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## Senior Activity Rate, Retirement Incentives, and Labor Relations

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**Abstract** In order to face the aging of their populations governments of developed countries reformed their retirement systems during the last two decades, by discouraging early retirement and increasing incentives to work for older workers. Senior participation rates to the labor force not only differ strikingly in level from one country to another, they also differ in their reaction to retirement incentives set by governments. This paper highlights how disutility to work can merely influence the effectiveness of such reforms. The authors build a highly stylized model according to which the reaction of senior activity rate to monetary incentives to work depends on the properties of the specific distribution of working conditions in the country. Second, taking the quality of labor relations as a proxy for working conditions, the authors show empirically that aggregate reactions to retirement incentives depend on the distribution of labor relations at country level. They use panel data for nineteen OECD countries from 1980 to 2004. They show that the elasticity of senior male labor force participation rate to retirement incentives is stronger in countries with better and more homogeneously distributed labor relations.

**JEL** Z10, J14, J26

**Keywords** Early retirement incentives; labor relations; senior activity rate

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# 1 Introduction

The issue of the efficiency of economic reforms is central in public policy agenda. Once a reform has been shown desirable by economic theory or empirical test, its implementation does not always reach the objectives. This question has been addressed by Acemoglu et al. (2008) who point out that setting an independent central bank is effective at fighting inflation if there are enough constraints on the executive. In this paper, we are interested in the effect of changes in retirement incentives on senior activity rate. We will conclude that their efficiency is conditioned by the quality of labor relations in the country.

Senior employment and activity rates are crucial economic issues, both for the sustainability of pension system, and for the raw creation of wealth. Facing the aging of their population, most developed countries have been constantly adjusting pension systems during the last decades. Any pension reform or adjustment has two objectives : first, a change in retirement schemes aims to improve the balance between expenditure and resources of the pension system ; second, it also aims to modify senior activity rate. The latter objective can of course be a major factor that allow to achieve the former.

In this paper, we focus on the effect of changes in retirement incentives on senior activity rate. We argue that the quality of working conditions in a country is likely to alter the response of senior activity rate to changes in retirement incentives. We first present a highly stylized model where senior workers have the choice between work and retirement. Their choice is affected by their perception of the disutility of labor and by the generosity of the pension system. At the aggregate level, the response of senior labor force participation rate to a change in retirement incentives depends on the distribution of the disutility of labor in the society. Then, turning to empirical evidence, we use aggregate data and show that the disutility of labor, approximated by the quality of labor relations, fosters the elasticity of senior male participation rate with respect to the implicit tax on continued work, which is the cost of staying at work compared with retiring.

Instruments to increase senior employment rate can be the postponing of the standard retirement age or the decreasing of retirement incentives which involve pension and contribution rates changes. The importance of this parameter has been stressed by Duval (2003). He showed that a decrease of the incentive to retirement may reduce the fall of employment between two five-years age groups. In a dynamic approach, Blau and Goodstein (2010) investigated to what extent changes in social security rules explain changes in labor force participation of seniors in the United States. Liebman et al. (2009) also examined the response of labor supply to social security benefits by older workers in the United States.

The intuition behind the results presented in this paper is fairly simple : monetary incentives can play a role in the retirement decision only if workers sufficiently enjoy going to work. In the opposite case, any decrease in retirement incentives would not have any effect on the seniors' decision since they suffer a large disutility at work. This idea that some factors may interfere with the retirement decision has been investigated by Blau and Shvydko (2007) who focused on the characteristics of firms and contracts. By an empirical study, they showed that seniors' choice of retirement also depends on the rigidities of technologies. Similarly, according to Cheron et al. (2004), trying to increase senior employment by a change of pension scheme is useless if wages are rigid and above their walrasian level.

At the country level, our proxy for the disutility at work is the quality of labor relations both between workmates and between employers and employees. Such idea on the influence of labor relations

on macroeconomic outputs was studied by Blanchard and Phillipon (2004). Considering the number of social conflicts as a proxy for bad labor relations, they showed that bad relations strengthen the negative effect of asymmetric information on the job market. Understanding labor relations as a component of a country's cultural trait, this paper is also linked to the literature on economic outcomes of culture. Interactions between labor markets outcomes and culture has been investigated by Aghion, Algan and Cahuc (2011). They show that policy can affect cooperation on the labor market depending on individual expectations regarding the organization of collective relations. The way culture and beliefs can affect activity rates has been underlined by Giavazzi, Schiantarelli and Serafinelli (2010). They show that culture matters for youth and female employment rates.

The structure of the paper is as follows. In section 2, we document the evolutions of senior activity rates and retirement incentives between 1990 and 2000. In section 3, we present the model and derive its implications. We describe the data used in the macroeconomic empirical part and present corresponding results in section 4. Finally, section 5 concludes.

## 2 Evolutions of retirement incentives and senior activity rates

As stressed in the introduction, governments can play on two parameters in order to influence senior activity rates : the standard retirement age, i.e. the standard age of eligibility to old-age pension benefits, and the extent of monetary retirement incentives. In this section, we briefly document the evolution of senior activity rates and retirement incentives between 1980 and 2000.

Table 1 presents changes in the implicit taxes on continued work, the standard retirement age and senior activity rates over the periods 1980-1990 and 1990-2000 for 14 OECD countries. The implicit tax on continued work has been computed by Duval(2003). It takes into account expected pension wealth and both employers and employees rates of contribution to the pension system.<sup>1</sup> When the implicit tax on continued work increases, a worker has weaker incentives to continue working. Senior activity rates are from the OECD database.

Over the period surveyed in table 1, standard retirement ages have not change much. Only three countries experienced changes in that parameter. France decreased it of five years between 1981 and 1983. Italy increased it progressively from 60 to 65 between 1994 and 2000. The government of New Zealand conducted the same reform between the late 1980s and the year 2000.

On the contrary, changes in the implicit taxes on continued work are far more frequent. We clearly see that nor the populations treated (age group 55-59 or age group 60-64), nor reactions to these are homogeneous. Over the period 1980-1990, implicit tax on continued work for age group 55-59 and the activity rate of this age group have moved in opposite directions in countries like Finland, Germany, Netherlands, Norway, Sweden and the United States. In other countries, both variables exhibited changes in the same direction. Similar remarks easily apply to age group 60-64 or to the 1990-2000 period. It is clear that the reaction of senior activity rate to changes in incentives is far from homogeneous.

