among white men in the U.S. Burtless (1987) found that while men in professional, managerial, clerical and sales occupations tend to work the longest, those working in crafts, operatives and service occupations retire at an intermediate age and, finally, farm and non-farm laborers tend to leave work at the youngest age. Mitchell, Levine and Pozzebon (1988) provide evidence that retirement patterns differ by occupation and industry and found that the major factors are job satisfaction, workplace injury or illness, and job productivity. Finally, Filer and Petri (1988) found significant relationship between job characteristic such as intense physical demands stress and repetitive working conditions and early retirement.

[6] Bartel and Sicherman (1993) also find that technological change can delay the retirement age through the direct effect of technological change on the amount of on-the-job training. In sum, differences in the age of retirement across occupations (industries) can be a result of differences in the pace of technological progress across occupation (industries).

The economic literature is complemented by sociological and medical literatures. Hayward (1986) and Hayward, Grady, Hardy and Sommers (1989b) examine how occupations influence the timing of retirement among older men and find that occupations characterized by physical demands are a direct force in retirement decision making. Haveman, Wolfe and Warlick (1985) found that occupational differences in the probabilities of death and disability directly affect differences in the probability of retirement. Hayward, Hardy and Grady (1989a) show that professionals, managers, and salesmen have relatively low rates of retirement and moderate rates of disability and mortality resulting in careers that extend to relatively old ages. Hurd and McGarry (1993) find that other occupation characteristics such like job flexibility are important for retirement as a worker who wants gradually to reduce hours per week as he ages but is constrained, may retire earlier than he would were the constraint removed. Finally, Karpansalo, Manninen, Lakka, Kauhanen, Rauramaa and Salonen (2002) found that physical workload increases the risk of retirement on a disability pension especially due to musculoskeletal disorders. Since, work conditions are occupation specific, different occupations are characterized by different age of retirement.

While the specific drivers of the different retirement ages across occupations constitute an interesting field of study, they are independent of the argument we advance in the present paper. Our approach simply relies on the fact that these differences across occupations exist and observe that they impact the average retirement age of an economy through its occupational composition.

1.3 Differences in the Distribution of Occupations Across Countries

Economic development and international trade are typically thought of as the two major determinants of the cross-country differences in the occupational distribution.

On the one hand, economic development and the adoption of new technologies obviously impacts the labor market and the composition of tasks and diversifications. Intuitively, the share of science and engineering professionals should be higher in more advanced economies, while the opposite is true for subsistence farmers. Imbs and Wacziarg (2003) show that economies on their development trajectory tend to undergo various stages of diversification within the spectrum of industries. This observation is unspecific about which sectors dominate at what level of development but clearly documents a strong impact of development on the distribution of labor across sectors and across occupations. Relatedly, Autor and Dorn (2009) and Acemoglu and Autor (2011) find that occupations that were in the top and bottom of the 1980 wage distribution grew in relative size compared to those in the middle. The authors' explanation for this polarization of the occupational employment distribution is technical change. Moreover, Acemoglu and Autor (2011) argue that recent changes in employment distribution in the United States and other advanced economies are shaped by the interactions among skills, evolving technologies and shifting trading opportunities. In line with these findings Goos, Manning and Salomons (2008) report that, for many European countries, disproportional growth in high paying occupations expanded relative to middle-wage occupations.

On the other hand, trade liberalization, inducing international specialization, affects the composition of industries and occupations. Empirical studies assessing the impact of trade on the labor market outcomes and job migration have traditionally looked at industry employment. Revenga (1992) finds substantial employment reductions in import-competing industries of the U.S. after the dollar appreciation 1980-1985. Using plant-level data from Chile, Levinsohn (1999) documents job creation and destruction effects due to international trade policies. Similarly, Amiti and Wei (2009) find modest employment changes in U.S. manufacturing due to outsourcing. Recently, Schott (2003, 2004) has shown that a large part of the factor reallocation takes place within industries. This observations implies that previous work that measures inter-industry labor migration is likely to miss large parts of the effect of trade on labor markets and further suggests to look on other dimensions of the labor market such as occupations. A number of papers investigated the effect of import competition on employment along the occupational dimension. Ebenstein, Harrison, McMillan and Phillips (2011) construct an occupation specific measure of import penetration and measure the effect of trade for U.S. employment. The authors report that "international trade has had large, significant effects on occupation-specific wages". In line with Schott (2003, 2004), the authors argue that "[t]he downward pressure on wages due to import competition has been overlooked because it operates between and not within industries." Focussing on the effect of trade in services, Liu and Trefler (2008) document that in the U.S. the export of services to China and India (or "inshoring" in the authors' terminology) has negative, albeit small, effects on the probability of switching occupations (at the 4-digit classification level). These findings show that there is a measurable impact of trade on the distribution of occupations.

With regard to the present paper's argument, the fundamental source of the cross-country differences in occupational distribution is largely irrelevant. Our main point, however, is that these underlying factors may very well affect an economy's retirement age.[7]

The remainder of the paper is structured as follows. Section 2 describes our empirical strategy, data and results and section 3 concludes.

2 Empirics

2.1 General Method

To what extent can cross-country differences in the occupational composition explain cross-country differences in the average effective retirement age? To address this question, we undertake the following exercise. In a first step, we compute the average retirement age per occupation. Specifically, we use employment data of individuals to estimate the simple empirical model

$$ret_i = \sum\nolimits_o \beta_o D_o + \gamma Z_i + \varepsilon_i, \qquad (1)$$

where ret_i is the logged retirement age and the indices o and i indicate the occupations and individuals, respectively. D_o stand for occupation dummies and Z_i is a vector of control variables that are likely to impact an individual's retirement age. The error term

[7] Of course, one might flip the question and ask to what extent the occupational composition explains a country's comparative advantage and the patterns of specialization. We do not further explore this interesting aspect in the present paper. We need to stress that we do not claim to establish causality in either direction between our predicted and the actual age of retirement.

ε_i is assumed to be normally distributed. We, henceforth, refer to this first step as a first stage.

In a second step, we employ the estimated coefficients $\hat{\beta}_o$ from the first stage (1) to predict the logged retirement age for a given country c by computing

$$\widehat{ret}_c = \sum\nolimits_o w_{c,o}\hat{\beta}_o. \tag{2}$$

Here we weight by the employment shares $w_{c,o}$ of occupation o in country c. In the following the expression defined by (2) will be referred to as our raw predictor. Notice that, while the regression in the first step may include a series of control variables, the prediction in the second step relies only on the coefficients of the occupation dummies.

2.2 Estimating the Age of Retirement at the Occupational Level

We first calculate a crude measure of the average retirement age for each occupation by running the first stage (1) without any control. However, the age of retirement is affected by other factors such as education, marital status and financial incentives driven by Social Security and pension funds and we would like to clean our measure from this type of information. Put differently, we need to isolate the information purely given by the occupations. We therefore run three additional regressions. In the second regression, we control for state fixed effect that captures differences in financial policies across states. In the third one, we also control for a time trend and in the fourth regression we add dummies for education and marital status.

To estimate equation (1) we use IPUMS-CPS employment data provided by the U.S. Census Bureau. We limit the data to the years from 1990 to 2010 to obtain enough observations and at the same time span a period that is comparable in terms of Social Security, technologies and retirement patterns.[8]

[8] Hazan (2009) documents that labor force participation of white American males older than 45 year old has been monotonically declining across cohorts born between 1840 and 1930. However, using data that covers the period 1992-2000, Coile and Gruber (2007) find no significant time pattern to retirement behavior in the U.S. Interestingly, Quinn (1999) showed that the strong time series trend toward earlier retirement was arrested beginning in the mid-1980s.

