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"Retirement Age across Countries
The Role of Occupations*"

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Abstract

Cross-country variation in average retirement age is usually attributed to institutional differences that affect individuals' incentives to retire. We suggest a different approach. Since workers in different occupations naturally retire at different ages, the composition of occupations within an economy matters for its average retirement age. Using U.S. data we infer the average retirement age by occupation, which we then use to predict the retirement age of 38 countries according to the occupational composition of these countries. Our findings suggest that the differences in occupational composition explain up to 32.4% of the observed cross-country variation in retirement age.

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

JEL Classifications: J14, J24, J26, J82.

1 Introduction

Long-standing trends towards earlier retirement and higher life expectancy jeopardize the sustainability of existing pension systems and fuel academic and political discussions.[1] Lifting the retirement age by a year or two is often proposed as a method for curbing the resulting costs of Social Security systems. While such proposals face strong political resistance, they appear rather modest in comparison with existent cross-country differences in the effective average retirement age.[2]

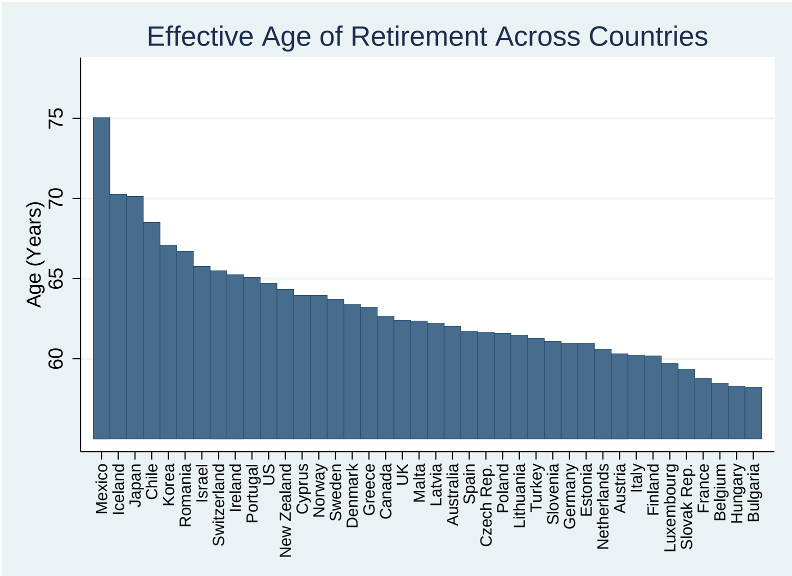

Figure 1: The effective age of retirement of male working populations across 40 countries for the year 2000. Source: Organization for Economic Cooperation and Development (OECD), based on national labor force surveys.

Figure 1 exhibits the huge cross-country variations in the retirement age of male working populations. The numbers vary widely between the poles of Mexico (75) and Bulgaria (58.2). Policy makers in search of tools to raise the average retirement age, must be interested in the determinants that drive the large cross-country differences exhibited in Figure 1.

[1]Kalemli-Ozcan and Weil (2010) attribute the rise of retirement over the course of the 20^{th} century to the reduction in mortality.

[2]Throughout the paper, we will use the term 'effective retirement age' to refer to the age of retirement actually observed or reported by our different data sources.

Existing research focuses on incentives related to Social Security and pension systems to explain the cross-country variation of retirement age. For example, 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 (p. 161).[3]

In the present paper we propose a new perspective on the cross-country variation in the age of retirement. Our explanation relies on the observation that individuals in different occupations retire at different ages.[4] At least part of these differences are intrinsically linked to the type of tasks that different occupations require. For example, when carpenters retire earlier than psychologists, at least part of these differences may be caused by different requirements in physical strength of the different tasks involved. 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 well in explaining the cross-country differences in the effective retirement age.

For policy-makers, it is important to acknowledge the role of occupations for the age of retirement for at least two reasons. First, to the extent that future occupational distributions can be projected, occupations will help to predict the evolution of the effective

[3]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. These incentives are thought to be driven not only by Social Security regulations (Gruber and Wise 2004) but also by private pension (Mitchell and Fields 1984), a mix of state, private pension provision and wealth (Blundell, Meghir and Smith 2002) and Social Security Disability Insurance (Autor and Duggan 2006). Bloom, Canning, Fink and Finlay (2009) analyze panel data for 40 countries over the period of 1970-2000 and find that Social Security reforms have substantially increased the labor supply of older men. It is important to note, however, that the literature does not unanimously suggest that Social Security has a significant impact on retirement (Krueger and Pischke 1992, Burtless 1986).

[4]By considering thirteen major industry dummies and seventeen major occupation dummies, Coile and Gruber (2007) find that the "industry and occupation dummies 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". However, these aggregated data hide huge differences in the age of retirement across narrowly defined occupations. Table A1 in the Appendix shows, for example, that while farm foremen retire at age 61.7, farm laborers retire at age 68.5.

retirement age, with the obvious consequences on the cost of social security systems and national budgets. Second, the design of social security and pension systems could be more effective if it is occupation-specific and accounts for the different elasticities of the retirement age to financial incentives across occupations.[5]

We stress that the two explanations of the cross-country variation in retirement ages – our occupational approach and the traditional explanation via Social Security and financial incentives – are neither contradictory nor excluding or orthogonal to each other. First and obviously, none of the different approaches can be expected to fully explain the cross-country variation of the data.[6] Second, and more interestingly, both approaches may be related and intertwined. Thus, an early mandatory retirement age may be binding for some occupations but not for others and thereby impact the comparative advantage and hence its occupational distribution of a country through international specialization. But also reversely, the occupational distribution of a country can affect political processes such as Social Security rules.

Technically, we predict the average retirement age of an economy via the retirement age of occupations and the country specific occupational distribution. If the occupational distribution is to impact a country's average retirement age, retirement age must differ across occupations. Figure 2 shows that within the U.S., the average effective age of retirement indeed varies over 179 occupations.[7] For example, 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). At least part of these differences are likely to be explained by intrinsic characteristics of the corresponding occupations such as physical requirements or the pace at which job-specific knowledge depreciates.[8]

[5]Discrepancies in retirement rules already exist. For example, not all workers in the U.S. today face a mandatory retirement age. The mandatory retirement age is 56, 57, 57, 55 and 65, for air traffic controllers, FBI agents and other federal law enforcement officers, national park rangers, U.S. lighthouse Service workers and airline pilots, respectively.

[6]Indeed, Manoli and Weber (2011) find that the elasticity of labor supply with respect to financial incentives is low suggesting that "many retirement decisions are likely to be affected by factors beyond only financial incentives from retirement benefits".

[7]We use Current Population Survey (CPS) data from Integrated Public Use Microdata Series (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 obtained observations for 179 of the 263 occupation classes defined by the Census Bureau.