Focusing on Finland and Italy can give us an idea of these striking differences. Figure 1 presents the evolutions of senior activity rate and implicit tax on continued work for age group 60-64 for these countries. In the case of Finland, we notice a perfect symmetric movement of incentives to retire and senior activity rate. The standard retirement age in Finland did not change over this period, remaining

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<sup>1</sup>See section 4 below for a detailed description of the implicit tax on continued work.

Table 1: Evolutions of senior activity rates and retirement incentives between 1980 and 2000.

	Age group 55-59		
	Activity rate in 2004	Change in activity rate	Change in implicit tax
Australia	74.29	-.73	-5.65
Canada	75.61	-.53	4.81
Finland	70.65	7.23	-7.09
France	63.75	-3.95	5.15
<b>Germany</b>	80.61	-1.86	2.54
<b>Italy</b>	56.29	-12.46	-75.58
Netherlands	76.81	10.52	-2.1
<b>New Zealand</b>	85.37	6.77	-.45
Norway	81.7	-.32	-2.29
Portugal	72.57	-2.44	4.24
Spain	74.97	-1.7	-10.41
Sweden	84.29	-3.09	-10.15
United Kingdom	77.47	-3.93	6.68
United States	77.55	-2.34	-.18

	Age group 60-64		
	Activity rate in 2004	Change in activity rate	Change in implicit tax
Australia	51.93	1.28	22.49
Canada	53.23	2.35	4.1
Finland	32.82	2.91	7.62
France	15.15	-7.65	-43.52
<b>Germany</b>	38.34	2.43	-8.29
<b>Italy</b>	30.39	-5.61	-78
Netherlands	31.27	8.59	-57.28
<b>New Zealand</b>	68.94	33.95	-27.01
Norway	64.29	.08	5.76
Portugal	51.22	-5.51	-1.06
Spain	47.85	.97	21.32
Sweden	65.92	2.33	28.32
United Kingdom	55.72	1.35	7.68
United States	57.01	1.49	6.35

Activity rates are in percentage of total population  
Changes are in percentage points  
Countries in **bold** are thos who increased standard retirement age over the period.

at 65. On the contrary, if we look at Italy, the senior activity rate continued its decreasing trend when the Italian government strongly decreased the incentive to retire at the end of the 1990s. It is like Italian seniors did not react to incentives set by the government. It is even more striking if we consider that this decrease in monetary incentive went alongside an increase of the standard retirement age from 60 in 1993 to 65 in 2002.

### 3 Model

In this section, we present a very simple model that can partly explain the differences mentioned above. The objective of this model is not to represent the whole process of the retirement decision. This would involve taking into account that individuals may optimize over longer time horizons, or modeling the retirement decision using an option value approach. On the contrary, the model is highly stylized, and aims at capturing a partial mechanism at the individual level and its aggregate consequences.

All senior individuals face a trade-off between work and retirement. This model shows how their choice depends on the disutility of labor and how the distribution of that later parameter alters the link between retirement incentives and labor force participation rate at the macroeconomic level.

Figure 1: Implicit tax on continued work and senior activity rate 1980-2004 in Finland and Italy.



### 3.1 Individual trade-off

Let us assume that there are two periods. In the first period, an individual can choose to continue working or to retire. In the later case, she gets a truncated pension  $\alpha p$ , where  $0 < \alpha < 1$ , and  $p$  is the full pension benefit. If she chooses to continue working, she receives a wage  $w$  and suffers a disutility from labor.

Let  $\delta_i$  be the disutility of labor for individual  $i$ . Assuming a linear utility function, utility of individual  $i$  in period 1 is either  $w - \delta_i$  if she chooses to work, or  $\alpha p$  if she chooses to retire. In second period, all individuals have to retire. If the individual chose to work in the first period, she gets pension  $p$ . If she chose to retire, she gets pension  $\alpha p$ . If  $\beta$  is the discount factor, the utility of early retirement can be written as

$$U^R = \alpha p + \beta(\alpha p) = (1 + \beta)\alpha p,$$

and the utility of standard retirement as

$$U^W = w - \delta_i + \beta p.$$

As a consequence, individual  $i$  chooses to retire early if and only if

$$\begin{aligned} U^R &> U^W \\ \iff (1 + \beta)\alpha p &> w - \delta_i + \beta p \\ \iff \delta_i &> w + \beta p - (1 + \beta)\alpha p. \end{aligned}$$

This result only implies that a worker stops to work in the first period if her disutility of labor exceeds the net gain of work during one more period. It is straightforward to see that individual  $i$  will have less incentives to retire if the right-hand term increases, i.e. if the gain of work during one more period becomes larger than the disutility of labor. This result is not path-breaking and simply mirrors the basic mechanisms of all retirement decision models. However, it will allow us to underline how the aggregate effect of changes in retirement incentives on senior activity rate depends on the distribution of the disutility of labor.

### 3.2 Aggregate consequences

The set of seniors choosing to stay at work in the first period is :

$$\{i / \delta_i < w + \beta p - (1 + \beta) \alpha p\}.$$

Assume that in a given country  $c$  disutility of labor is distributed among seniors according to the cumulative distribution function  $F_c(.)$ . Then, the proportion of seniors working in country  $c$  is simply given by

$$n^c = F_c(w + \beta p - (1 + \beta) \alpha p).$$

Since  $F_c(.)$  is an increasing function, the fraction of seniors in the labor force is obviously increasing with the wage  $w$  and decreasing with the penalty on pension  $\alpha$ . We can derive additional properties from this simple model :

1. For a given set of the parameters  $\alpha$ ,  $p$  and  $w$ , the resulting labor force participation rate in country  $c$  depends on the distribution of the disutility of labor  $F_c(.)$ .
2. Let us write  $T = w + \beta p - (1 + \beta) \alpha p$ , the opportunity cost of early retirement. The derivative of  $n^c$  with respect to  $T$  is

$$\frac{\partial n^c}{\partial T} = F'_c(T).$$

Since  $F'_c(.) \geq 0$ , we get  $\partial n^c / \partial T \geq 0$ . This implies that the stronger the incentive to stay at work, the larger the proportion of seniors who continue working. Individuals responds to incentives unless the density of variable  $\delta$  is null. However, the size of the effect of a change in  $T$  on  $n^c$  depends on the characteristics of the distribution function  $F_c(.)$ .

As a result, the effectiveness of early retirement incentives depends on the characteristics of the distribution function of the disutility of labor among workers.

## 4 Empirical evidence

In this section, we test the two properties of our model using international aggregate data. Parameter  $T$ , the incentive to stay at work, is identified using the implicit tax on continued work (see below). We first present the data, then we present empirical results using international panel data. The models to be estimated will be presented on the fly.