Following the previous literature we focus on male individuals. To identify the retiring men, we assume that a worker retires when, simultaneously, he is aged 50 or above, reports to be "Not in labor force" (according to the variable *Employment Status*) and was working 45 weeks or more in the previous year (according to *Weeks worked last year*). These restrictions leave us with 4,989 observations, each corresponding to the retiring incident of one individual. The IPUMS-CPS provides us with the variable *Occupation last year*, which reports the person's primary occupation during the previous calendar year. Accordingly, we could identify the last occupation of retirees. However, the occupational coding scheme for the CPS changed over time. We, thus use the variable 'occupation last year, 1950 basis', which is time-invariant. Finally, the ample information of the individual CPS data allow us to include dummies for the 179 relevant classes of occupations, but also to control for education level, marital status, years and state when estimating equation (1).[9]

With the retirement incidents thus identified and using the information of the control variables, we can estimate equation (1) at the individual level. The upper part of Table 1 (Panel A) summarizes the results of the underlying regressions, whose four columns correspond to the specifications with the four different sets of control variables described above. This part summarizes the results for the first stage (1), for which we do not report the coefficients of all of the dummies but report the specification of the model, the number of observations and the adjusted R^2. The latter ranges between 10 and 20 percent for the 4500 to 5000 individual observations. The last row of the first panel shows the values of a F-test of the hypothesis that the coefficients on all of the occupation dummies D_o are jointly zero. The according values range around 3. In all specifications, the hypothesis that the coefficients of the D_o are jointly zero is rejected on all conventional significance levels, indicated by the p-values.

Table A1 reports the full list of occupation classes together with the corresponding estimated retirement ages. It shows that within the upper end of the distribution, the

[9]Categories for 'Marital Status' are: Married, spouse present, Married, spouse absent, Separated, Divorced, Widowed, Never married/single. Categories for 'Education' are: No school completed; 1st-4th grade; 5th-8th grade; 9th grade; 10th grade; 11th grade; 12th grade; no diploma; High school graduate, or GED; Some college, no degree; Associate degree; occupational program; Associate degree, academic program; Bachelors degree; Masters degree; Professional degree; Doctorate degree.

estimated ages of retirement are 71, 67.2 and 66.6 for *Psychologists* (code 82), *Architects* (code 3) and *Bookkeepers* (code 310), respectively. Within the lower end of the distribution, the ages of retirement are 58.8, 60.2 and 61.6 for *automobile mechanics and repairmen* (code 550), *Airplane pilots and navigators* (code 2) and *carpenters* (code 510), respectively.

2.3 Predicting Retirement Age for U.S. States

We test-run our method by applying it on U.S. data. That is, we predict the average retirement age at the state level by the age of retirement in each occupation calculated at the national level and the distribution of occupations in each state. In this exercise we calculate the share of variation in the actual age of retirement across the 50 U.S. states that is explained by the predicted age of retirement.

To compute employment shares, $w_{c,o}$, for the calculation of our raw predictor in (2), we use data on employment from the CPS. Finally, we also use the CPS data to compute the effective average retirement age at the state level. Hence, we predict within sample.

To assess the success of our raw predictor, $\widehat{ret}_c$, we decompose the variance in the actual age of retirement and compute the share of the variance in the cross-state retirement ages that is explained by our predictions, i.e. we compute

$$1 - VAR(ret_c - \widehat{ret}_c)/VAR(ret_c) \tag{3}$$

The expression computed in (3) equals one when the raw predictor perfectly fits the actual data and negative (and potentially unbounded) in case our raw predictor is independent or negatively correlated with the actual data.

The numbers that correspond to our four specifications described above are 0.225, 0.168, 0.163 and 0.13, respectively.[10] According to this measure, our raw predictor, thus, explains between 13% and 22.5% of the cross-state variation of retirement ages. We view these numbers as a considerable success of our predictions.

[10]They are very close to the R^2 of the regressions reported in Table 1 since the estimates of the coefficients of the predictions are close to unity.

We refine our prediction by running the actual age of retirement on our raw predictor. Figure 4 provides a graphical representation of our four different specifications. There is a clear positive correlation between predicted and actual ages of retirement in all of the four panels, which correspond to four different specifications of the first stage (1). In the upper left panel, the *refined predictor* relies on a first stage regression without any controls; for the upper right we included state dummies, for the lower left we add state and year effects and for the lower right panel we include, in addition, dummies for marital status and the level of education.

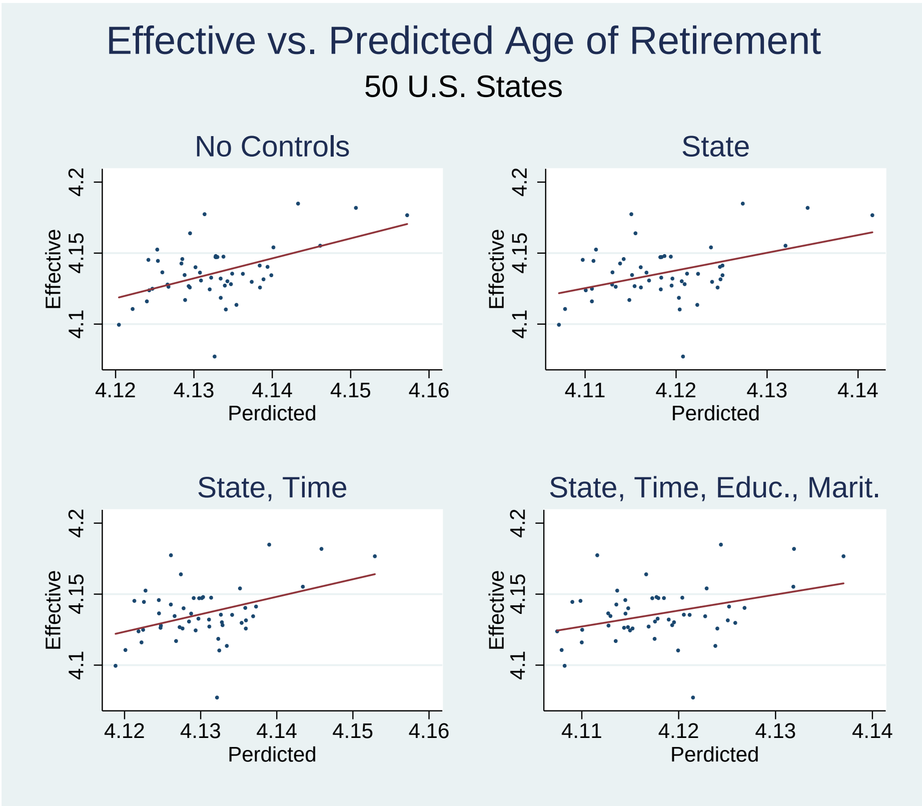

Figure 4: The effective age of retirement vs the predicted age of retirement across 50 US states (log scale).

Panel B of Table 1 reports simple OLS regressions of the actual retirement age ret_c on the raw predictor $\widehat{ret}_c$, corresponding to Figure 4. Each of the four columns reflect one of the four specifications just described. We observe that the coefficient of interest varies slightly between 1.4 and 1.1 and is significant at the 1 percent level in all specifications. The adjusted R^2 lies between 0.13 and 0.25.

2.4 Predicting Retirement Age for OECD Countries

While the previous exercise with U.S. data delivers promising results, we recognize that the findings above might suffer an endogeneity problem. Specifically, U.S. national averages of retirement age per occupation can be expected to be affected by the occupational composition of the individual states. Moreover, explaining differences across U.S. states by U.S. data is not a big surprise, while it is much more challenging to explain differences across a group of heterogenous countries.

Hence, we use our estimates from the first stage (1) for the retirement ages by occupation in the U.S. to predict the ages of retirement over a set of countries. To use the pure information revealed by the differences in occupations, we control in the first stage (1) for years, state effects, marital status and the level of education (see Table 1, Panel A, Column IV). The estimated occupational retirement ages are those from the previous subsection (Table A1).