[8]Differences in the age of retirement across occupations could be driven by differences in rates of human capital depreciation through knowledge obsolescence and health deterioration. On the one hand,

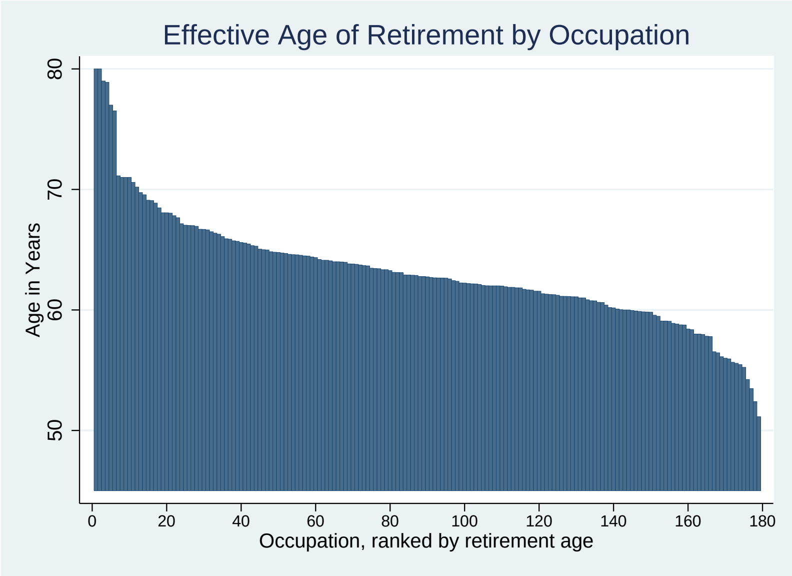

Figure 2: The effective age of retirement of male working populations in the U.S. across 179 occupations during the period $1990-2010$. Data are based on census classification scheme (3 digit). Source: authors' calculations from IPUMS-CPS.

Clearly, a country whose working population is mostly engaged in occupations characterized by early 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 retirement age. The composition of occupations, however, can be relevant for cross-country differences in the retirement age only if the underlying occupational distribution varies across countries. Figure 3 shows that, in fact, large cross-country differences in the occupational distribution exist within a sample of 44 countries.[9] The figure plots the share of employment for male

since the pace of technological progress varies across occupations, wage structure and the decision to retire is thus occupation specific (Ahituv and Zeira 2011, Allen 2001, Aubert, Caroli and Roger 2006, Bartel and Sicherman 1993). On the other hand, job characteristics such as undesirable working conditions, physical demands and necessary aptitudes are important factors that affect the decision to retire (Quinn 1977, Mitchell, Levine and Pozzebon 1988, Filer and Petri 1988)

[9]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 (Imbs and Wacziarg 2003, Autor and Dorn 2009, Acemoglu and Autor 2011, Goos, Manning and Salomons 2008). On the other hand, trade liberalization -inducing international specialization- affects the composition of industries and occupations. Recently, Schott (2003, 2004) has shown that a large part of the factor reallocation takes place within industries. A number

working population in these countries across nine broad one-digit of the International Standard Classification of Occupations (ISCO-88).[10] Each of the small dots represents the employment share of a country in the respective occupation; the larger 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.[11]

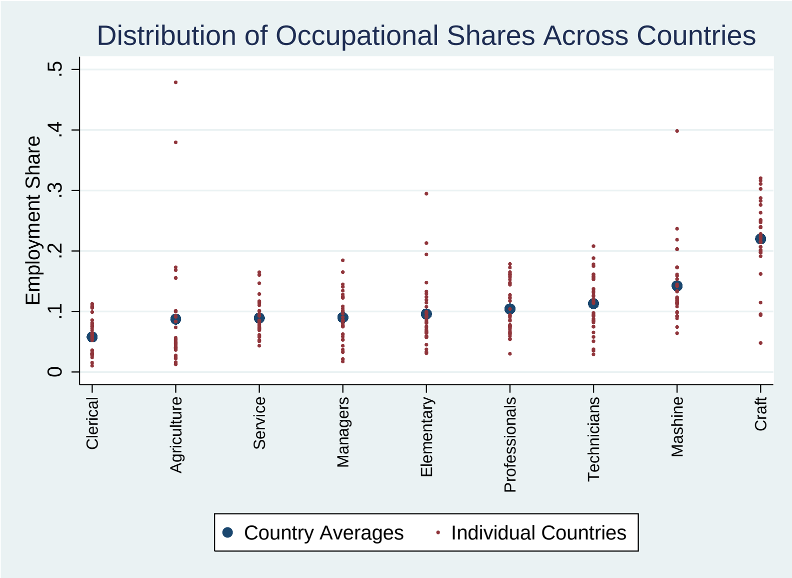

Figure 3: The share of employment of male working population across 34 countries. Data are based on ISCO-88 classification scheme. Source: ILO.

To assess how occupational distributions affect average retirement ages we proceed in two steps. First, we use U.S. data to infer the average retirement age by occupation. Second, for any given economy, we predict its average retirement age by the weighted

of papers investigate 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 on U.S. employment. The authors report that "international trade has had large, significant effects on occupation-specific wages"

[10]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, and the United Kingdom.

[11]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%).

average of occupational retirement age from the U.S.; the weights are the economy's occupational employment shares. The result of this out of sample prediction will be called the *raw predictor*. Finally, we 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.

We compare our raw predictor with the effective retirement age in two different samples.[12] First, we start with the OECD sample that includes a set of homogenous countries. 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 10.5% of the cross-country variation in the effective age of retirement. Second, we extend the range of countries to include not only developed countries but also developing ones. Our sample grows to 39 countries. In this extended sample a variance decomposition shows that our raw predictor explains about 16.5% of the variation in the effective age of retirement across countries.

We next surmise that our raw predictor might be improved by accounting for the possibility that external factors may influence absolute differences in the age of retirement across occupations but preserve the relative differences. For example, the inevitable loss of information in the crosswalk of occupation classifications we use tends to blur the differences in the corresponding retirement ages and to compress the distribution of retirement ages.[13] To correct for these effects, we conduct a linear transformation of our raw predictor. Specifically, we run a regression to estimate the way our raw predictor correlates with the effective age of retirement. In these regressions we obtain an adjusted R^2 of 24.9% for the sample of OECD countries and an impressive 32.4% for the extended sample. These numbers strongly indicate that occupational distribution is an important factor in explaining differences in the age of retirement across countries.

We notice that in the OECD sample the estimated coefficient, which is significant at the one percent level, is 4.7 and significantly above one (Table 2, Column I). This finding

[12]To use the U.S. average retirement age by occupation for the cross country analysis, we produce a crosswalk to map the 179 different occupations of the 3-digit 1950 census classification scheme to 43 categories of the 2-digit ISCO-88 classification scheme, by which employment data are given.

[13]Consider the extreme case of a crosswalk mapping all U.S. classes into only one single class. The predicted retirement ages based on this crosswalk would be constant across countries, hence totally compressing the cross-country difference in the raw predictor.

requires a word of explanation. One possible explanation is the effect of the crosswalk of occupation classifications we need to use to map 179 occupation classes from the U.S. data into the 43 classes of our cross-country data. As pointed out above, the loss of information tends to blur the differences of retirement ages and compress the distribution of retirement ages, which results in a steeper estimated coefficient. Another possible explanation for the high coefficient relies on the differences in the Social Security system. Thus, the U.S. has a relatively lean Social Security system compared to most other OECD countries, which may well compress the occupational distribution of retirement ages in the U.S.[14] Indeed, it is possible that in economies with lean Social Security programs virtually everybody is working up to the mandatory retirement age, while generous Social Security programs induce workers of some occupations – e.g. those characterized by high levels of human capital depreciation – to retire relatively early. When the impact of Social Security programs on the age of retirement differs across occupations, the generous systems will result in a more dispersed occupational retirement ages, thus explaining that the size of the estimated coefficient exceeds one.[15] Indeed, when extending the sample to include developing countries characterized by lean Social Security and welfare programs the magnitude of the coefficient drops to 3.8 (Table 3, Column I).