### 4.1 Data

This sub-section describes the data used in this paper. We use data from several sources. Our sample includes 19 OECD countries : Australia, Belgium, Canada, Finland, France, Germany, Ireland, Italy, Japan South Korea, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States.

**Senior activity rates** Senior activity rates are taken from the OECD database. Data are available for males and females by age group from the mid-1980s onwards. We built two measures and selected data for males in age groups 55-59 and 60-64. We focus on senior male individuals for a very simple

reason : data on retirement incentives are available only for male workers. However, this restriction offers the advantage to avoid all issues related to female employment, which are obviously beyond the scope of this paper.

**Pension system** Pension system generosity is measured using the implicit tax on continued work developed by Duval (2003). The average implicit tax on continued work is computed for each year at a given age for a five year period. It takes into account expected pension wealth and both employers and employees rates of contribution to the pension system. In other terms, when the implicit tax on continued work increases, a worker has weaker incentives to continue working.

Let us recall the formula used by Duval (2003). Formally, the implicit tax on continued work in a specific year is the change in pension or social wealth from working five additional years (from  $R$  or  $R + 5$ ) :

$$T_R = [PWY_{R+5}] \left[ S_{R+5} / (1 + r)^5 \right] - PWY_R - \sum_{A=R}^{A=R+4} \left[ \frac{S_A C_A}{(1 + r)^{A-R}} \right],$$

where  $PWY_k$  is the present value of expected pension payments at age  $k$ ,  $S_k$  is the probability of being alive at age  $k$ ,  $r$  is the real discount rate, and, finally,  $C_A/Y$  is the sum of employees and employers rates of contributions to the pension system. For a more detailed presentation of the methodology, see Duval (2003). In this paper, we use the measures for the 55-59 and 60-64 age groups. For each age group, the implicit tax is available with or without taking into account early retirement schemes. However, implicit tax including early retirement route is by construction less trustworthy since information about early retirement eligibility are hard to assemble. This is why we focus on the indicator without early retirement schemes.<sup>2</sup>

**Working conditions** The disutility of labor can be considered as a non-monetary negative payoff workers get through their work. This includes the quality of relations at the workplace. We use the ISSP survey about work orientations to build measures of the quality of working conditions. This survey has been conducted in 1989, 1997 and 2005 in 30 countries. Among the broad set of questions asked to workers, we selected two questions that reflect the human dimension of working conditions, namely :

- *rel management* : “In general, how would you describe relations at your workplace between management and employees ?”
- *rel workmates* : In general, how would you describe relations at your workplace between work-mates/colleagues ?

Answers to those questions are coded from 1 (very bad) to 5 (very good).

For each of these questions, we construct two basic indicators that may reflect some aspects of the distribution of working conditions at the country level. The first and simplest indicator is the average answer. The other one is the coefficient of variation, i.e. the ratio of the standard deviation to the mean for each variable. This is a broad measure for the dispersion of the variable.

Unfortunately, these questions are only asked to workers and since we are interested in working conditions perceived by all seniors, including those who are retired, the computed indicator may be biased upward if only seniors are selected. Hence, we used male workers aged between 35 and 54 as

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<sup>2</sup>Estimations involving implicit tax on continued work including early retirement route are presented in appendix.



a proxy of the perception of working conditions at the country level. Figures 3 and 4, presented in appendix, plot the average values of *rel management* and *rel workmates* for seniors and prime-age male workers in 2005. The correlation is strong and positive. This shows a specificity of labor relations in each country. Furthermore, the average answer of seniors is most of the time above the 45 degrees line, which confirms the expected bias.

In panel data estimations, we assign working conditions for missing years using the following simple method : for years 1980-1989, we use the 1989 working conditions measure if available, for years 1990-1996 the 1997 measure and for years 1998 onwards the 2005 measure. If a country has been surveyed only once or twice, we replicate this method, but using only available data.

**Control variables** Panel data regressions include wealth and economic activity indicators as control variables. Wealth is measured using the (log of) real GDP per capita provided by the Penn World Table. We take the OECD male unemployment rate as a proxy for economic activity at the country level. We also use the standard retirement age provided by Duval (2003).

## 4.2 Results

This sub-section presents empirical evidence. We first show that working conditions explain some of cross country differences in senior activity rates. Then, we use panel data estimates to show that senior activity rate does react stronger to changes in incentives in countries with better and more homogeneously distributed labor relations. By doing this, we extend and mitigate the analysis of the effect of retirement incentives on the retirement decision using international data, as conducted by Blöndal and Scarpetta (1999), Johnson (2000) and Duval (2003) among others.

### 4.2.1 Cross country evidence

We pooled all available observations in order to investigate the cross-country relationship between working conditions and senior activity rates. Table 2 presents the estimated coefficients for different specifications. The activity rate of age group 55-59 is the dependent variable in the upper part of the table, whereas the activity rate of age group 60-64 is the dependent variable in the bottom part.

In column 1, we merely regress senior males activity rate on average relation between management and employees. The estimated coefficient is positive and significant at the 10% level. In column 2, we include a dummy variable for European countries to ensure that this relationship is not driven only by the opposition between Europe and the rest of the world. Indeed, Alesina et al. (2001) pointed out the specificity of the European welfare states that could explain part of the differences in senior activity rates. The estimated coefficient on *rel management* increases and becomes significant at the 5% level. The dummy variable for European countries is negative and significant. This implies that senior labor force participation rates are weaker in Europe than in the rest of the world. In column 3, we control by the implicit tax on continued work for age group 55-59 : this variable is not significant whereas the quality of the relations between management and employees remains significant at the 5% level and has the same order of magnitude as in former specifications. In column 4, we add real GDP per capita and standard retirement age as additional control variable, which lowers the significance of the coefficient on *rel management*. In columns 5 to 8 we repeat the same exercise with the other measure of working conditions. The effect of *rel workmates* is robust to the introduction of all co-variates.

Table 2: Relationship between senior activity rate and the quality of labor relations, pooled cross sections for 1989, 1997 and 2004.

