An International Comparison of the Efficiency of Government Disability Programs

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Abstract

There are large variations across countries in the fraction of the workforce receiving disability insurance (DI) payments, ranging in 2008 from 3.8 percent in Spain to 10.3 percent in Sweden. Previous research has stressed the importance of institutional features of DI programs in explaining overall costs, but much less is known about the efficiency of such programs in their ability to screen applicants and thereby avoid Type I error (providing benefits to healthy recipients) or Type II error (denying benefits to unhealthy applicants). In this paper, we draw on the Survey of Health, Ageing, and Retirement in Europe (SHARE) and the Health and Retirement Study (HRS) in the United States for micro-level data on people between the ages of 50 and 64 during 2004-2010 to address this question. Using the Poterba, Venti, and Wise health index, we find large differences in the efficiency of DI systems across 11 countries. Switzerland, Denmark, and the U.S. ranking highly in efficiency rankings, while France, the Netherlands, and (on two measures) Sweden rank lower.

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1. Introduction

There are large variations across countries in the fraction of the population receiving disability insurance (DI) payments, ranging from 3.3 percent in Italy and 3.8 percent in Spain, to 8.2 percent in the Netherlands and 10.3 percent in Sweden.[1] The United States began with moderate DI participation rates, 4.7% in 1995, but has since grown to 7.0 percent in 2008. Most countries are critically concerned about rising rates of disability insurance enrollment, and the resulting pressure on public sector budgets in European countries and the United States (European Commission, 2006; OECD, 2003, 2010; McVicar, 2008; Autor and Duggan, 2006).

Previous literature suggests that institutional features of disability programs reflecting ease of being accepted, and the generosity of benefits, are important determinants of the overall size of the DI program (Börsch-Supan and Roth, 2010; Börsch-Supan , 2007, 2008; Milligan and Wise, 2012). In the cross section, pioneering work by the OECD (2003, 2010) has categorized DI programs along dimensions such as the severity of disability needed to qualify, the duration and size of the compensation, and types of vocational and employment support, summarized by two numerical score (e.g., OECD 2003, p. 188; OECD 2010, p. 101).

While innovative, this survey approach has several limitations. First, DI agencies across countries may have different norms that depart from the official rule-book in determining “disability” or in judging employment opportunities of applicants.[2] Second, the OECD policy typology index is a simple sum of many different dimensions, some of which are likely to be less important for the decision to apply or to be accepted, and it is not clear *a priori* how to weight

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[1] These estimates are from the OECD Social Expenditutre Database for 2008, just prior to the great recession, except for Italy, which is from 2007.

[2] Studies of time-series changes in policies within a country, as in Milligan and Wise (2012), are less subject to this criticism.

such factors.[3] Finally, the OECD measures do not necessarily measure Type I and Type II selection error. Type I error corresponds to providing disability benefits to someone who is healthy enough that she doesn't really require such payments (or alternatively is healthy enough to work on her own). Type II error corresponds to denying disability benefits to someone who is unhealthy and unable to work.

In this paper, we develop estimates of Type I and Type II error using micro-level data from the Health and Retirement Study (HRS) and the Survey of Health, Ageing, and Retirement in Europe (SHARE) for a set of 10 European countries and the United States.[4] We use a newly developed health index measure from Poterba, Venti, and Wise (2010, 2011, 2013), expanded to include SHARE data, that captures many dimensions of health, normalized to each country.[5] We first address the straightforward question of how different countries rank with regard to the sorting of individuals by health into disabled and non-disabled status, and estimate hypothetical measures of Type I and Type II error under the assumption that the country holds the fraction of disability recipients constant – an assumption that implies equality in Type I and II error. Countries with larger DI programs tend to have greater Type I and II error, and so we also

[3] Since there are fewer countries in the sample than attributes of DI programs, it is difficult to estimate the weights. Even a factor analysis would be limited by small sample sizes of countries for which data are available.

[4] This paper uses data from SHARE wave 4 release 1.1.1 (March 2013), SHARE wave 1 and 2 release 2.5.0 (May 2011) and SHARELIFE release 1 (November 2010). 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), through the 6th Framework Programme (projects SHARE-I3, RII-CT-2006-062193, COMPARE, CIT5- CT-2005-028857, and SHARELIFE, CIT4-CT-2006-028812) and through the 7th Framework Programme (SHARE-PREP, N° 211909, SHARE-LEAP, N° 227822 and SHARE M4, N° 261982). Additional funding from the U.S. National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, R21 AG025169, Y1-AG-4553-01, IAG BSR06-11 and OGHA 04-064) and the German Ministry of Education and Research as well as from various national sources is gratefully acknowledged (see www.share-project.org for a full list of funding institutions).

[5] The Poterba, Venti, and Wise (2010, 2011, 2013) health index was developed for a single country, the US, using HRS. We consider a variant of this index meant to be comparable across countries.

estimate an index of DI effectiveness that adjusts for program size: What fraction of DI enrollees experience health in the bottom quintile of the health distribution? A third measure of DI efficiency includes other pension programs beyond just DI to allow for differences across countries in the composition of support for those age 50-64.