An assessment of our raw predictor (2) requires a comparison with the actual, observed age of retirement for a set of countries. For a broad set of OECD countries, such data is available.[11] Two additional virtues arise from using the OECD countries. First, this set of countries is relatively homogenous and second, the quality of OECD data is generally good.[12]

To actually compute the raw predictor (2) for different countries, we need the occupational employment shares $w_{c,o}$. To construct this variable we use data from the International Labor Organization (ILO), which provides the number of working individuals by gender, disaggregated according to different classification systems of occupations for a broad set of countries. For a subset of 42 of these countries, occupational data are reported based on the ISCO-88 classification. We use this subsample of countries for our exercise.[13]

[11] See (Table A4, Column III) of the Appendix.

[12] OECD estimates are based on the results of national labor force surveys and the European Union Labor Force Survey. The OECD computes the average effective age of retirement "as a weighted average of (net) withdrawals from the labor market at different ages over a 5-year period for workers initially aged 40 and over. In order to abstract from compositional effects in the age structure of the population, labor force withdrawals are estimated based on changes in labor force participation rates rather than labor force levels. These changes are calculated for each (synthetic) cohort divided into 5-year age groups."

[13] For the list of countries see (Table A4, Column I) of the Appendix.

Finally, we obviously need the estimated age of retirement of each occupation to compute our raw predictor (2). Unfortunately, the estimates which we calculated in the first stage using U.S. data according to (1) are not directly comparable to the ILO data since the former are coded using the 1950 census classification scheme while the latter are based on ISCO-88 classification. Therefore, we define a concordance table between the 1950 census classification scheme and the ISCO-88.[14] With this concordance table we map 179 different occupations of the 3-digit 1950 census classification scheme to 43 categories of the 2-digit ISCO-88 classification scheme. When translating the estimated coefficients on the occupation dummies obtained from the first stage regression (1) to the ISCO-88 classification we face the situation that to some ISCO-88 codes there are more than one census classification code assigned. For these ISCO-88 codes we weight occupational retirement ages by the according U.S. employment shares.

Table A3 of the Appendix reports the resulting constructed average retirement age for the 43 ISCO-88 occupations. The distribution of the estimated occupational retirement ages is now much more concentrated than in Table A1 and outliers in the upper and lower spectrum are less frequent.

Using the employment shares of the ISCO-88 occupations as weights, we can now easily compute the raw predictor according to equation (2). Recall that the occupational retirement ages, $\hat{\beta}_o$ in (2), are based on U.S. data but the weights ($w_{c,o}$) are from the ILO.

Merging the data on the actual age of retirement provided by the OECD with predicted age of retirement leaves us with 28 advanced countries (the U.S. is excluded). We restrict our cross-country analysis to the year 2000, which leaves our set of countries unchanged.[15]

With the variance decomposition, (3), we evaluate the success of our raw predictor by computing the part of the variance explained by our prediction. According to this exercise, our out-of-sample prediction explains 10.3 % of the cross-country variation, not far from the number achieved in the within-sample prediction of the individual U.S. states (13%). We interpret this number as a considerable success of our approach: the

[14]see Table A2 of the Appendix

[15]Our restriction eliminates one data points for Cyprus, South Korea, Poland Portugal Switzerland, respectively.

U.S. occupational retirement ages can explain about a tenth of the considerable cross-country variation on average retirement age merely through the occupational composition effects of the different countries.

For each individual country, we further compute the deviation from the 'naturally implied' retirement age by taking the differences between the effective, ret_c, and the predicted retirement age, $\widehat{ret}_c$.

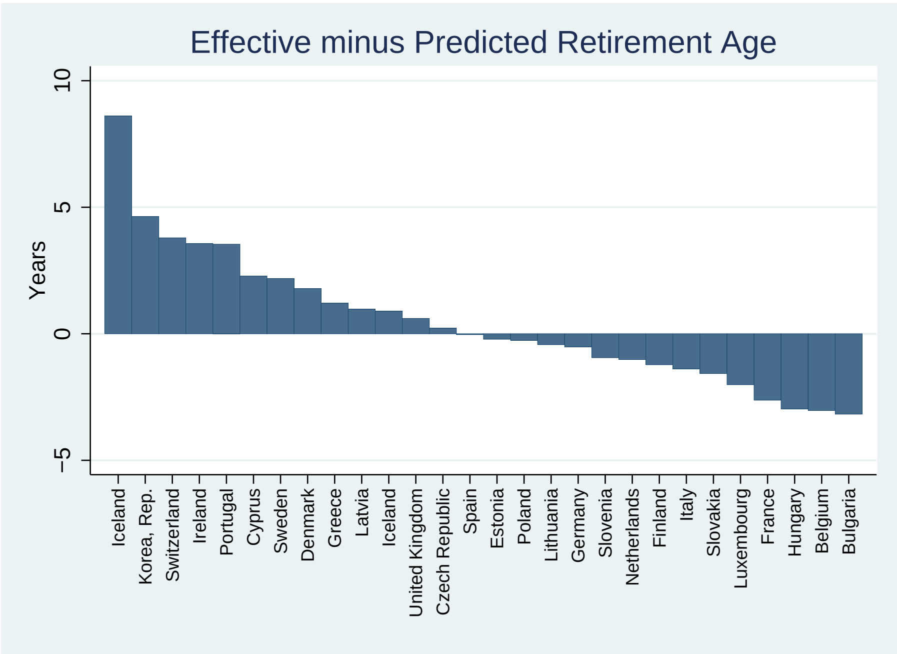

Figure 5: The effective minus predicted age of retirement for the year 2000. Source: Authors' calculations based on data from OECD, ILO, and CPS.

Figure 5 plots these deviations. While male workers in Iceland, South Korea and Switzerland retire relatively late, those in Hungary, Belgium and Bulgaria retire much earlier than their occupational distribution would suggest. Interestingly, the average effective retirement age of males in Spain is almost exactly the same as in the U.S. when accounting for the occupational distribution. Another interesting example are Czech Republic and Poland with virtually identical effective retirement ages; but Czechs retire almost 10 months later when correcting for the respective occupational composition. Conversely, the observed difference of 27 month in the retirement age between Greece (age 63.22) and Germany (age 60.98) shrinks to less than 20 month when occupations are accounted for. Nevertheless, the retirement age in Greece is more than a year higher than predicted by its occupational distribution (+1.21), while Germany falls short of the prediction by about half a year (-0.43). Quite generally, those countries that have frequently faced requests to reform and tighten their pension systems during the current Euro Crisis (Portugal, Greece, Spain) see positive and higher deviations from the predictions than countries from which such requests originate (Germany, France).

2.4.1 Refining the Prediction of Retirement Age

The variance decomposition (3) has shown that the predicted age of retirement explains more than 10% of the variation in the actual age of retirement. However, our prediction can even be improved by accounting for the fact that link between occupations and the age of retirement may differ across countries. E.g., Social Security and welfare programs may magnify the differences in the retirement ages across occupations. It is well known that the U.S. has a relatively lean Social Security system compared to most other OECD countries, which may compress the occupational distribution of retirement ages. Also, the inevitable mistakes in the crosswalk of occupation classifications defined in Table A2 are likely to blur the differences in the according retirement ages and compress the distribution of retirement ages. Both effects mentioned may imply that one year difference in our raw predictor of retirement age actually reflect a much larger difference in effective retirement ages.

To correct for these influences in a very rough way, we refine our predictor by a linear transformation. Specifically, we run a regression to estimate the coefficient, by which our raw predictor impacts the actual age of retirement. In these regressions we can, at the same time, control for Social Security variables and other relevant factors.

Figure 6 plots the actual against the predicted retirement age for the 28 countries. While the two variables exhibit a strong and clearly positive correlation, it is striking that the slope of the included trend line exceeds one.[16] Table 2, Column I reports the results of the corresponding regression, showing that the estimated coefficient, which is

[16]Notice that the deviations from the trend line do not correspond to those plotted in Figure 5, where deviations from the 45° line are measured.