Dependent variable is activity rate for reported age group								
	(1)	(2)	(3)	Age group 55-59		(6)	(7)	(8)
				(4)	(5)			
rel management	17.94*	20.50**	20.48**	14,82				
	(9,099)	(7,762)	(7,646)	(10,87)				
rel workmates					16,63	26.35***	27.51***	20.92*
					(11,08)	(9,311)	(9,004)	(11,41)
Europe		-7.447**	-7.737**	-6.978**		-9.694***	-10.35***	-9.124***
		(2,93)	(3,009)	(3,091)		(3,01)	(3,006)	(3,096)
Implicit tax			0,0506	0,0432			0,0885	0,0731
			(0,112)	(0,108)			(0,103)	(0,105)
Real GDP per capita				4,03				1,516
				(5,919)				(4,677)
Standard retirement age				1,138				1,058
				(0,882)				(0,737)
Constant	8,373	4,921	4,301	-89,18	6,865	-25,35	-31,25	-88,27
	(34,43)	(29,91)	(28,75)	(58,69)	(45,99)	(38,32)	(36,79)	(54,67)
Observations	37	37	37	37	37	37	37	37
R-squared	0,124	0,261	0,267	0,318	0,091	0,296	0,317	0,347
	(9)	(10)	(11)	Age group 60-64		(14)	(15)	(16)
				(12)	(13)			
rel management	33.19**	38.68***	23,79	16,11				
	(15,78)	(12,42)	(14,31)	(15,25)				
rel workmates					31.56*	52.05***	34.43**	25,57
					(17,5)	(14,38)	(15,68)	(15,92)
Europe		-15.90***	-12.32**	-11.93**		-20.43***	-15.89***	-14.85***
		(4,458)	(5,268)	(4,949)		(4,927)	(5,735)	(5,286)
Implicit tax			-0.221***	-0.167*			-0.183**	-0,132
			(0,0726)	(0,0965)			(0,0792)	(0,109)
Real GDP per capita				3,681				0,294
				(9,563)				(9,028)
Standard retirement age				2,29				2,406
				(1,976)				(1,894)
Constant	-80	-87.36*	-25,59	-184,2	-86,02	-153.9**	-77,4	-201,7
	(58,98)	(45,92)	(53,55)	(113,9)	(72,18)	(57,89)	(64,02)	(119,5)
Observations	37	37	37	37	37	37	37	37
R-squared	0,154	0,345	0,445	0,486	0,123	0,403	0,463	0,501
*** p<0.01, ** p<0.05, * p<0.1								
Robust standard errors in parentheses								
OLS regressions with time fixed effects								
Implicit tax is defined for reported age group								

Figure 2: Activity rate of age group 60-64 and relations between management and employees in 2005.



ISSP Work Orientation 2005 for all countries except Italy (1997) and Netherlands (1997).

As shown in the bottom part of the table, the results are very similar when using data for age group 60-64. When significant, the coefficient of the implicit tax variable is negative. This result is consistent with our prediction that controlling for working conditions, generosity of the pension system has a negative impact on senior activity rate.

Figure 2 shows the positive relationship between labor force participation rate of seniors aged 60-64 and the variable *rel management* in 2005. In line with estimations made here, working conditions explain a substantial part of differences in senior activity rate across countries. Figures 5, 6 and 7 in appendix describe the same relationship for the variable *rel workmates* and for age group 55-59.

These results show that, in a cross section of countries, better working conditions, represented by labor relations, are associated with stronger labor force participation rate of senior males, which is consistent with our model.

#### 4.2.2 Panel data evidence

In this sub-section, we test the following conclusion of the model : at the aggregate level, the effect of a change in retirement incentives on senior activity rate depends on the characteristics of the distribution function of working conditions. From now on, senior activity rates and implicit taxes are always taken in log. Thus, estimated coefficients reflect elasticities of labor market participation to retirement incentives.

**Benchmark estimations** We first estimate the average effect of the implicit taxes on senior activity rate. Table 3 displays estimated coefficients. The model estimated in this table is a standard within OLS regression with country fixed effects.

When significant, the estimated effect of the implicit tax on continued work on senior activity rate is negative. However, the coefficient is never significant for age group 55-59.<sup>3</sup> This suggests that this

<sup>3</sup>Note that there are only 18 countries in estimations for age group 55-59. Indeed, implicit tax data for this age

Table 3: Relationship between senior activity rate and implicit tax on continued work, panel data 1980-2004.

Dependent variable is activity rate for reported age group						
	Age group 55-59			Age group 60-64		
	(1)	(2)	(3)	(4)	(5)	(6)
Implicit tax	-0,00338 (0,0132)	0,00167 (0,0146)	-0,0116 (0,0118)	-0,0698** (0,033)	-0,0668** (0,0293)	-0,0312 (0,0261)
Unemployment rate	-0,00586*** (0,00126)	0,000862 (0,00175)	-0,000252 (0,00174)	-0,0229*** (0,00305)	-0,0137*** (0,00454)	-0,0125*** (0,00421)
Real GDP per capita	-0,105*** (0,0214)	0,112* (0,0665)	0,0326 (0,0632)	-0,279*** (0,0566)	0,0641 (0,154)	0,165 (0,149)
Standard retirement age			-0,0225*** (0,00834)			0,0497** (0,0194)
Constant	5,433*** (0,214)	3,281*** (0,68)	5,548*** (0,95)	6,942*** (0,57)	3,514** (1,544)	-0,766 (2,051)
Time fixed effects	-	Yes	Yes	-	Yes	Yes
Observations	272	272	272	277	277	277
Number of countries	18	18	18	19	19	19
R-squared (within)	0,14	0,372	0,447	0,247	0,396	0,443

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1  
Robust standard errors in parentheses  
OLS regressions with country fixed effects  
Implicit tax is defined for reported age group

variable has no effect on activity rate for this group. For age group 60-64, the estimated effect equals  $-0,07$ . However, it is null when including the standard retirement age.

It is clear that wealth, measured as the real GDP per capita, and economic activity, measured as male unemployment rate, both have negative effects on the labor force participation rate of seniors. The effect of wealth on the dependent variable suggests that non-participation to the labor market increases as the economy grows. However, when including time fixed effect in order to control for the evolution of senior activity rate common to all countries, the effect of real GDP per capita vanishes. This suggests that labor force participation rate of seniors depends more on broad global economic developments than on specific national wealth effects.