We do not ignore that the literature on retirement decisions typically focuses on financial incentives, in particular on those connected to Social Security and pension systems. We therefore examine whether the predictive power of occupational compositions is affected by these policy variables. To this end, 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. The coefficient on our raw predictor of retirement remains highly significant and positive. The inclusion of the policy variables increases the adjusted R^2 from 44% up to 74% in our OECD sample and from 43% to 76% in our extended sample. Thus, financial incentives and occupational compositions

[14]Bloom et al. (2009) report that in the year 2000 the replacement rate in the defined benefit scheme in the U.S. was 46%, while it was 62.6%, 58.6%, 60%, 78.2%, 80%, 67.2%, 97%, 85.7%, 58.8% and 70% in Belgium, Denmark, Finland, Germany, Italy, Japan, Luxembourg, Spain, Switzerland and Turkey, respectively.

[15]This explanation is reminiscent of the one Ljungqvist and Sargent (1998) provide for the long-term unemployment in welfare states during the 1980s. The authors argue that without technological progress unemployed workers easily get back into employment even with 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 from accepting new job offers.

jointly explain the major part of the variation in the effective age of retirement.

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.

With the current study we establish a clear link between occupations and the age of retirement. However, we need to stress that we do not identify a country's occupational distributions as the cause for its average age of retirement. Indeed, one may think of mechanisms that establish a causal link in the reverse direction. For example, a general mandatory retirement age will affect some occupations more than others[16] or Social Security systems may systematically discriminate between occupations. Both of these policies distort the relative occupational retirement ages, and therefore the occupations' relative productivity. The resulting impact on a country's comparative advantage generates international specialization and hence determines the country's occupational distribution. In these examples, policies causally affect the occupational distribution via their effect on the age of retirement.

On the other hand, one may argue that the very policies themselves are shaped by a country's occupational distribution. Indeed, if the number of workers in a specific occupation grows and becomes politically relevant, the resulting political pressure may induce changes of the Social Security system that favor these specific occupations. At the individual level, joining private pension systems might be driven, among other things, by the nature of individual's occupation as individuals' health and productivity differ across occupations. By endogenizing Social Security systems, these examples show that retirement incentives, which are usually taken as the key determinant of retirement decisions, are not necessarily the starting point of a causal chain. Instead, they may well be shaped by the occupational distribution, making the latter the deeper determinants for policies.

In sum, our study neither establishes causality nor does it claim to do so. Nevertheless,

[16] Assuming that the ages reported in Table A3 in the appendix are undistorted, mandatory retirement at age 65 would not affect Chemists who retire at 62.9 but forces Clergymen who retire at 68 to retire earlier (codes 7 and 9).

we argue that it adds to the literature in some relevant dimensions. At the very least, our results show that a strong link exists between occupations and the retirement age and that this link is relevant for macroeconomic aggregates. This observation implies that there is high potential for studies that investigate the occupation specific retirement incentives and that retirement studies ignoring occupational dimensions are likely to miss part of the variation.

Moreover, our methodology provides a natural benchmark of a country's retirement age that helps to assess common arguments in on-going political debates. For example, Greece, Spain and Portugal are recently accused of retiring too early. For example, the German chancellor Angela Merkel requested that people in Southern Europe should not "be able to retire earlier than in Germany". This argument seems far-fetched when observing that the effective age of retirement in Greece exceeds that of Germany by about 27 month. Indeed, referring to these inconsistencies, the Financial Times Deutschland writes that "Merkel's push for a comparison here is both unnecessary and absurd".[17] However, when accounting for differences in occupational compositions between the two countries, the picture is somewhat altered. Greek excess retirement age over the German one shrinks considerably to less than 20 months. Moreover, when refining the predicted occupational distribution with a linear fit the overall picture turns upside down: Germans retire ten months later than Greeks.[18]

In the remainder of this paper, 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 ques-

[17] See http://www.spiegel.de/international/europe/0,1518,763639,00.html.

[18] It is important to stress that this explanation, however, does not apply in the cases of Portugal and Spain.

tion we observe that the average retirement age in country c, ret_c, can be written as:

$$ret_c = \sum_{o \in O} w_{c,o} ret_{c,o}. \tag{1}$$

where, $w_{c,o}$ is the employment share of occupation $o \in O$ in country $c \in C$ and $ret_{c,o}$ is the average retirement age of occupation o in country c.

We define now ret_o as the retirement age of occupation o in our benchmark economy. With this definition we can write the identity

$$ret_c \equiv \sum_{o \in O} w_{c,o} ret_o + \sum_{o \in O} w_{c,o} \left(ret_{c,o} - ret_o \right), \tag{2}$$

The first term on the right hand side of equation (2) represents the contribution of the occupational composition to the retirement age and the second term consists of the weighted deviations of the occupational retirement ages from the exogenous ones.

Writing now w_o for the employment shares of our benchmark economy and ret for its average retirement age, we have

$$ret_c - ret \equiv \sum_{o \in O} \left(w_{c,o} - w_o \right) ret_o + \sum_{o \in O} w_{c,o} \left(ret_{c,o} - ret_o \right). \tag{3}$$

Equation (3) defines a decomposition of the deviation of the average retirement age from our benchmark economy. The first term on the right hand side of (3) captures the between occupations variations and the second term on the right hand side of (3) captures the within occupations variations. While, variations in the age of retirement across countries that are driven by differences in occupational composition will show up in the between occupations, variations that are driven by differences in tastes or policies will show up in the within occupations. Thus, An analysis that addresses cross-country differences in retirement age, ret_c but ignores intrinsic differences across occupations implicitly assumes that ret_o is constant in o and will therefore explain the cross-country variance exclusively through the second term in (3). In the present paper, we pursue the opposite approach and specifically focus on the occupational differences of retirement ages. To this aim, we define the relevant term:

$$\overline{ret}_c = \sum_{o \in O} w_{c,o} ret_o, \tag{4}$$

This expression represents the retirement age in country c, that is driven by its occupational composition assuming that the occupational retirement age in country c coincides with that of our benchmark economy. Then we estimate the following econometric model

$$ret_c = \delta_1 \overline{ret}_c + \delta_2 X_c + \varepsilon_c \tag{5}$$

where X_c is a set of factors affecting the second term in (2). Indeed, if occupational employment shares were exogenous, our approach would identify the causal effect of occupations on a country's average retirement age. As we have pointed out in the introduction, however, Social Security legislation can shape a country's comparative advantage and impact occupational distribution through international specialization. Also, the occupational distribution can reversely impact Social Security programs through the median voter. In either case, the weights $w_{c,o}$ are not entirely independent of other factors influencing a country's average retirement age. We are therefore careful to read our results as a variance decomposition only.

Implementing our approach we proceed with the following two steps. In a first step, we compute the average retirement age per occupation. In a second step, we employ the estimates from the first step to predict the retirement age for a given country c according to (4).

Finally, we take our prediction, $\overline{ret}_c$ from equation (4) and assess to what extent it explains differences in the effective age of retirement across countries. We do so in two different ways. First, based on equation (3), we calculate the share of variation in the effective retirement age that is explained by the variation in the first term of its right hand side. Second, we regress the effective retirement age on $\overline{ret}_c$ according to (5) and estimate the goodness of fit through the R^2.

2.2 The Age of Retirement at the Occupational Level

We begin by calculating ret_o, a clean measure of the average retirement age for each occupation. We use individual employment data and estimate the simple empirical model

$$ret_i = \sum\nolimits_o \beta_o D_o + \gamma Z_i + \varepsilon_i, \tag{6}$$

where ret_i is the 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 ε_i is assumed to be normally distributed. Henceforth, we refer to this first step as the first stage. We choose to use the U.S. as our benchmark economy for estimating ret_o. Using the U.S. for our first stage has many virtues. First, the U.S. data have a good coverage. Second, the U.S. has a very different Social Security system from the other OECD countries and, therefore, any mismatch in the occupational retirement age between the U.S. and the other countries should limit our ability to explain cross-country differences in the retirement age. Thus, our results should be taken as a lower bound of the importance of occupations in explaining cross-country differences in the retirement age.