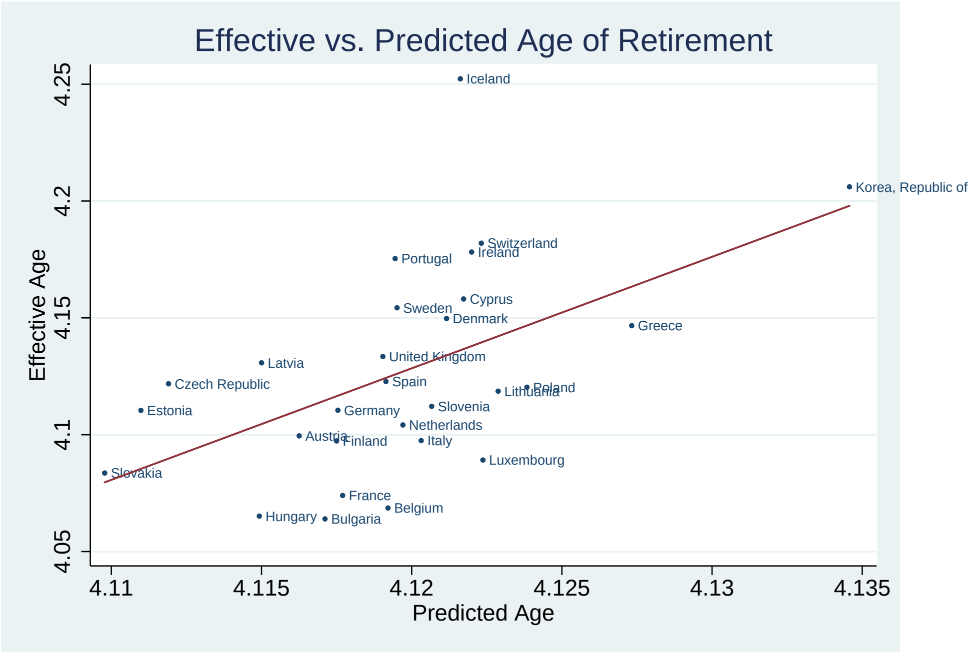

Figure 6: The effective vs. predicted age of retirement across 29 OECD countries for the year 2000.

significant at the 1 percent level, is 4.77 and the adjusted R^2 is 0.274. Put differently, a simple linear transformation of our raw predictor can explain more than a quarter of the cross-country variation of retirement ages within a sample of 28 OECD countries.

Interestingly, the fact that the estimated coefficient on our raw predictor exceeds one is consistent with both suggestions from above – the compression of our predictor due to either social security systems or else due to the translation of occupation codes in the crosswalk. While both effects obviously steepen the slope in Figure 6 and lead to a higher estimated coefficient, the former explanation is reminiscent of the explanation which Ljungqvist and Sargent (1998) provide for the long-term unemployment in welfare states during the 1980s. Specifically, the authors argue that without technological progress unemployed workers easily get back into employment even with a generous unemployment benefits. However, in periods of fast technological progress the skill of laid-off workers quickly becomes obsolete and generous unemployment compensations prevent them to accept new job offers. With regard to the present paper's focus on retirement, the skill obsolescence is particularly relevant for older workers, and, therefore, the long-term unemployment can lead to relatively early retirement.

The observation that an economy's Social Security system appears to influence our predicted retirement age might actually be a source of potential concern. Specifically, Social Security legislation might be the overriding determinant of all direct and indirect effects on retirement age, which, once it is accounted for, leaves no room to other explanations. to address such concerns, we now turn to an econometric analysis that includes both, our predictor (2) and institutional determinants of the average effective retirement age.

2.4.2 Occupational Distribution vs. Institutional Factors

Our approach to explain a country's effective retirement ages by its occupational composition and the typical retirement ages per occupation faces a broad literature that stresses the individual's incentives when it comes to explain the cross-country differences in retirement ages.

To give a first assessment of the relative importance of these two approaches, we include both: political variables and our raw predictor to explain the variation of effective retirement ages in our OECD sample. Specifically, we use data about Social Security systems from the U.S. Social Security Administration's "Social Security Programs Throughout the World" as reported in Bloom et al. (2009). The five categories of interest are, Social Security eligibility age (age of entitlement to full benefits), allowance (number of years before the eligibility age that early retirement, at reduced benefits, is allowed), deferred bonus (increase in benefits due to an additional year of work past the eligibility age), and the last two measures capture the replacement rate (percentage of average earnings replaced by the pension if the worker retires at the normal eligibility age).[17]

For the year 2000, these variables are available for 40 countries.[18] Merging the data with our OECD dataset leaves us with 17 observations. In this sample we run regressions of the actual age of retirement age on the raw predictor and find that within this

[17] Bloom et al. (2009) use these two measures of replacement rate: one is replacement rate from the defined benefit portion of a scheme separately from replacement that accrues from defined contributions.

[18] See (Table A4, Column IV) of the Appendix.

group of homogenous countries the coefficient on the raw predictor is significant at the one percent level and the R^2 is 0.454 (Table 2 Column II). We add each one of the five policy variables separately and find that the significance of our predicted aged of retirement is intact (Table 2 Columns III-VII). Next, we exclude our predicted aged of retirement and run the actual age of retirement on these five policy variables jointly and find that the R^2 is 0.429 (Table 2 Column IX). When we run a regression including both: our raw predictor and the five policy variables we find that the R^2 is very high, 0.83. In this specification our raw predictor is still significant at the one percent level, indicating its robust role in explaining differences in the effective age of retirement across countries.

We further extend the variables Eligibility and Allowance to our set of OECD countries by going back to the database "Social Security Programs Throughout the World" from the U.S. Social Security Administration, which Bloom et al. (2009) use for their calculations.[19] Specifically, we complete the variables: Eligibility and Allowance for all countries in our original set of countries, using data for the year 1999. Columns X and XI report the corresponding regression results. None of the control variables Eligibility and Allowance is significant in this extended set of countries, while Allowance was negative and significant in the smaller sample (see Column IV).[20] Most importantly, however, the estimates of the coefficient of interest remain significant and are virtually unchanged in terms of magnitude.

2.5 Predicting Retirement Age for an Extended Sample

We next extend the range of countries for which we compare the effective with the predicted retirement age. Consistent data on employment by occupation is relatively hard to obtain and the ILO data of occupational distribution already provides a good cover-

[19]Our source is the International Social Security Association, which provides detailed descriptions of Social Security programs. These descriptions comprise all information of the publication "Social Security Programs Throughout the World" of the U.S. Social Security Administration, referred to by Bloom et al. (2009). The International Social Security Association reports early retirement for five countries (Czech Republic, Ecuador, Iceland, Lithuania and Hungary). We set this variable to zero for those countries in the database for which it is not specifically reported. There are three additional variables: Deferred Bonus and the two measures of replacement rate. Bloom et al (2009) compute these variables based on the definition of a representative worker and formulas that are not further specified. We do not extend these variables to our set of countries.

[20]This lack of significance may indicate that the variables are less reliable than for the limited sample.

age of countries. We thus enlarge our sample by extending the set of countries for which we can obtain effective average retirement age. Specifically, we use ILO data on employment by age group to compute a proxy for the effective retirement age, relying on the method employed by the OECD (see Footnote 12). Hence, we compute for country c the employment shares $\theta_{c,a}$ for each 5-year age group a starting from age 40. We then calculate

$$ret_c = \sum_a (\theta_{c,a} - \theta_{c,a-1}) \cdot a$$

where a runs over all age groups and $\theta_{c,a} \equiv 1$ if $a < 40$.