**Interaction between implicit tax and average working conditions** We now allow the effect of implicit tax on continued work to vary with the distribution of working conditions. Hence, the estimated equation is now :

$$n_{it} = \delta_1 T_{it} + \delta_2 W_i T_{it} + \delta_3 X_{it} + C_i + \delta_4 + \varepsilon_{it}, \quad (1)$$

where  $n_{it}$  denotes labor force participation rate of senior males in country  $i$  at time  $t$ ,  $T_{it}$  the implicit tax on continued work,  $W_i$  working conditions and  $X_{it}$  a vector of control variables (wealth, unemployment and standard retirement age). The variable  $C_i$  is the country fixed effect,  $\delta_4$  the constant, and  $\varepsilon_{it}$  the error term. More complete specifications include year fixed effects  $Y_t$  not reported in equation (1). Since country fixed effects are included and given the structure of available data for working conditions (see above), variable  $W_i$  does not vary across time within country and its coefficient will not be reported.

group are missing for France. However, data on implicit tax including early retirement route are available. Results of estimations using these data and including France are presented in appendix and confirm the results presented here.

The estimated elasticity may now vary with working conditions :

$$\frac{\partial n_i}{\partial T_i} = \hat{\delta}_1 + \hat{\delta}_2 W_i.$$

Table 4 presents the estimated coefficients of equation (1). The measure of working conditions is the average value of each variable at the country level. In the case of age group 55-59, the interaction term is always negative and significant, even when adding time fixed effects and standard retirement age as control variables. This implies that countries with average better working conditions react stronger to changes in incentives than others. The two bottom line of the table present the values of elasticities for the countries with lower and higher working conditions. The previously null estimated effect ranges in fact from 0 to  $-0.03$ .

The bottom part of table 4 presents the estimated coefficients in the case of age group 60-64. In columns 10 to 12, the interaction variable is the quality of relations between management and employees. In this case, the interaction term is not significant. However, it is significant and negative in the left part of the table, i.e. when the quality of relation between workmates is used as interaction variable. In the most demanding specification, the estimated effect ranges from  $-0.01$  to  $-0.07$ .

These results imply first that labor participation rate of senior reacts stronger to changes in retirement incentives in countries with better average working conditions ; but also that the situation is different for different age groups. In the case of “young” seniors, i.e. for age group 55-59, both the quality of the relation with employers and between workmates matters. However the effect of retirement incentives on the retirement decision is weak. On the contrary, for “old” seniors, i.e. for age group 60-64, only the quality of the relations between workmates plays a role. This shows a strong conditional effect of retirement incentives.

**Interaction between implicit tax and the dispersion of working conditions** We will now use the coefficient of variation of working conditions at the country level as an alternative characteristic of the distribution of the quality of labor relations. Table 5 presents the estimated coefficients of equation (1).

For age group 55-59, the interaction term between implicit tax and the coefficient of variation is positive and significant in all specifications. The coefficient is positive, which suggests that countries with more a more homogeneous distribution of working conditions, i.e. a weaker coefficient of variation, react stronger to changes in incentives than countries with higher dispersion of working conditions. In the two bottom lines, the reading order is opposite to the one in former tables. The maximum (minimum) effect is the elasticity associated with the country with the higher (lower) dispersion of working conditions. Whereas some specification leads to a puzzling positive maximum effect, the most demanding specifications (columns 3 and 6) furnish a reassuring null maximum effect. Thus, the estimated effect ranges from 0 to  $-0.02$  or  $-0.03$ . These estimations are very similar to the former.

Results for age group 60-64 are presented in the bottom part of table 5. They mirror those found in table 4. Indeed, we find no effect of the interaction with the dispersion of the relations with employers. On the contrary, relation with workmates play once again a role in the reaction of activity rate to changes in retirement in the implicit tax on continued work.

Intuitively, this may be explained by the fact that in a country where people are similar in their disutility to work, more people will react to small changes (unless we are situated in the queue of the distribution).

Table 4: Relationship between senior activity rate and implicit tax on continued work interacted with average labor relations, panel data 1980-2004.

Dependent variable is activity rate for reported age group						
	Age group 55-59					
	rel workmates			rel management		
	(1)	(2)	(3)	(4)	(5)	(6)
Implicit tax	0.263*** (0,0719)	0.221*** (0,077)	0.147** (0,0655)	0.218*** (0,0716)	0.202*** (0,0765)	0.135** (0,0652)
Interaction term	-0.0649*** (0,0166)	-0.0537*** (0,0176)	-0.0384** (0,0151)	-0.0589*** (0,0177)	-0.0534*** (0,0187)	-0.0387** (0,0161)
Unemployment rate	-0.00553*** (0,0012)	0.000858 (0,00166)	-0.000136 (0,00169)	-0.00601*** (0,00125)	0.000326 (0,00169)	-0.000523 (0,00171)
Real GDP per capita	-0.107*** (0,0203)	0.0917 (0,0566)	0.0266 (0,0571)	-0.108*** (0,0208)	0.0866 (0,0587)	0.0226 (0,0589)
Standard retirement age			-0.0201** (0,00801)			-0.0201** (0,00797)
Constant	5.454*** (0,203)	3.488*** (0,58)	5.455*** (0,892)	5.471*** (0,209)	3.541*** (0,599)	5.497*** (0,903)
Time fixed effects	-	Yes	Yes	-	Yes	Yes
Minimum effect	0,01	0,01	0	0,01	0,01	0
Maximum effect	-0,03	-0,02	-0,03	-0,03	-0,03	-0,03
Observations	272	272	272	272	272	272
Number of countries	18	18	18	18	18	18
R-squared (within)	0,193	0,407	0,464	0,184	0,407	0,464

	Age group 60-64					
	rel workmates			rel management		
	(7)	(8)	(9)	(10)	(11)	(12)
Implicit tax	0.234* (0,123)	0,135 (0,132)	0.288** (0,136)	-0,0557 (0,133)	-0,142 (0,14)	0,042 (0,128)
Interaction term	-0.0744** (0,0313)	-0,0496 (0,0326)	-0.0776** (0,0322)	-0,00378 (0,036)	0,0202 (0,0373)	-0,0194 (0,0332)
Unemployment rate	-0.0222*** (0,00295)	-0.0133*** (0,00451)	-0.0118*** (0,00417)	-0.0229*** (0,00305)	-0.0136*** (0,00456)	-0.0125*** (0,00421)
Real GDP per capita	-0.277*** (0,0554)	0,0543 (0,149)	0,157 (0,139)	-0.279*** (0,057)	0,0657 (0,156)	0,167 (0,148)
Standard retirement age			0.0534*** (0,0187)			0.0512*** (0,0191)
Constant	6.923*** (0,562)	3.615** (1,492)	-0,928 (1,958)	6.941*** (0,573)	3.495** (1,563)	-0,881 (2,022)
Time fixed effects	-	Yes	Yes	-	Yes	Yes
Minimum effect	-0,06	-	-0,01	-	-	-
Maximum effect	-0,11	-	-0,07	-	-	-
Observations	277	277	277	277	277	277
Number of countries	19	19	19	19	19	19
R-squared (within)	0,256	0,4	0,453	0,247	0,397	0,443

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1  
Robust standard errors in parentheses  
OLS regressions with country fixed effects  
Implicit tax is defined for reported age group

These results suggest that labor participation rate of seniors react stronger to changes in retirement incentives in countries with more homogeneously distributed labor relations.