2.2.1 Estimating the Occupational Retirement Age

To estimate equation (6), 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.[19]

Following the previous literature, we focus on male individuals. To identify 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 re-

[19]Hazan (2009) documents that labor force participation of white American males above age 45 has been monotonically declining across cohorts born between 1840 and 1930. However, using data spanning from 1992 through 2000, Coile and Gruber (2007) find no significant time pattern to retirement behavior in the U.S. Interestingly, Quinn (1999) shows that the strong time series trend toward earlier retirement was arrested since the mid-1980s. Our calculations verify these previous findings and show that there is no time trend during the period: 1990-2010.

ported 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, year and state fixed effects when estimating equation (6).[20]

With the retirement incidents thus identified and using the information provided by control variables, we can estimate equation (6) at the individual level. The four columns of Table 1 summarize the results of the underlying regression. In Column I we calculate a crude measure of the average retirement age for each occupation by running the first stage (6) without any control. However, the age of retirement is affected by other factors such as education, marital status among other things. Therefore, we would like to clean our measure from the impact of this type of information. We thus run three additional regressions. In the second regression, we control for a state-fixed effect. In the third one, we also add year dummies and in the fourth regression we add dummies for education and marital status. Thus, Table 1 summarizes the results for the first stage (6), 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 R^2 ranges between ten and twenty percent for the 4,500 to 5,000 individual observations. The lower part of the table shows the values of an F-test of the hypothesis that the coefficients on all of the occupation dummies D_o are jointly zero. The according values range around three. 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 es-

[20]Categories for 'Marital Status' are: Married, spouse present, Married, spouse absent, Separated, Divorced, Widowed, Never married/single. Categories for 'Education' are: No school completed; $1^{st} - 4^{th}$ grade; $5^{th} - 8^{th}$ grade; 9^{th} grade; 10^{th} grade; 11^{th} grade; 12^{th} 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.

timated retirement ages. It shows that within the upper end of the distribution, the 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.[21]

2.3 Predicting Cross-Country Retirement Ages

In our second step, we employ the estimated coefficients $\hat{\beta}_o$ from the first stage (6) to predict the retirement age for a given country c according to (4). Specifically, we compute

$$\widehat{ret}_c = \sum\nolimits_o w_{c,o}\hat{\beta}_o. \tag{7}$$

Here, we weight by the employment shares $w_{c,o}$ of occupation o in country c. Henceforth, we refer to the outcome of the expression (7) as our *raw predictor*. 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. Notice that $\widehat{ret}_c$ is defined in parallel to $\overline{ret}_c$ from equation (4) with the difference that ret_o are replaced by their estimates, $\hat{\beta}_o$, we account for this difference by this slightly different notation. Thus, equation (5) is being modified to

$$ret_c = \rho_1\widehat{ret}_c + \rho_2 X_c + \pi_c \tag{8}$$

2.3.1 Comparing Occupational Retirement Ages Across Countries

When constructing the raw predictor, (7), a central underlying assumption is that the distribution of occupational retirement ages is similar across countries. Indeed, our presumption is that the age of retirement is occupation-specific and stems from the intrinsic

[21]Some of estimated retirement ages are not very realistic - e.g., Optometrists (code 70) retire at age 80, Demonstrators (code 420) retire at age 78.9 and Bookbinders (code 502) retire at age 79. Such outliers results from the fact that the number of observations is very small for some of the occupations reported in Table A1. As explained below, however, the CPS occupations will be reclassified into broader classifications. Since we weight by occupation size in this process, the outliers are given very little weight, which substantially alleviates the problem (see Table A3 in the Appendix).

characteristics of each occupation, such as physical requirement or the pace at which job-specific knowledge depreciates. We do not blindly accept this assumption but ask whether individuals within the same occupation in different countries retire at similar ages. To answer this question we use the Survey of Health, Ageing and Retirement in Europe (SHARE), which provides data on retirement by occupation for 12 European countries.[22] Using information for 5355 European retirees from this source we can estimate the average age of retirement for the 25 occupation classifications.[23] Figure 4 plots the occupational averages for the U.S. and Europe, illustrating a positive correlation of 68%.

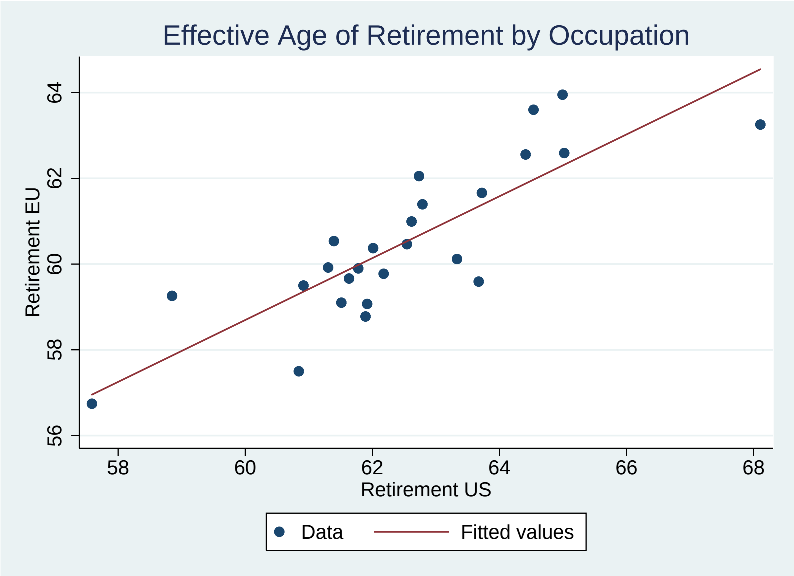

Figure 4: The average age of retirement in the U.S. versus Europe across 25 2-digit ISCO-88 occupations.

[22]The SHARE is a multidisciplinary and cross-national panel database of micro data on health, socio-economic status and social and family networks of more than 55,000 individuals from 20 European countries aged 50 or over. We use Wave 1, for which data on occupation are available for 12 countries. These countries are Austria, Germany, Sweden, Netherlands, Spain, Italy, France, Denmark, Greece, Switzerland, Belgium and Israel. Henceforth, we will refer to these twelve countries as Europe. For a complete description of SHARE, see the dedicated website: www.share-project.org. The SHARE data collection has been primarily funded by the European Commission through the 5th framework programme (project QLK6-CT-2001-00360 in the thematic programme Quality of Life). Additional funding came from the US National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, Y1-AG-4553-01 and OGHA 04-064). Data collection in Austria (through the Austrian Science Fund, FWF), Belgium (through the Belgian Science Policy Office) and Switzerland (through BBW/OFES/UFES) was nationally funded.

[23]In both data sources we have 43 different ISCO-88 classification at a two-digit level. However, these two different classifications do not completely coincide so that we need to merge some of the classifications. This leaves us with 25 broader classification

Of course, the occupational age of retirement is affected by other factors such as Social Security and welfare programs that differ across countries. Therefore, it may be the case that farmers and factory workers in the U.S. do not retire exactly at the same age as farmers and factory workers in Germany but their relative retirement age or ranking is preserved. To address this question we examine the similarity in the ranking of occupational retirement age across countries. We calculate the Spearman rank correlation between the US and the European occupational average, which is 76%.

Motivated by the strong similarity of occupational retirement ages across countries, we proceed by estimating the age of retirement at the occupational level from the U.S. data to predict the average retirement age for the rest of the world.