With this method, we proxy the countries' retirement ages. To keep our previous terminology and considering that our calculation method relies on that of the OECD, we refer to these proxies as effective retirement ages. Our calculations increase the set of countries for which we have raw predictor and effective retirement ages to 38 countries.[21] For most of these countries, data exist in the year 2000. For the few exceptions, we take the closest available year to 2000.[22] In the following, we will refer to this set of countries as the full sample

Figure 7 shows that, within the sample of countries for which OECD data and our own calculations exist, there is a strong correlation between the two proxies of effective average retirement age. With the exception of Mexico, all countries lie reasonably close to the 45-degree line in the scatterplot. In a regression the estimated coefficient is 1.4, with a standard deviation .103 and an adjusted R^2 of 0.832 (1.261, 0.084 and 0.86, respectively when excluding Mexico).

A variance decomposition according to equation (3) shows that our raw predictor explain 17% of the cross-country variance in the age of retirement. This result constitutes a substantial improvement over the previous predictions based on the advanced countries only and even relative to the within sample prediction of section 2.3.

Figure 8 provides a graphical representation of the fit, plotting the effective versus the predicted retirement age for our full sample (replicating the impressive correlation

[21]See (Table A4, Column III) of the Appendix.

[22]These exceptions are Uganda 1991; Gabon 1993, Iran 1996, Seychelles 1997, Pakistan 1998, Hong Kong 2001.

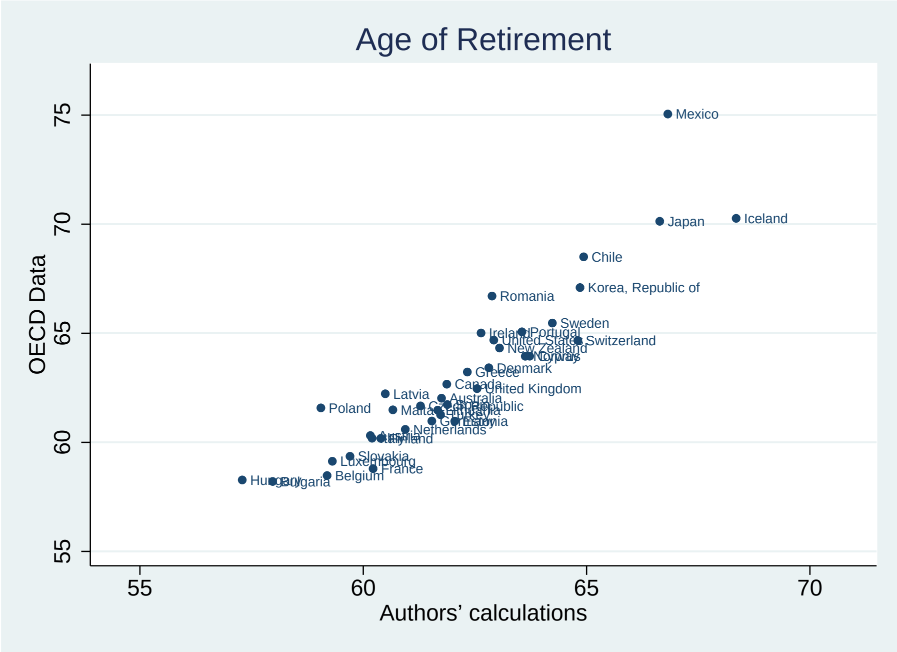

Figure 7: The effective age of retirement - OECD vs. authors' calculations. Source: authors' calculations are based on ILO data.

of Figure 6). It is especially striking that our predictions, which are based on U.S. employment data, performs well for very diverse and less developed countries such as Uganda and Pakistan as well as Gabon and Iran.

Table 3, Column I reports the regression results corresponding to the trend line in Figure 8. The coefficient of interest is now 3.78 and significant at the one percent level; the R^2 is 0.378. Thus, following our earlier interpretation, our *refined predictor* explains close to 40% of the cross-country variation in the average effective retirement age. Since this full sample includes some observation of years different from the year 2000, our baseline specification, which is reported in Column II includes the year of observations to control for global trends in the retirement age. In this baseline specification the estimated coefficient on the raw predictor declines to 3.173 The adjusted R^2 improves relative to the OECD sample and stands at the level 0.399

In this full sample we repeat our previous exercise by including the five political variables that capture Social Security and pension incentives discussed in the previous section in order to see whether our variable of interest: the raw predictor survives the

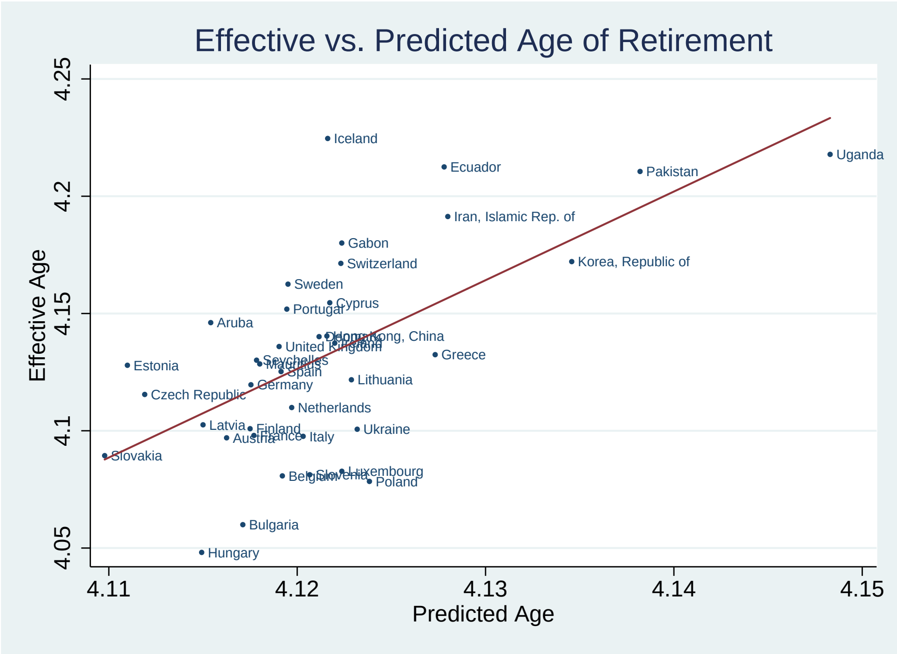

Figure 8: The effective vs. predicted age of retirement across 38 countries.

inclusion of these variables in a very heterogenous sample that includes not only developed countries but also developing ones. Columns IV-XII of Table 3 show the corresponding specifications of Columns III-XI of Table 2. Overall, all conclusions drawn from the OECD sample with regard to the inclusion of the political variables are repeated in the full sample. A noticeable difference of the two samples, however, is the magnitude of the coefficient on the raw predictor. In the OECD sample its magnitude ranges around 6.5 while in the enlarged sample its magnitude ranges around 3.5. Thus, the inclusion of developing countries reduces the magnitude of our coefficient. This observation supports our conjecture from before that the magnitude of our coefficient is affected, among other things, by the welfare economy. While OECD (mainly European) countries provide much more generous financial support than most emerging countries, retirement decisions of individuals in the latter countries are less sensitive to their occupations as old age consumption needs to be financed by a longer work life.

2.6 Further Control Variables

For a last robustness check, we also include the control variables *GDP per capita* (in US dollars, logged), *Urban population* (in percent of population) and *Life Expectancy* (at birth, in years for male population). These three variables are readily available in the World Development Indicators (WDI), provided by the World Bank. A fourth variable *Average Schooling* is from Barro and Lee (2000).[23]

Table 4 reports the regression results when including these control variables, jointly or separately, in our full sample. In the baseline specification within this full sample we control for year trend just as in the regressions reported in Table 3 (see footnote 22). Clearly, Table 4 shows that controlling for all four variables does not affect neither the significance nor the magnitude of our predicted age of retirement. The coefficient is around 3.5 and significant at the 1 percent level. The control *Life Expectancy* included in Column II is the only one which is significant, although marginally. Also, the adjusted R^2 increases somewhat compared to the regression excluding all controls (Table 3, Column III).