## 5 Conclusion

In this paper, we tried to identify one of the causes of different reactions of the senior populations to monetary incentives between countries. By a simple model we first showed that one of the determinants of how seniors react to policies is their disutility at work. We tested this hypothesis by using aggregate panel data.

We then used aggregate panel data and average opinions about working conditions from the ISSP in 19 OECD countries to investigate the interplay between working conditions and retirement incentives at the aggregate level. We found that if the average opinion about labor relations is high in a country, then senior employment will be more sensitive to changes in retirement incentives. We have also shown that reactions to policies are stronger when opinions are homogeneous.

A side result of this paper is that all type of labor relations do not play the same role in the retirement decision. Namely, we found that the quality of labor relations between colleagues interfere with retirement incentives for all seniors, whereas the quality of relations between management and employees only plays a role for “young” seniors. This leaves room for future researches on the subjective determinants of the retirement decision.

This paper stressed the key role of the quality of work conditions in the trade-off between work and retirement. Our results imply that changes in retirement incentives are a necessary condition to foster senior activity rate, but surely not a sufficient condition. A policy that would only focus on financial incentives would miss one of its goals and would not have any effect on seniors’ activity if the latter suffer from a large disutility of labor.

Table 5: Relationship between senior activity rate and implicit tax on continued work interacted with the dispersion of labor relations, panel data 1980-2004.

Dependent variable is activity rate for reported age group						
	Age group 55-59					
	rel workmates			rel management		
	(1)	(2)	(3)	(4)	(5)	(6)
Implicit tax	-0.0477*** (0,0157)	-0.0404** (0,0155)	-0.0399*** (0,0129)	-0.0484*** (0,0183)	-0.0526*** (0,0162)	-0.0510*** (0,0136)
Interaction term	0.309*** (0,0795)	0.291*** (0,0791)	0.218*** (0,0622)	0.198*** (0,0659)	0.241*** (0,0584)	0.189*** (0,0463)
Unemployment rate	-0.00486*** (0,00113)	0,00203 (0,00159)	0,000877 (0,00165)	-0.00547*** (0,00116)	0,00217 (0,00157)	0,00104 (0,00164)
Real GDP per capita	-0.0972*** (0,0196)	0.132** (0,0588)	0,0662 (0,0591)	-0.0979*** (0,0203)	0.153** (0,0605)	0,0832 (0,0608)
Standard retirement age			-0.0173** (0,00775)			-0.0172** (0,00771)
Constant	5.358*** (0,197)	3.088*** (0,6)	4.876*** (0,896)	5.364*** (0,205)	2.885*** (0,616)	4.705*** (0,917)
Time fixed effects	-	Yes	Yes	-	Yes	Yes
Minimum effect	-0,03	-0,03	-0,03	-0,02	-0,02	-0,02
Maximum effect	0,01	0,02	0	0,02	0,02	0
Observations	272	272	272	272	272	272
Number of countries	18	18	18	18	18	18
R-squared (within)	0,223	0,442	0,482	0,195	0,451	0,491

	Age group 60-64					
	rel workmates			rel management		
	(7)	(8)	(9)	(10)	(11)	(12)
Implicit tax	-0.0919** (0,0418)	-0.0819** (0,0364)	-0.0664** (0,0303)	-0,0294 (0,0464)	-0,0247 (0,0439)	-0,0261 (0,0393)
Interaction term	0,159 (0,118)	0,109 (0,126)	0,288* (0,146)	-0,159 (0,116)	-0,167 (0,127)	-0,0229 (0,114)
Unemployment rate	-0.0221*** (0,00299)	-0.0128*** (0,00457)	-0.0101** (0,00429)	-0.0231*** (0,00311)	-0.0148*** (0,00476)	-0.0127*** (0,0044)
Real GDP per capita	-0.269*** (0,0573)	0,0791 (0,154)	0,219 (0,148)	-0.290*** (0,0593)	0,0142 (0,157)	0,156 (0,149)
Standard retirement age			0.0565*** (0,0189)			0.0488*** (0,0187)
Constant	6.845*** (0,576)	3.365** (1,542)	-1,752 (2,06)	7.042*** (0,592)	3.989** (1,565)	-0,624 (1,982)
Time fixed effects	-	Yes	Yes	-	Yes	Yes
Minimum effect	-	-	-0,04	-	-	-
Maximum effect	-	-	-0,01	-	-	-
Observations	277	277	277	277	277	277
Number of countries	19	19	19	19	19	19
R-squared (within)	0,25	0,398	0,453	0,253	0,403	0,443

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1  
Robust standard errors in parentheses  
OLS regressions with country fixed effects  
Implicit tax is defined for reported age group



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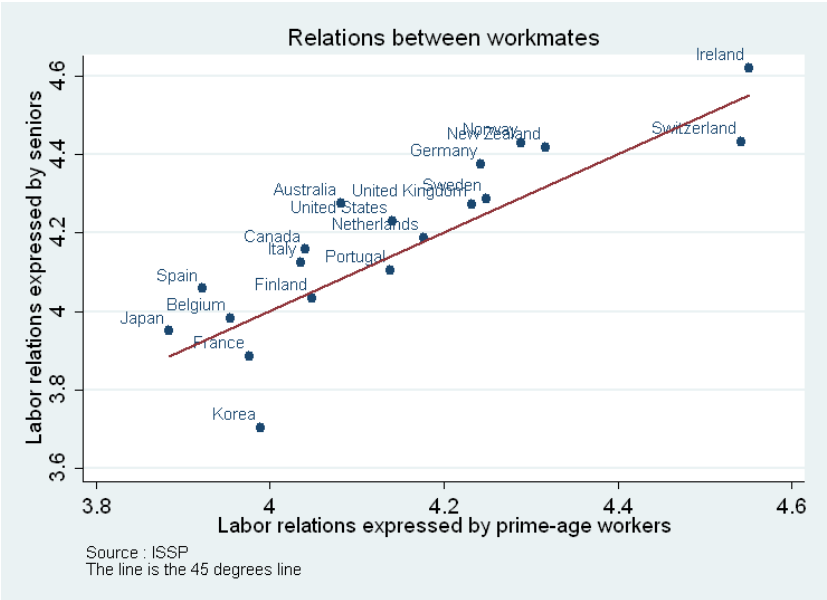
# Appendix

Figure 3: Relations between management and employees expressed by seniors and prime-age workers in 2005.