2.4 Predictions for OECD Countries

Could U.S. occupational data explain differences in the effective age of retirement across countries? We are now ready to answer this central question of the current paper. To this end, we use our estimates from the first stage (6) 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 (6) for years, state effects, marital status and level of education (see Table 1, Column IV). The estimated occupational retirement ages are those from the previous subsection (Table A1).

An assessment of our raw predictor (7) requires a comparison with the effective, observed age of retirement for a set of countries. Such data is available for a broad set of OECD countries.[24] Two additional virtues arise from focusing on the OECD countries. First, this set of countries is relatively homogenous and second, the quality of OECD data is generally high.[25]

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

[25]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."

We need to know the occupational employment shares $w_{c,o}$ in order to actually compute the raw predictor (7) for different countries. To construct this variable, we use ILO data, which provides the number of working individuals by gender, disaggregated according to different classification systems of occupations for 85 counties. 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.[26]

Finally, we obviously need to know the estimated age of retirement of each occupation to compute our raw predictor (7). Unfortunately, the estimates that we calculated in the first stage using U.S. data according to (6) 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.[27] 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 (6) to the ISCO-88 classification, we note that more than one census classification code was assigned to some ISCO-88 codes. For these ISCO-88 codes, we weight occupational retirement ages by the corresponding 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 (7). Recall that the occupational retirement ages, $\hat{\beta}_o$ in (7), are based on U.S. data but the weights ($w_{c,o}$) are provided by the ILO.

Merging the data on the effective age of retirement provided by the OECD with our predicted age of retirement leaves us with 28 advanced countries (excluding U.S.). We

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

[27]see Table A2 of the Appendix

restrict our cross-country analysis to the year 2000, which leaves our set of countries unchanged.[28]

To assess the success of our raw predictor, $\widehat{ret}_c$ from (7) we decompose the variance in the effective age of retirement and compute the share of the variance in the cross-country retirement ages that is explained by our predictions, i.e. we compute

$$1 - VAR(ret_c - \widehat{ret}_c)/VAR(ret_c) \tag{9}$$

The expression computed in (9) equals one when the raw predictor perfectly fits the effective data and negative (and potentially unbounded) in case our raw predictor is independent or negatively correlated with the effective data.

With this variance decomposition we evaluate the success of our raw predictor by computing the part of the variance explained by our prediction. According to this exercise, our prediction explains 10.5 % of the cross-country variation. Thus, the U.S. occupational retirement ages can explain about a tenth of the considerable cross-country variation in 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 considering the differences between the effective retirement age, ret_c, and the predicted one, $\widehat{ret}_c$.

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 nearly ten 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 twenty months when accounting for occu-

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

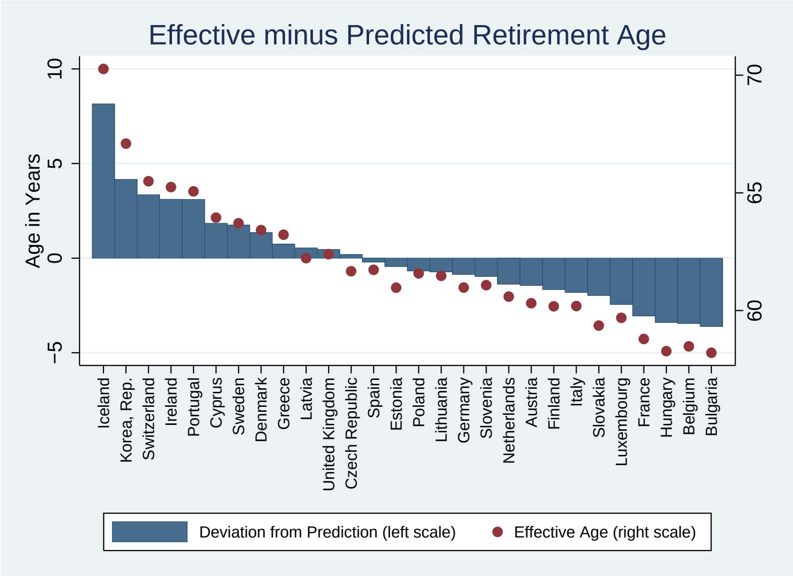

Figure 5: The bars are the effective minus predicted age of retirement (left scale) and the red dots are the effective age of retirement (right scale) for the year 2000. Source: Authors' calculations based on data from OECD, ILO, and CPS.

pations. Nevertheless, the effective retirement age in Greece is more than a year higher than is 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).[29]

2.4.1 Refining the Prediction of Retirement Age

The variance decomposition (9) has shown that the predicted age of retirement explains more than ten percent of the variation in the effective age of retirement. However, our prediction can be even further improved by accounting for the fact that the link between occupations and the age of retirement may differ across countries. For example, Social Security and welfare programs may magnify the differences in the retirement ages across occupations. Clearly, the U.S. has a relatively lean Social Security system compared to most other OECD countries, which may compress the occupational distribution of

[29] Italy might be regarded as an exception to this rule.

retirement ages in the U.S. Moreover, the inevitable loss of information 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's 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 through a linear transformation. Specifically, we run several regressions according to (8) and estimate the coefficient, ρ_1, by which our raw predictor impacts the effective age of retirement. In these regressions we can, at the same time, control for Social Security variables and other relevant factors.

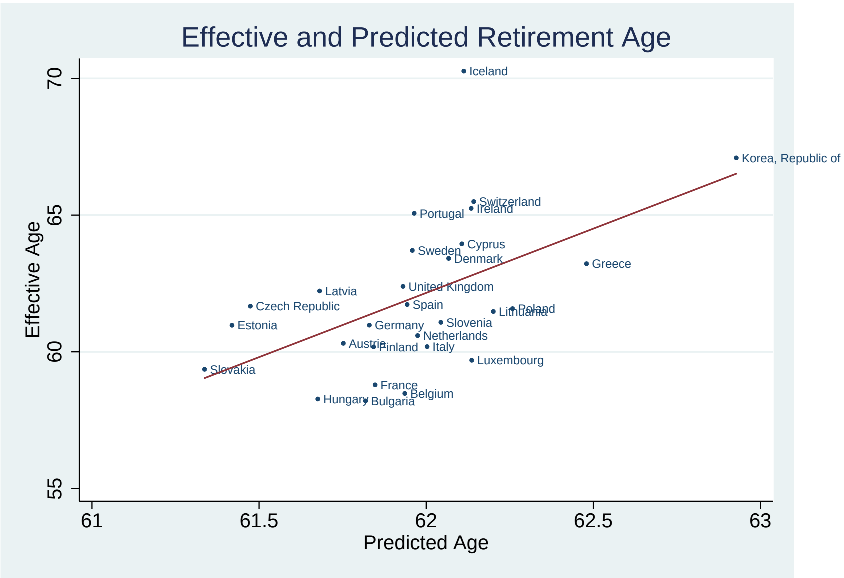

Figure 6: The effective vs. predicted age of retirement across 28 OECD countries for the year 2000.

Figure 6 plots the effective 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.[30] Table 2, Column I reports the results of the corresponding regression, showing that the estimated coefficient, which is significant at the one percent level, is 4.7. This means that a one year increase in the raw predictor is associated with 4.7 years increase in the effective retirement age. Finally, the

[30]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.

adjusted R^2 is 0.25, which implies that our raw predictor can explain 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 that 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 from accepting new job offers. Analogously, workers in occupations characterized by high levels of human capital depreciation might retire early when the Social Security and welfare programs are relatively generous and retire late otherwise. Whereas, the age of retirement of workers in the other occupations might be less dependent on the generosity of the Social Security and welfare programs.