3 Conclusion

Economic literature has studied retirement decisions mainly from the viewpoint of institutional incentives. Consequently, cross-country differences are ultimately linked to Social Security and pension systems. In this paper, we have proposed a new explanation for the cross-country differences in the age of retirement. We have looked at the occupational composition and its impact on the actual average age of retirement. Our explanation leans on two prerequisites. First, the age of retirement is occupation specific and originates in intrinsic characteristics of each occupation such as physical requirements or the pace at which job-specific knowledge depreciates. Second, occupational distribution varies significantly across countries. We use the rich U.S. data to infer a proxy for the average retirement age by occupation. We thereby control for state dummies (which

[23] Data on Average Schooling are missing for Aruba, Gabon, Luxembourg and Ukraine.

captures Social Security and pension incentives that are state specific) marital status, the level of education and year dummies, thus extracting the pure impact of occupation on the age of retirement. Based on this ’pure’ measure of retirement age, we construct a raw predictor of average retirement age by weighting the occupational retirement age with occupational employment shares. Our predictor, which is based on U.S. data, can explain a large part of the cross-country variation in the average effective retirement age for a sample of 38 countries. Next, we include in our analysis financial retirement incentives that are typically being focused on in the literature. In a regression of the effective average retirement age on our raw predictor plus relevant control variables 83% of the observed sample variation are explained, while the coefficient on our predicted age of retirement is significant at the one percent level. This picture does not change when we include per-capita GDP, life expectancy, the share of urban population and average schooling in the regression. These results indicate that the occupational distribution is a major determinant of the differences in the age of retirement across countries. For each country, our raw predictor of retirement age constitutes also an interesting ’natural benchmark’ against which we can compare the effective retirement ages. This comparison delivers interesting insights. Thus, the Czech Republic and Poland have virtually identical effective retirement ages, but Czechs retire almost 10 months later when correcting for the respective occupational composition. Conversely, the observed difference of 27 month in the retirement age between Greece (age 63.2) and Germany (age 61.0) shrinks to less than 20 month when occupations are accounted for. Finally, our findings may stimulate questions about the extent to which savings decisions, current accounts and the sustainability of pension systems are affected by the occupational patterns. In particular, the role of economic development or international specialization as underlying determinants of occupational structure might deserve further studies.

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Table 1: Retirement Age Across U.S. States

	I	II	III	IV
Panel A: Imputing Occpational Retirement Age				
Dep Variable: Retirement Age (Individual Level)				
$D_{occupation}$	yes	yes	yes	yes
D_{state}		yes	yes	yes
D_{year}			yes	yes
$D_{marital}$				yes
$D_{education}$				yes
Observations	4989	4989	4989	4511
R-squared	0.104	0.117	0.124	0.202
Joint test D_{occ}==0				
F-statistic	3.119	3.002	2.959	2.762
p-value	0.000	0.000	0.000	0.000
Panel B: Regressing Effective on Predicted Retirement Age by State				
Dep Variable: Effective Retirement Age (State Level)				
Predicted Ret	1.406***	1.245***	1.233***	1.124***
	(0.356)	(0.390)	(0.395)	(0.416)
Constant	-1.673	-0.991	-0.957	-0.491
	(1.471)	(1.608)	(1.632)	(1.714)
Observations	50	50	50	50
R-squared	0.245	0.175	0.169	0.132

Note. –Panel A describes four different specifications of the first stage. Each specification corresponds to different sets of controls. Regressions are conducted on U.S. individual data from IPUMS-CPS. All models are weighted by CPS sampling weights. Control variables: (1) Doccupation comprises 179 dummies for occupations (3- digit census occupation scheme). (2) Dstate includes 50 U.S. states. (3) Dyear includes 21 dummies for the period 1990-2010. (4) Dmarital includes 6 dummies (see footnote 9 for categories). (5) Deducation includes 19 dummies (see footnote 9 for categories). Panel B reports the result of four simple OLS of the actual age of retirement on the raw predictor at the state level. The raw predictor is based on the occupation dummies of the four corresponding regressions in Panel A. The actual age of retirement is also calculated using data from IPUM-CPS data. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2: Retirement Age, Cross-Country, OECD Countries

Dep Variable: Effective Retirement Age

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Predicted Ret	4.772***	6.194***	7.252***	6.907***	5.509***	5.981***	7.276***		7.994***	4.193**	5.369***
	(1.522)	(1.753)	(1.846)	(1.581)	(1.591)	(1.663)	(1.934)		(1.643)	(1.513)	(1.578)
Eligibility			0.640					0.313	0.782**	0.481	
			(0.444)					(0.538)	(0.322)	(0.290)	
Allowed				-0.495**				0.402	-0.167		-0.330
				(0.217)				(0.400)	(0.257)		(0.263)
Repl. Benefit					-0.0777**			-0.145**	-0.0679		
					(0.0351)			(0.0634)	(0.0396)		
Repl. Contrib.						0.431		0.582	0.314		
						(0.259)		(0.348)	(0.207)		
Defer. Bonus							0.563	-0.167	0.532		
							(0.457)	(0.503)	(0.322)		
Constant	-15.53**	-21.40***	-26.17***	-24.32***	-18.53**	-20.52***	-25.86***	3.999***	-29.28***	-13.45**	-17.98**
	(6.269)	(7.224)	(7.725)	(6.512)	(6.562)	(6.852)	(7.971)	(0.338)	(6.845)	(6.194)	(6.500)
Observations	28	17	17	17	17	17	17	17	17	28	28
R-squared	0.274	0.454	0.525	0.602	0.596	0.544	0.508	0.429	0.830	0.347	0.318

Note. – Data on effective retirement age are from the OECD. Predicted retirement age is calculated using specification 4 of Table 1 (Panel A) and employment weights are from ILO. Data on all other control variable are from Bloom et al. (2009) for the Columns III-IX. Eligibility: Social Security eligibility. Allowed: Allowance for early retirement. Defer. Bonus: increase in benefits due to an additional year of work. Repl. Benefit and Repl. Contrib. are replacement rate for benefit scheme and contribution scheme, respectively. Data for Eligibility and Allowance in Columns X and XI are from International Social Security Association. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Retirement Age, Cross-Country, Full Sample

Dep Variable: Effective Retirement Age

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Predicted Ret	3.781***	3.173***	3.534**	3.699**	4.297***	2.956**	3.340**	4.267**		4.368***	3.295***	3.140***
	(0.806)	(0.984)	(1.421)	(1.480)	(1.269)	(1.256)	(1.345)	(1.551)		(1.403)	(0.995)	(1.089)
Year		-0.00383	-0.00658*	-0.00880	-0.00422	-0.00721**	-0.00689*	-0.00697*	-0.00748	-0.00848*	-0.00542	-0.00435
		(0.00357)	(0.00362)	(0.00541)	(0.00328)	(0.00316)	(0.00342)	(0.00361)	(0.00520)	(0.00403)	(0.00410)	(0.00396)
Eligibility				0.155					-0.0859	0.147	0.169	
				(0.277)					(0.274)	(0.225)	(0.199)	
Allowed					-0.435**				0.0643	-0.243		0.0841
					(0.170)				(0.231)	(0.204)		(0.215)
Repl. Benefit						-0.0594**			-0.0755**	-0.0426		
						(0.0233)			(0.0305)	(0.0259)		
Repl. Contrib.							0.373*		0.445*	0.283		
							(0.212)		(0.233)	(0.188)		
Defer. Bonus								0.410	0.127	0.454		
								(0.362)	(0.334)	(0.279)		
Constant	-11.45***	-1.298	2.727	6.375	-5.117	6.395	4.137	0.476	19.17*	3.007	1.279	-0.117
	(3.322)	(10.03)	(9.646)	(11.81)	(8.920)	(8.512)	(9.138)	(9.773)	(10.27)	(9.496)	(10.83)	(11.33)
Observations	38	38	20	20	20	20	20	20	20	20	37	37
R-squared	0.379	0.399	0.376	0.388	0.557	0.556	0.477	0.422	0.540	0.745	0.428	0.419