ISSP Work Orientation 2005 for all countries except Italy (1997) and Netherlands (1997).

Figure 4: Relations between workmates expressed by seniors and prime-age workers in 2005.



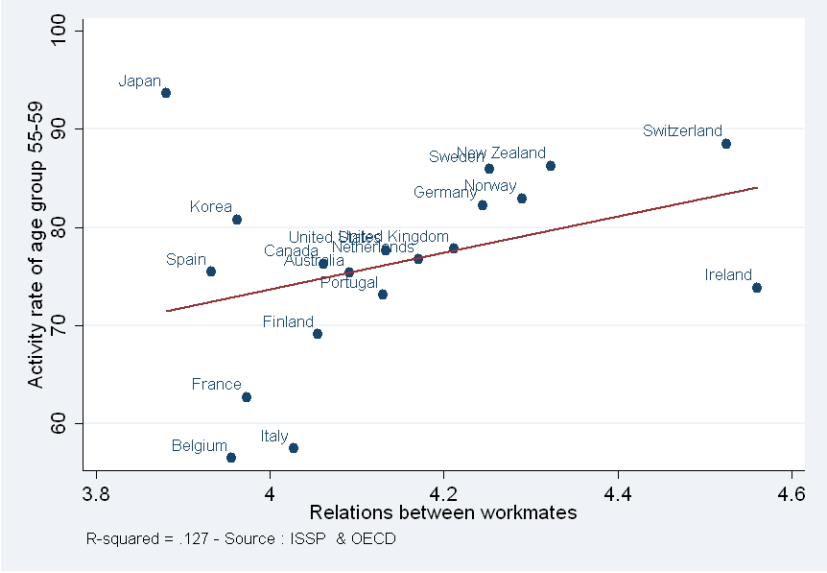
ISSP Work Orientation 2005 for all countries except Italy (1997) and Netherlands (1997).

Figure 5: Activity rate of age group 55-59 and relations between management and employees in 2005.



ISSP Work Orientation 2005 for all countries except Italy (1997) and Netherlands (1997).

Figure 6: Activity rate of age group 55-59 and relations between workmates in 2005.



ISSP Work Orientation 2005 for all countries except Italy (1997) and Netherlands (1997).

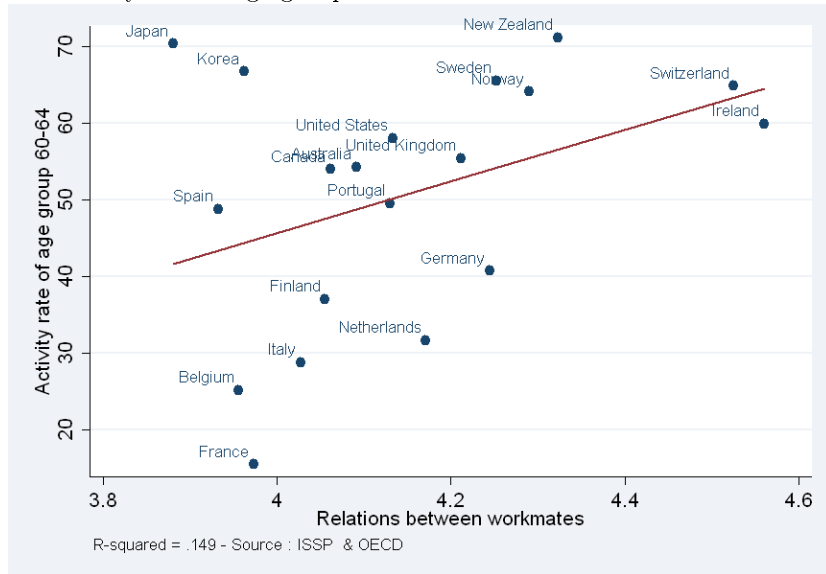
Table 6: Relationship between senior activity rate and implicit tax on continued work (including early retirement route), panel data 1980-2004.

This table mirrors table 3, but uses the implicit tax on continued work including early retirement route.

Dependent variable is activity rate for reported age group						
	Age group 55-59			Age group 60-64		
	(1)	(2)	(3)	(4)	(5)	(6)
Implicit tax	-0.0229 (0.0139)	-0.0146 (0.0139)	-0.0220** (0.00936)	-0.0717*** (0.0275)	-0.0602** (0.0252)	-0.0372* (0.0204)
Unemployment rate	-0.00635*** (0.00122)	0.000223 (0.00169)	-0.000632 (0.00163)	-0.0221*** (0.00258)	-0.0128*** (0.00461)	-0.0104** (0.00410)
Real GDP per capita	-0.124*** (0.0185)	0.0971* (0.0503)	0.0481 (0.0486)	-0.305*** (0.0545)	0.0421 (0.154)	0.158 (0.145)
Standard retirement age			-0.0230*** (0.00839)			0.0473*** (0.0179)
Constant	5.672*** (0.199)	3.466*** (0.520)	5.453*** (0.764)	7.250*** (0.583)	3.750** (1.544)	-0.512 (1.874)
Time fixed effects	-	Yes	Yes	-	Yes	Yes
Observations	290	290	290	294	294	294
Number of countries	19	19	19	19	19	19
R-squared (within)	0.201	0.368	0.457	0.268	0.393	0.442

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1  
Robust standard errors in parentheses  
OLS regressions with country fixed effects  
Implicit tax is defined for reported age group and includes early retirement route

Figure 7: Activity rate of age group 60-64 and relations between workmates in 2005.



ISSP Work Orientation 2005 for all countries except Italy (1997) and Netherlands (1997).

Table 7: Relationship between senior activity rate and implicit tax on continued work (including early retirement route) interacted with average labor relations, panel data 1980-2004.

This table mirrors table 4, but uses the implicit tax on continued work including early retirement route.