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 for other explanations. To address such concerns, we now turn to an econometric model, as specified in equation (8) and controls for 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 faces a broad literature that stresses the individual's incentives in explaining 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".[31] From this source we include three policy variables. These variables are *Eligibility* (age of entitlement to full Social Security benefits), *Allowed* (number of years before the eligibility age during which early retirement -at reduced benefits- is allowed), and *Deferred Bonus* (increase in benefits due to an additional year of work past the eligibility age). The data are available for all 28 countries in our OECD sample. We run regressions of the effective retirement age on the raw predictor and find that within this group of OECD countries the coefficient on the raw predictor is significant at the one percent level; the R^2 is 0.249 (see Table 2 Column I). We add each one of the three policy variables separately and find that the significance of our predicted age of retirement is intact (Table 2 Columns II-IV).

Bloom et al. (2009) calculates another two important policy variables. These variables, which are *Replacement Benefit* and *Replacement Contribution*, capture the share of average earnings replaced by the pension if the worker retires at the normal eligibility age.[32] For the year 2000, these variables are available for 40 countries.[33] Merging the data with our OECD dataset leaves us with 17 observations. We run regressions of the effective retirement age on the raw predictor and find that within this small group of homogenous countries the coefficient on the raw predictor is significant at the one percent level; the R^2 is 0.438 (see Table 2 Column V). We add each one of the five policy variables separately and find that the significance of our predicted age of retirement is intact (Table 2 Columns VI-X). Next, we run the effective age of retirement on these five policy variables jointly, excluding and including our raw predictor (Table 2 Columns XI and XII).

[31]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. Three additional variables exist: 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.

[32]As in Bloom et al. (2009), replacement rate from the defined benefit portion of a scheme is measured separately from the one that accrues from defined contributions.

[33]See Table A4, Column IV of the Appendix.

The adjusted R^2 is 0.179 and 0.742, respectively. In the last specification, which includes all policy variables, our raw predictor is still significant at the one percent level.

While we are mainly interested in the performance of our raw predictor, it is reassuring to note that, overall, the social security variables explain a good share of the cross-country variation in retirement age. In line with the findings from Bloom et al. (2009), Table 2 shows that fewer allowed years of early retirement, higher replacement rate in the defined benefit scheme and lower replacement rate in the defined contribution scheme are positively associated with a higher retirement age.[34] Table 2 also shows that the social security eligibility ages and the bonus for deferring retirement are not significantly correlated with the retirement age. This lack of significance may be the result of limited variation these two variables exhibit within our set of 17 countries. Nevertheless, the coefficients of these two variables still have the expected positive sign.

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 coverage 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 25). Hence, we compute for country c the employment shares $\theta_{c,a}$ for each five-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

[34] These results are also consistent with Pestieau and Possen (2009), who find that shifting from defined benefit to defined contribution plans fosters the rate of activity of elderly workers.

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 39 countries.[35] For most of these countries, data exist in the year 2000. For the few exceptions, we take the closest available year to 2000.[36] In the following, we will refer to this set of countries as the “full sample”.

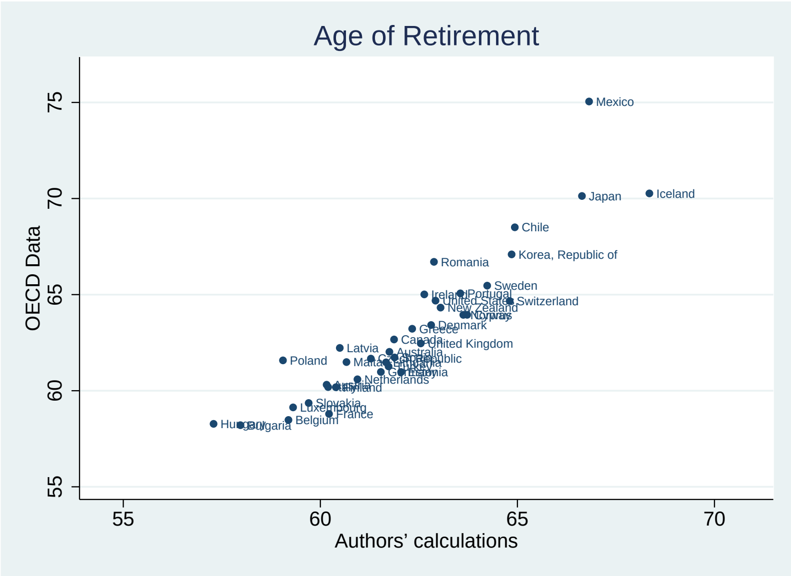

Figure 7: The effective age of retirement - OECD vs. authors’ calculations - based on ILO data.

Figure 7 shows that, within the sample of countries for which OECD data and our own calculations exist, a strong correlation exists 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 (when excluding Mexico the figures are 1.261, 0.084 and 0.86 respectively).

A variance decomposition according to equation (9) shows that our raw predictor explains 16.5% 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.

[35]See Table A4, Columns I and II of the Appendix.

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

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

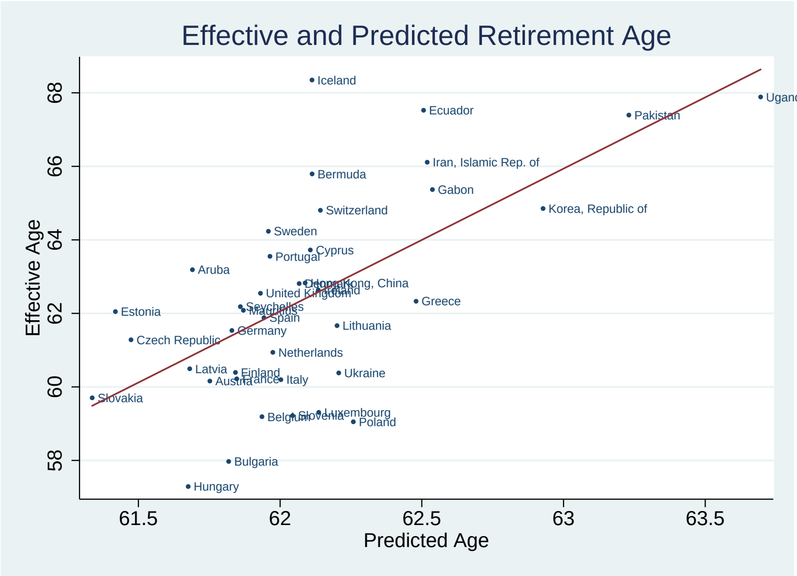

Figure 8: The effective vs. predicted age of retirement across 39 countries for the year 2000 for most countries and for some countries the closest available year to 2000.

Table 3, Column I reports the regression results corresponding to the trend line in Figure 8. The coefficient of interest is now 3.8 and significant at the one percent level. This implies that a one year increase in our raw predictor increases the age of retirement by 3.8 years. The adjusted R^2 of this specification is 0.324. Thus, following our earlier interpretation, our refined predictor explains close to 32.4% of the cross-country variation in the average effective retirement age.

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 test whether our variable of interest - the raw predictor - survives the inclusion of these variables in a very heterogenous sample that includes not only developed countries but also developing ones. Columns I-XII of Table 3 show the corresponding specifications of Columns I-XII of Table 2. Overall, our conclusions drawn from the

OECD sample with regard to the inclusion of the political variables are repeated in the full sample.

A noticeable difference between the two samples, however, is the magnitude of the coefficient on the raw predictor. In the OECD sample, its magnitude ranges around 6, while in the enlarged sample its magnitude ranges around 4. 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 Robustness

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).[37]

Table 4 reports the regression results when including these control variables, jointly or separately, in our full sample. Clearly, Table 4 shows that controlling for all four variables affects neither the significance nor the magnitude of our predicted age of retirement. The coefficient is around 4 and significant at the one percent level. The control *Life Expectancy* included in Column II is the only one that is significant, although only marginally so.