Note. –Effective retirement age are Based on ILO data on employment by age group. See the note to Table 2 for additional sample details and variables definition. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Retirement Age, Socio-Economic Controls, Full Sample

Dep Variable: Effective Retirement Age

	I	II	III	IV	V
Predicted Ret	3.397***	3.197***	3.353***	3.785***	3.490***
	(1.012)	(0.954)	(1.005)	(1.102)	(1.119)
year	-0.00515	-0.0100**	-0.00484	0.00179	-0.00623
	(0.00383)	(0.00487)	(0.00374)	(0.00529)	(0.00767)
GDP p.c.	0.520				-0.551
	(0.541)				(1.211)
Life Expect.		0.250*			0.263
		(0.138)			(0.311)
Urban Pop.			0.0352		0.0676
			(0.0385)		(0.0609)
Av. Schooling				-0.286	-0.516
				(0.384)	(0.495)
Constant	0.388	10.81	-0.0284	-15.03	2.070
	(10.19)	(11.80)	(10.15)	(13.43)	(17.98)
Observations	38	38	38	34	34
R-squared	0.415	0.452	0.413	0.450	0.527

Note. –Effective retirement age are Based on ILO data on employment by age group. Control variables: GDP per capita (in US dollars, logged), Urban population (in percent of population) and Life Expectancy (at birth, in years for male population) are from World Development Indicators (WDI), provided by the World Bank, Average Schooling is from Barro and Lee (2000). See the note to Table 2 for additional sample details and variables definition. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix

Table* A1*: Census Occupational Classification Scheme (1950) and Retirement Age

Occupation Code	Description	Retirement Age (Average)
0	Accountants and auditors	62.6
1	Actors and actresses	71.0
2	Airplane pilots and navigators	60.2
3	Architects	67.2
4	Artists and art teachers	67.0
5	Athletes	67.0
6	Authors	61.3
7	Chemists	62.9
9	Clergymen	68.0
18	Mathematics	62.0
27	Social sciences (n.e.c.)	62.8
28	Nonscientific subjects	67.7
29	Subject not specified	65.5
31	Dancers and dancing teachers	65.3
32	Dentists	62.6
33	Designers	64.5
35	Draftsmen	63.1
36	Editors and reporters	61.6
41	Engineers, aeronautical	69.7
42	Engineers, chemical	62.2
43	Engineers, civil	63.8
44	Engineers, electrical	62.1
45	Engineers, industrial	65.7
46	Engineers, mechanical	66.7
48	Engineers, mining	64.4
49	Engineers (n.e.c.)	63.4
51	Entertainers (n.e.c.)	61.1
53	Foresters and conservationists	58.8
54	Funeral directors and embalmers	62.0
55	Lawyers and judges	64.6
56	Librarians	65.6
57	Musicians and music teachers	64.1
58	Nurses, professional	62.9
61	Agricultural scientists	61.0
62	Biological scientists	59.9
68	Physicists	60.0
69	Miscellaneous natural scientists	77.0
70	Optometrists	80.0
72	Personnel and labor relations workers	60.9
73	Pharmacists	65.1
74	Photographers	62.2
75	Physicians and surgeons	64.7
76	Radio operators	58.4
78	Religious workers	67.8

Table A1 *(continued)*

Occupation Code	Description	Retirement Age (Averg.)
79	Social and welfare workers, except group	64.1
81	Economists	63.1
82	Psychologists	71.0
83	Statisticians and actuaries	62.4
91	Sports instructors and officials	71.0
92	Surveyors	59.5
93	Teachers (n.e.c.)	61.2
94	Technicians, medical and dental	58.8
95	Technicians, testing	59.9
96	Technicians (n.e.c.)	66.7
97	Therapists and healers (n.e.c.)	64.1
98	Veterinarians	71.1
99	Professional, technical and kindred workers (n.e.c.)	62.4
100	Farmers (owners and tenants)	68.1
123	Farm managers	69.1
200	Buyers and department heads, store	63.1
201	Buyers and shippers, farm products	60.1
203	Conductors, railroad	62.2
210	Inspectors, public administration	65.6
230	Managers and superintendents, building	63.8
240	Officers, pilots, pursers and engineers, ship	65.9
250	Officials and administrators (n.e.c.), public administration	61.0
270	Postmasters	59.8
280	Purchasing agents and buyers (n.e.c.)	62.9
290	Managers, officials, and proprietors (n.e.c.)	62.7
301	Attendants and assistants, library	51.1
305	Bank tellers	64.0
310	Bookkeepers	66.6
320	Cashiers	64.5
321	Collectors, bill and account	64.0
322	Dispatchers and starters, vehicle	62.7
335	Mail carriers	56.5
340	Messengers and office boys	64.8
341	Office machine operators	63.4
342	Shipping and receiving clerks	60.2
350	Stenographers, typists, and secretaries	65.0
380	Ticket, station, and express agents	53.5
390	Clerical and kindred workers (n.e.c.)	61.7
400	Advertising agents and salesmen	66.5
420	Demonstrators	78.9
430	Hucksters and peddlers	66.9
450	Insurance agents and brokers	64.2
460	Newsboys	62.8
470	Real estate agents and brokers	66.4
480	Stock and bond salesmen	65.3
490	Salesmen and sales clerks (n.e.c.)	64.5
500	Bakers	62.2

Table **A1** ***(continued)***

Occupation Code	Description	Retirement Age (Averg.)
502	Bookbinders	79.0
503	Boilermakers	66.1
504	Brickmasons, stonemasons, and tile setters	70.6
505	Cabinetmakers	66.3
510	Carpenters	61.6
511	Cement and concrete finishers	55.2
512	Compositors and typesetters	58.0
513	Cranemen, derrickmen, and hoistmen	54.2
515	Electricians	59.9
522	Excavating, grading, and road machinery operators	63.3
523	Foremen (n.e.c.)	61.9
530	Glaziers	56.0
531	Heat treaters, annealers, temperers	61.4
533	Inspectors (n.e.c.)	63.7
534	Jewelers, watchmakers, goldsmiths, and silversmiths	67.0
540	Linemen and servicemen, telegraph, telephone, and powe	56.1
541	Locomotive engineers	62.7
544	Machinists	60.0
545	Mechanics and repairmen, airplane	61.1
550	Mechanics and repairmen, automobile	58.8
551	Mechanics and repairmen, office machine	61.1
552	Mechanics and repairmen, radio and television	62.2
553	Mechanics and repairmen, railroad and car shop	58.9
554	Mechanics and repairmen (n.e.c.)	62.0
560	Millwrights	63.3
564	Painters, construction and maintenance	62.0
570	Pattern and model makers, except paper	60.6
573	Plasterers	52.4
574	Plumbers and pipe fitters	63.8
575	Pressmen and plate printers, printing	61.7
580	Rollers and roll hands, metal	55.9
581	Roofers and slaters	60.6
582	Shoemakers and repairers, except factory	61.8
583	Stationary engineers	61.3
585	Structural metal workers	60.0
590	Tailors and tailoresses	64.4
591	Tinsmiths, coppersmiths, and sheet metal workers	61.9
592	Tool makers, and die makers and setters	68.9
593	Upholsterers	69.1
594	Craftsmen and kindred workers (n.e.c.)	59.1
595	Members of the armed services	55.5
620	Asbestos and insulation workers	64.0
621	Attendants, auto service and parking	64.0
624	Brakemen, railroad	58.0
625	Bus drivers	61.1
632	Deliverymen and routemen	65.7
635	Filers, grinders, and polishers, metal	64.6