Dependent variable is activity rate for reported age group						
	Age group 55-59					
	rel workmates			rel management		
	(1)	(2)	(3)	(4)	(5)	(6)
Implicit tax	0.229*** (0.0676)	0.184*** (0.0670)	0.120** (0.0487)	0.238*** (0.0614)	0.181*** (0.0633)	0.128*** (0.0477)
Interaction term	-0.0613*** (0.0151)	-0.0484*** (0.0152)	-0.0345*** (0.0113)	-0.0701*** (0.0151)	-0.0530*** (0.0159)	-0.0405*** (0.0124)
Unemployment rate	-0.00600*** (0.00116)	0.000193 (0.00161)	-0.000561 (0.00158)	-0.00653*** (0.00119)	-0.000430 (0.00165)	-0.00105 (0.00160)
Real GDP per capita	-0.132*** (0.0180)	0.0780* (0.0438)	0.0397 (0.0439)	-0.131*** (0.0175)	0.0811* (0.0463)	0.0404 (0.0457)
Standard retirement age			-0.0205** (0.00797)			-0.0209*** (0.00788)
Constant	5.767*** (0.190)	3.663*** (0.451)	5.380*** (0.708)	5.758*** (0.186)	3.642*** (0.477)	5.402*** (0.712)
Time fixed effects	-	Yes	Yes	-	Yes	Yes
Minimum effect	-0.01	0	-0.01	0	0	-0.01
Maximum effect	-0.05	-0.04	-0.04	-0.06	-0.05	-0.05
Observations	290	290	290	290	290	290
Number of countries	19	19	19	19	19	19
R-squared (within)	0.270	0.410	0.477	0.278	0.410	0.480

	Age group 60-64					
	rel workmates			rel management		
	(7)	(8)	(9)	(10)	(11)	(12)
Implicit tax	-0.0110 (0.117)	-0.0902 (0.120)	0.0871 (0.123)	-0.107 (0.116)	-0.220* (0.121)	-0.0453 (0.113)
Interaction term	-0.0145 (0.0254)	0.00721 (0.0270)	-0.0295 (0.0278)	0.00934 (0.0281)	0.0422 (0.0305)	0.00212 (0.0283)
Unemployment rate	-0.0220*** (0.00256)	-0.0128*** (0.00462)	-0.0101** (0.00412)	-0.0221*** (0.00258)	-0.0123*** (0.00462)	-0.0104** (0.00412)
Real GDP per capita	-0.306*** (0.0543)	0.0453 (0.154)	0.151 (0.141)	-0.304*** (0.0543)	0.0608 (0.156)	0.158 (0.146)
Standard retirement age			0.0498*** (0.0178)			0.0471*** (0.0179)
Constant	7.259*** (0.580)	3.719** (1.547)	-0.615 (1.847)	7.244*** (0.581)	3.563** (1.567)	-0.503 (1.870)
Time fixed effects	-	Yes	Yes	-	Yes	Yes
Minimum effect	-	-	-	-	-	-
Maximum effect	-	-	-	-	-	-
Observations	294	294	294	294	294	294
Number of countries	19	19	19	19	19	19
R-squared (within)	0.269	0.393	0.444	0.269	0.397	0.442

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1  
Robust standard errors in parentheses  
OLS regressions with country fixed effects  
Implicit tax is defined for reported age group and includes early retirement route

Table 8: Relationship between senior activity rate and implicit tax on continued work (including early retirement route) interacted with the dispersion of labor relations, panel data 1980-2004.

This table mirrors table 5, but uses the implicit tax on continued work including early retirement route.

Dependent variable is activity rate for reported age group						
	Age group 55-59					
	(1)	rel workmates (2)	(3)	(4)	rel management (5)	(6)
Implicit tax	-0.0536*** (0.0136)	-0.0460*** (0.0136)	-0.0429*** (0.0104)	-0.0547*** (0.0164)	-0.0512*** (0.0156)	-0.0482*** (0.0122)
Interaction term	0.235*** (0.0794)	0.237*** (0.0767)	0.167*** (0.0566)	0.141** (0.0591)	0.160*** (0.0562)	0.118*** (0.0429)
Unemployment rate	-0.00531*** (0.00115)	0.00187 (0.00162)	0.000674 (0.00157)	-0.00598*** (0.00116)	0.00151 (0.00158)	0.000429 (0.00154)
Real GDP per capita	-0.116*** (0.0172)	0.131*** (0.0488)	0.0800* (0.0463)	-0.116*** (0.0177)	0.150*** (0.0520)	0.0937* (0.0476)
Standard retirement age			-0.0191** (0.00776)			-0.0201** (0.00783)
Constant	5.591*** (0.185)	3.134*** (0.502)	4.880*** (0.710)	5.594*** (0.191)	2.948*** (0.534)	4.815*** (0.718)
Time fixed effects	-	Yes	Yes	-	Yes	Yes
Minimum effect	-0.04	-0.03	-0.03	-0.03	-0.03	-0.03
Maximum effect	-0.01	0	-0.01	-0.01	0	-0.01
Observations	290	290	290	290	290	290
Number of countries	19	19	19	19	19	19
R-squared (within)	0.263	0.428	0.484	0.244	0.420	0.483

	Age group 60-64					
	(7)	rel workmates (8)	(9)	(10)	rel management (11)	(12)
Implicit tax	-0.0883*** (0.0336)	-0.0669** (0.0312)	-0.0659** (0.0269)	-0.0506 (0.0385)	-0.0234 (0.0355)	-0.0326 (0.0330)
Interaction term	0.126 (0.104)	0.0501 (0.116)	0.237* (0.135)	-0.0839 (0.0989)	-0.146 (0.104)	-0.0198 (0.0992)
Unemployment rate	-0.0215*** (0.00252)	-0.0124*** (0.00465)	-0.00825* (0.00420)	-0.0224*** (0.00267)	-0.0138*** (0.00478)	-0.0105** (0.00423)
Real GDP per capita	-0.300*** (0.0547)	0.0496 (0.156)	0.208 (0.147)	-0.309*** (0.0561)	0.000516 (0.156)	0.151 (0.144)
Standard retirement age			0.0535*** (0.0173)			0.0466*** (0.0175)
Constant	7.195*** (0.586)	3.676** (1.562)	-1.416 (1.903)	7.285*** (0.595)	4.144*** (1.566)	-0.394 (1.817)
Time fixed effects	-	Yes	Yes	-	Yes	Yes
Minimum effect	-	-	-0.05	-	-	-
Maximum effect	-	-	-0.02	-	-	-
Observations	294	294	294	294	294	294
Number of countries	19	19	19	19	19	19
R-squared (within)	0.271	0.393	0.450	0.271	0.399	0.442

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Robust standard errors in parentheses

OLS regressions with country fixed effects

Implicit tax is defined for reported age group and includes early retirement route

Please note:

You are most sincerely encouraged to participate in the open assessment of this discussion paper. You can do so by either recommending the paper or by posting your comments.

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The Editor