Finally, to make sure that our results are not driven by exception of the armed forces, we exclude this occupation from our forecasts and estimations and find that all of our results are virtually unchanged.

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

3 Conclusion

Economic literature has studied retirement decisions mainly from the viewpoint of institutional incentives and consequently linked cross-country differences to Social Security and pension systems. In this paper, we have proposed a new perspective on the cross-country differences in the age of retirement. We have looked at the occupational composition and its link to the effective average age of retirement. Our explanation leans on two prerequisites. First, the age of retirement is occupation-specific and stems from the 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, thereby controlling for state dummies, marital status, the level of education and year dummies. Based on the resulting 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, explains 32.4% of the cross-country variation in the average effective retirement age for a sample of 39 countries. We also include in our analysis financial retirement incentives that the literature typically focuses on. In a limited sample of 20 countries, for which we have data on policy variables, a regression of the effective average retirement age on our raw predictor plus relevant policy variables 76.4% of the observed sample variation are explained, while the coefficient on our predicted age of retirement is significant at the one percent level. The general 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 there is a strong link between countries' occupational distribution and the age of retirement, even controlling for variables that typically explain retirement ages. For each country, our raw predictor of retirement age also constitutes an interesting 'natural benchmark' against which we can compare the effective retirement ages. This comparison delivers noteworthy insights. Thus, the Czech Republic and Poland have virtually identical effective retirement ages, but Czechs retire almost ten months later when correcting for the respective occupational composition. Conversely, the observed difference of 27 months in the retirement age between Greece (age 63.2) and Germany (age 61.0) is inverted when occupations are accounted for: Germans retire ten months later than Greeks.

Finally, by highlighting the strong link between a country's average retirement age and its occupational distribution our findings may stimulate research about the extent to which life-cycle savings are affected by occupational structure. The subsequent implications for the current account and sustainability of pension systems might be worth studying as well. In this realm, the role of economic development or international specialization as underlying determinants of occupational structure might be especially interesting.

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Table 1: Retirement Age Across U.S. States

	I	II	III	IV
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	4972	4972	4972	4494
R-squared	0.105	0.119	0.124	0.205
Joint test D_{occ}==0				
F-statistic	3.158	3.035	2.997	2.800
p-value	0.000	0.000	0.000	0.000

Note. – The table describes the resgression results of four different specifications of a the empirical model (1). 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). 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	XII
Predicted Ret	4.699***	4.148***	5.240***	4.726***	6.120***	7.087***	6.780***	7.162***	5.441***	5.915***		7.723***
	[1.489]	[1.481]	[1.541]	[1.532]	[1.668]	[1.760]	[1.498]	[1.836]	[1.508]	[1.575]		[1.543]
Eligibility		0.301				0.381					0.179	0.466**
		[0.183]				[0.273]					[0.334]	[0.196]
Allowed			-0.201				-0.306**				0.255	-0.0950
			[0.165]				[0.133]				[0.248]	[0.156]
Def. Bonus				0.0412				0.351			-0.110	0.326
				[0.315]				[0.280]			[0.312]	[0.196]
Repl. Benefit									-0.0485**		-0.0915**	-0.0429
									[0.0214]		[0.0394]	[0.0241]
Repl. Contrib.										0.271	0.367	0.203
										[0.158]	[0.216]	[0.126]
Constant	-229.2**	-214.1**	-262.2**	-230.9**	-317.7***	-402.3***	-357.6***	-382.8***	-272.6**	-305.2***	55.11**	-444.8***
	[92.28]	[89.86]	[95.41]	[94.97]	[103.5]	[117.3]	[92.85]	[114.1]	[93.84]	[97.71]	[21.01]	[100.5]
Observations	28	28	28	28	17	17	17	17	17	17	17	17
R-squ. Adj.	0.249	0.295	0.263	0.220	0.438	0.471	0.563	0.458	0.559	0.502	0.179	0.742

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	3.879***	4.191***	4.031***	4.085***	3.969***	3.831**	4.298***	4.710***	3.541***	3.855***		4.589***
	[0.782]	[0.849]	[0.810]	[0.812]	[1.244]	[1.387]	[1.057]	[1.359]	[1.143]	[1.183]		[1.320]
Eligibility		0.0691				-0.0315					-0.225	-0.00556
		[0.110]				[0.124]					[0.130]	[0.115]
Allowed			-0.0262				-0.274**				0.0303	-0.174
			[0.121]				[0.0955]				[0.148]	[0.125]
Def. Bonus				0.143				0.277			0.0788	0.305
				[0.273]				[0.220]			[0.214]	[0.173]
Repl. Benefit									-0.0329**		-0.0463**	-0.0228
									[0.0148]		[0.0196]	[0.0161]
Repl. Contrib.										0.225	0.277*	0.170
										[0.130]	[0.150]	[0.116]
Constant	-178.5***	-202.2***	-187.9***	-191.4***	-184.3**	-173.7*	-203.8***	-230.5**	-155.8**	-177.3**	78.87***	-220.9**
	[48.56]	[55.53]	[50.25]	[50.46]	[77.25]	[89.49]	[65.61]	[84.48]	[71.09]	[73.42]	[8.455]	[86.45]
Observations	39	38	38	38	20	20	20	20	20	20	20	20
R-squ. Adj.	0.324	0.350	0.357	0.324	0.433	0.441	0.578	0.447	0.575	0.596	0.553	0.764

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

Dep Variable: Effective Retirement Age

	I	II	III	IV	V
Predicted Ret	4.272***	4.255***	4.155***	3.637***	3.917***
	[0.880]	[0.893]	[0.839]	[0.927]	[0.947]
GDP p.c.	0.297				0.00603
	[0.305]				[0.660]
Life Expect.		0.0565			0.0315
		[0.0641]			[0.139]
Urban Pop.			0.0198		0.0488
			[0.0215]		[0.0374]
Av. Schooling				-0.140	-0.444
				[0.207]	[0.272]
Constant	-205.5***	-205.8***	-196.9***	-162.3***	-182.7***
	[55.98]	[57.73]	[52.62]	[58.47]	[60.98]
Observations	39	39	39	34	34
R-squared	0.382	0.379	0.381	0.426	0.438

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 - For Online Publication

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

Occupation Code	Description	Retirement Age (Average)	No of Observations
0	Accountants and auditors	62.6	45
1	Actors and actresses	71.0	1
2	Airplane pilots and navigators	60.2	9
3	Architects	67.2	4
4	Artists and art teachers	67.0	14
5	Athletes	67.0	2
6	Authors	61.3	7
7	Chemists	62.9	7
9	Clergymen	68.0	49
18	Mathematics	62.0	1
27	Social sciences (n.e.c.)	62.8	2
28	Nonscientific subjects	67.7	2
29	Subject not specified	65.5	17
31	Dancers and dancing teachers	65.3	2
32	Dentists	62.6	8
33	Designers	64.5	11
35	Draftsmen	63.1	9
36	Editors and reporters	61.6	11
41	Engineers, aeronautical	69.7	3
42	Engineers, chemical	62.2	4
43	Engineers, civil	63.8	28
44	Engineers, electrical	62.1	31
45	Engineers, industrial	65.7	29
46	Engineers, mechanical	66.7	14
48	Engineers, mining	64.4	3
49	Engineers (n.e.c.)	63.4	24
51	Entertainers (n.e.c.)	61.1	5
53	Foresters and conservationists	58.8	3
54	Funeral directors and embalmers	62.0	1
55	Lawyers and judges	64.6	33
56	Librarians	65.6	3
57	Musicians and music teachers	64.1	23
58	Nurses, professional	62.9	8
61	Agricultural scientists	61.0	1
62	Biological scientists	59.9	3
68	Physicists	60.0	1
69	Miscellaneous natural scientists	77.0	1
70	Optometrists	80.0	1
72	Personnel and labor relations workers	60.9	15
73	Pharmacists	65.1	8
74	Photographers	62.2	4
75	Physicians and surgeons	64.7	39
76	Radio operators	58.4	4
78	Religious workers	67.8	4