Table A1 *(continued)*

Occupation Code	Description	Retirement Age (Averg.)
641	Furnacemen, smeltermen and pourers	55.7
643	Laundry and dry cleaning operatives	55.6
644	Meat cutters, except slaughter and packing house	62.7
650	Mine operatives and laborers	63.3
662	Oilers and greaser, except auto	62.0
670	Painters, except construction or maintenance	61.8
671	Photographic process workers	60.0
672	Power station operators	61.3
674	Sawyers	68.1
680	Stationary firemen	58.4
682	Taxicab drivers and chauffers	64.8
683	Truck and tractor drivers	61.1
685	Welders and flame cutters	59.6
690	Operative and kindred workers (n.e.c.)	60.8
720	Private household workers (n.e.c.)	62.0
730	Attendants, hospital and other institution	57.8
731	Attendants, professional and personal service (n.e.c.)	69.6
732	Attendants, recreation and amusement	70.2
740	Barbers, beauticians, and manicurists	64.7
750	Bartenders	62.8
753	Charwomen and cleaners	59.8
754	Cooks, except private household	57.8
760	Counter and fountain workers	80.0
762	Firemen, fire protection	59.1
763	Guards, watchmen, and doorkeepers	63.5
764	Housekeepers and stewards, except private household	62.9
770	Janitors and sextons	64.6
773	Policemen and detectives	56.4
780	Porters	58.0
781	Practical nurses	65.0
782	Sheriffs and bailiffs	60.8
784	Waiters and waitresses	64.8
785	Watchmen (crossing) and bridge tenders	76.5
790	Service workers, except private household (n.e.c.)	63.7
810	Farm foremen	61.7
820	Farm laborers, wage workers	68.5
910	Fishermen and oystermen	65.9
930	Gardeners, except farm, and groundskeepers	63.7
940	Longshoremen and stevedores	59.1
950	Lumbermen, raftsmen, and woodchoppers	60.4
970	Laborers (n.e.c.)	61.9

Table A2*: Crosswalk ISCO-88 to Census Occupational Classification Scheme (1950)*

ISCO-88	Census Code
1	595
2	595
3	595
11	250
12	200, 201, 260, 270, 290
13	123, 205, 290
14	260, 290
21	3, 7, 33, 35, 41, 42, 43, 44, 45, 46, 47, 48, 49, 52, 61, 62, 63, 67, 68, 69, 92, 583
22	32, 34, 58, 70, 71, 73, 75, 97, 98, 772
23	4, 10, 12, 13, 14, 15, 16, 17, 18, 19, 23, 24, 25, 26, 27, 28, 29, 81, 82, 83, 84, 93
24	0, 72, 400, 430
25	67, 69
26	1, 4, 6, 9, 31, 36, 51, 55, 56, 57, 81, 82, 83, 84
31	2, 53, 95, 96, 99, 240, 672
32	8, 59, 94, 730, 781
33	204, 210, 280, 300, 450, 470, 480, 773
34	4, 5, 33, 74, 77, 78, 79, 91, 210, 514, 732
35	96, 99, 360, 365, 370
41	302, 341, 350, 365, 370
42	76, 305, 320, 321, 540, 761
43	304, 310, 322, 325, 342
44	301, 335, 340, 360, 390
51	54, 203, 230, 621, 631, 700, 731, 740, 750, 751, 752, 754, 764, 783, 784
52	380, 410, 420, 460, 490, 760
53	731
54	630, 680, 762, 763, 770, 771, 780, 782, 785
61	100, 810
62	910
63	840, 910
71	504, 505, 510, 511, 523, 524, 531, 564, 565, 573, 574, 581, 584, 620
72	501, 503, 535, 543, 544, 545, 550, 551, 552, 553, 554, 560, 561, 580, 585, 591, 592, 635, 642, 641, 642, 662, 685
73	502, 512, 514, 521, 530, 534, 563, 571, 572, 575, 634, 670, 690
74	515, 520
75	500, 525, 532, 555, 570, 582, 590, 593, 594, 622, 633, 640, 644, 645, 674
81	643, 650, 671, 675, 684
82	970
83	513, 522, 541, 542, 623, 624, 625, 660, 661, 673, 681, 682, 683, 960
91	710, 720, 753, 920
92	820, 830, 840, 910, 930, 950
93	950, 970
94	640, 644, 645
95	790
96	632, 753

Table A3*: Occupational Class (* ISCO-88*) and Retirement Age*

Code	Description	Retirement Age (Averg.)
1	Commissioned armed forces officers	56.7
2	Non-commissioned armed forces officers	56.7
3	Armed forces occupations, other ranks	56.7
11	Chief executives, senior officials and legislators	60.4
12	Administrative and commercial managers	61.2
13	Production and specialised services managers	61.4
14	Hospitality, retail and other services managers	61.3
21	Science and engineering professionals	62.3
22	Health professionals	62.4
23	Teaching professionals	61.0
24	Business and administration professionals	61.5
25	Information and communications technology professionals	76.2
26	Legal, social and cultural professionals	64.5
31	Science and engineering associate professionals	60.8
32	Health associate professionals	57.8
33	Business and administration associate professionals	61.4
34	Legal, social, cultural and related associate professionals	64.2
35	Information and communications technicians	61.9
41	General and keyboard clerks	64.9
42	Customer services clerks	59.5
43	Numerical and material recording clerks	62.2
44	Other clerical support workers	60.9
51	Personal service workers	61.9
52	Sales workers	63.5
53	Personal care workers	61.7
54	Protective services workers	62.3
61	Market-oriented skilled agricultural workers	65.8
62	Market-oriented skilled forestry, fishery and hunting workers	64.1
63	Subsistence farmers, fishers, hunters and gatherers	64.1
71	Building and related trades workers, excluding electricians	60.6
72	Metal, machinery and related trades workers	60.4
73	Handicraft and printing workers	59.5
74	Electrical and electronic trades workers	58.7
75	Food processing, wood working, garment and other craft and related trades workers	60.9
81	Stationary plant and machine operators	56.4
82	Assemblers	60.6
83	Drivers and mobile plant operators	60.5
91	Cleaners and helpers	60.1
92	Agricultural, forestry and fishery labourers	62.9
93	Labourers in mining, construction, manufacturing and transport	60.6
94	Food preparation assistants	60.4
95	Street and related sales and service workers	61.8
96	Refuse workers and other elementary workers	60.4

Table A4: List of Available Data

Country	**ILO (Empl. by ISCO-88)**	**ILO (Empl. by Age)**	**OECD (Eff. Ret. Age)**	**Bloom et al (2009)**
Aruba	x	x		
Australia		x	x	x
Austria	x	x	x	x
Belgium	x	x	x	x
Bulgaria	x	x	x	
Canada		x	x	x
Chile		x	x	x
Cyprus	x	x	x	x
Czech Rep.	x	x	x	
Denmark	x	x	x	x
Ecuador	x	x		
Egypt	x			
Estonia	x	x	x	
Finland	x	x	x	x
France	x	x	x	x
Gabon	x	x		x
Germany	x	x	x	x
Greece	x	x	x	x
Hong Kong	x	x		x
Hungary	x	x	x	
Iceland	x	x	x	
Iran	x	x		
Ireland	x	x	x	x
Israel			x	
Italy	x	x	x	x
Japan		x	x	x
Korea	x	x	x	x
Latvia	x	x	x	
Lithuania	x	x	x	
Luxembourg	x	x	x	x
Malta		x	x	x
Mauritius	x	x		x
Mexico		x	x	x
Mongolia	x			
Netherlands	x	x	x	x
New Zealand		x	x	x
Norway		x	x	x
Pakistan	x	x		
Philippines	x			
Poland	x	x	x	
Portugal	x	x	x	
Romania		x	x	
Seychelles	x	x		
Slovakia	x	x	x	
Slovenia	x	x	x	
Spain	x	x	x	x
Sweden	x	x	x	x
Switzerland	x	x	x	x
Thailand	x			
Turkey		x	x	x
Uganda	x	x		
Ukraine	x	x		
United Kingdom	x	x	x	x
United States		x	x	x