Table A1 *(continued)*

Occupation Code	Description	Retirement Age (Averg.)	No of Observations
79	Social and welfare workers, except group	64.1	13
81	Economists	63.1	4
82	Psychologists	71.0	1
83	Statisticians and actuaries	62.4	2
91	Sports instructors and officials	71.0	1
92	Surveyors	59.5	4
93	Teachers (n.e.c.)	61.2	78
94	Technicians, medical and dental	58.8	13
95	Technicians, testing	59.9	38
96	Technicians (n.e.c.)	66.7	4
97	Therapists and healers (n.e.c.)	64.1	5
98	Veterinarians	71.1	3
99	Professional, technical and kindred workers (n.e.c.)	62.4	91
100	Farmers (owners and tenants)	68.1	157
123	Farm managers	69.1	18
200	Buyers and department heads, store	63.1	12
201	Buyers and shippers, farm products	60.1	10
203	Conductors, railroad	62.2	3
210	Inspectors, public administration	65.6	11
230	Managers and superintendents, building	63.8	29
240	Officers, pilots, pursers and engineers, ship	65.9	3
250	Officials and administrators (n.e.c.), public administration	61.0	46
270	Postmasters	59.8	2
280	Purchasing agents and buyers (n.e.c.)	62.9	18
290	Managers, officials, and proprietors (n.e.c.)	62.7	660
301	Attendants and assistants, library	51.1	2
305	Bank tellers	64.0	1
310	Bookkeepers	66.6	21
320	Cashiers	64.5	27
321	Collectors, bill and account	64.0	1
322	Dispatchers and starters, vehicle	62.7	7
335	Mail carriers	56.5	24
340	Messengers and office boys	64.8	23
341	Office machine operators	63.4	14
342	Shipping and receiving clerks	60.2	33
350	Stenographers, typists, and secretaries	65.0	13
380	Ticket, station, and express agents	53.5	3
390	Clerical and kindred workers (n.e.c.)	61.7	189
400	Advertising agents and salesmen	66.5	10
420	Demonstrators	78.9	4
430	Hucksters and peddlers	66.9	14
450	Insurance agents and brokers	64.2	41
460	Newsboys	62.8	10
470	Real estate agents and brokers	66.4	47
480	Stock and bond salesmen	65.3	16
490	Salesmen and sales clerks (n.e.c.)	64.5	186
500	Bakers	62.2	7

Table **A1** *(continued)*

Occupation Code	Description	Retirement Age (Averg.)	No of Observations
502	Bookbinders	79.0	1
503	Boilermakers	66.1	3
504	Brickmasons, stonemasons, and tile setters	70.6	8
505	Cabinetmakers	66.3	9
510	Carpenters	61.6	75
511	Cement and concrete finishers	55.2	5
512	Compositors and typesetters	58.0	1
513	Cranemen, derrickmen, and hoistmen	54.2	7
515	Electricians	59.9	58
522	Excavating, grading, and road machinery operators	63.3	24
523	Foremen (n.e.c.)	61.9	113
530	Glaziers	56.0	3
531	Heat treaters, annealers, temperers	61.4	2
533	Inspectors (n.e.c.)	63.7	14
534	Jewelers, watchmakers, goldsmiths, and silversmiths	67.0	7
540	Linemen and servicemen, telegraph, telephone, and powe	56.1	28
541	Locomotive engineers	62.7	5
544	Machinists	60.0	26
545	Mechanics and repairmen, airplane	61.1	10
550	Mechanics and repairmen, automobile	58.8	67
551	Mechanics and repairmen, office machine	61.1	12
552	Mechanics and repairmen, radio and television	62.2	16
553	Mechanics and repairmen, railroad and car shop	58.9	7
554	Mechanics and repairmen (n.e.c.)	62.0	143
560	Millwrights	63.3	6
564	Painters, construction and maintenance	62.0	34
570	Pattern and model makers, except paper	60.6	3
573	Plasterers	52.4	3
574	Plumbers and pipe fitters	63.8	37
575	Pressmen and plate printers, printing	61.7	7
580	Rollers and roll hands, metal	55.9	2
581	Roofers and slaters	60.6	5
582	Shoemakers and repairers, except factory	61.8	6
583	Stationary engineers	61.3	15
585	Structural metal workers	60.0	5
590	Tailors and tailoresses	64.4	6
591	Tinsmiths, coppersmiths, and sheet metal workers	61.9	14
592	Tool makers, and die makers and setters	68.9	11
593	Upholsterers	69.1	9
594	Craftsmen and kindred workers (n.e.c.)	59.1	23
595	Members of the armed services	55.5	17
620	Asbestos and insulation workers	64.0	3
621	Attendants, auto service and parking	64.0	16
624	Brakemen, railroad	58.0	5
625	Bus drivers	61.1	51
632	Deliverymen and routemen	65.7	11
635	Filers, grinders, and polishers, metal	64.6	7

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

Occupation Code	Description	Retirement Age (Averg.)	No of Observations
641	Furnacemen, smeltermen and pourers	55.7	5
643	Laundry and dry cleaning operatives	55.6	4
644	Meat cutters, except slaughter and packing house	62.7	24
650	Mine operatives and laborers	63.3	10
662	Oilers and greaser, except auto	62.0	3
670	Painters, except construction or maintenance	61.8	8
671	Photographic process workers	60.0	1
672	Power station operators	61.3	5
674	Sawyers	68.1	3
680	Stationary firemen	58.4	4
682	Taxicab drivers and chauffers	64.8	31
683	Truck and tractor drivers	61.1	241
685	Welders and flame cutters	59.6	22
690	Operative and kindred workers (n.e.c.)	60.8	320
720	Private household workers (n.e.c.)	62.0	17
730	Attendants, hospital and other institution	57.8	14
731	Attendants, professional and personal service (n.e.c.)	69.6	13
732	Attendants, recreation and amusement	70.2	12
740	Barbers, beauticians, and manicurists	64.7	6
750	Bartenders	62.8	10
753	Charwomen and cleaners	59.8	6
754	Cooks, except private household	57.8	37
760	Counter and fountain workers	80.0	1
762	Firemen, fire protection	59.1	28
763	Guards, watchmen, and doorkeepers	63.5	95
764	Housekeepers and stewards, except private household	62.9	16
770	Janitors and sextons	64.6	254
773	Policemen and detectives	56.4	40
780	Porters	58.0	3
781	Practical nurses	65.0	1
782	Sheriffs and bailiffs	60.8	12
784	Waiters and waitresses	64.8	8
785	Watchmen (crossing) and bridge tenders	76.5	3
790	Service workers, except private household (n.e.c.)	63.7	51
810	Farm foremen	61.7	2
820	Farm laborers, wage workers	68.5	44
910	Fishermen and oystermen	65.9	4
930	Gardeners, except farm, and groundskeepers	63.7	69
940	Longshoremen and stevedores	59.1	3
950	Lumbermen, raftsmen, and woodchoppers	60.4	4
970	Laborers (n.e.c.)	61.9	201

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

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