As noted above, countries differ widely with regard to the fraction of individuals receiving DI payments. These differences presumably reflect both the (inadvertent) design of the system, but also the preferences of voters who could favor a disability program that extends beyond compensating people because they are sick, to providing insurance against both sickness and poor employment opportunities. We therefore consider a more complicated model of disability insurance instituting tradeoffs between employment risk and health risk which allows for the possibility of an individual with borderline health status not being covered by disability insurance if their employment opportunities are sufficient, for example if they have higher educational levels and thus can perform non-manual labor even with a disability.

Briefly, our results suggest large differences across countries in the distribution of DI benefits by health status. Comparing two countries with similar sized DI programs, Type I/II error, as a fraction of the population, is lower in the U.S. (4.8%) than in Belgium (5.7%), higher in Spain (5.7%) than in Italy (3.5%), and lower in Denmark (7.2%) than in the Netherlands (8%). The fraction of people in the DI program who are in the bottom quintile of the health index also differs across countries, ranging from Sweden and Germany (fewer than half of recipients are in the bottom health quintile), but with Denmark (62.8%), Italy (67.4%), Switzerland (73.6%) and the U.S. (77.1%) showing a substantially higher fraction of recipients in poor health. France relies heavily on non-DI pension benefits for early retirees, but these benefits are not as well targeted towards those with poorer health as in other countries.

In the more general model of disability benefit receipt, we do not find that college graduates are at much more disadvantage in qualifying for DI benefits, conditional on health status. The exception is Denmark, where college graduates are 12% less likely than high-school dropouts to be receiving disability conditional on health status. This result is consistent with Denmark's recognition as a country with "best practice" DI programs (according to OECD, 2009) that help to keep disabled people with better employment opportunities in the labor force.

What can be learned from these comparisons? First, there is considerable variation across countries in how well disability programs target those with disability; in some countries the program appears to be covering a large fraction of people age 50-64 in reasonable or even good health. Second, labor market opportunities do not appear to have a first-order impact on disability eligibility decisions in most countries. The larger message, however, is that – assuming that our health index is valid across countries -- the evidence points to a considerable degree of inefficiency in the allocation of disability benefits, suggesting potential gains from programs that intervene quickly and providing supportive employment to avoid the worst-case outcome of a permanent transition to long-term disability status (Burns, 2007; Drake et al., 2009).

2. Theoretical Models

In this section, we first present a very simple model of Type I and Type II error, and then consider a variety of ways to relax these strong assumptions in the context of uncertainty about "objective" measures of disability, the sensitivity of Type I and II error to the size of the disability program, the interaction between DI and other types of public pensions, and differences in country-level policies towards the use of low earnings opportunity as a means to qualify for disability.

Measuring Type I and Type II error

We begin by defining Type I and Type II errors under very strong assumptions providing a useful metric for cross-country comparisons. Type I error is the fraction of individuals receiving benefits who are in some sense "too healthy," while Type II error is the fraction of truly sick individuals who do not receive DI benefits. Assume that the rate of participation for DI insurance is determined optimally; thus we do not attempt to explain why Sweden supports 26% of the population aged 50-64, while Italy supports just 5%. If the objective of DI programs is to transfer resources to unhealthy people, then we assume initially that the goal of the program is to rank individuals by their illness level, and only provide support to the bottom 26% in Sweden, and the bottom 5% in Italy.

To show graphically these types of errors, we use as an example data the Netherlands, pooled to include 2004, 2006, and 2010 waves. We discuss the data source, and the health status index (as in Poterba, Venti and Wise, 2010, 2011, and 2013) in more detail in Section 3; this is used simply as an example here. Figure 1 shows the percentage of individuals in the sample receiving DI benefits by decile of health status.[6] The green bar and the striped blue bars show the fraction in each decile receiving DI; reassuringly, the fraction declines in going from the sickest individuals (Decile 1) up to the healthiest (Decile 10). Even in the 6th decile, those with above-median health status, 7.8% are still receiving disability payments.

The overall fraction of those aged 50-64 in the Netherlands who are receiving some kind of DI benefit is 13.7%. Relative to the "ideal" in which only the bottom 13.7% of individuals receive DI payments (thus keeping the budgetary costs constant), the Type I error is the fraction of the population with health status above 13.7% who receive DI payments (the blue striped columns in Figure 1), while Type II is the fraction in very poor health who do not receive DI

[6] For simplicity, we do not weight the sample in this example.

payments (the red speckled bar in Figure 1). The green bars (the bottom 10% plus 3.7% of the next decile) reflects those in the bottom 13.7% of health who are receiving DI benefits, while the tan bars are those with better health who are *not* receiving DI benefits.[7]

By construction, the number of people deemed “Type I” error are exactly equal to the number deemed “Type II”, a result that occurs because in both the actual and the counterfactual, the same overall fraction (and number) of people are receiving disability. Thus our combined Type I/II measure shows that 8.0% (of the total 13.7%) of enrollees are deemed to be Type I/II error. Note also that (as is discussed below), this measure is biased upward, since any type of selection error, or mismeasured “true” disability, would tend to overstate Type I/II error.

Disability insurance programs that cover a larger fraction of the population are more likely to a larger degree of Type I/II error. One could express Type I/II error as a fraction of those enrolled, but this ratio asymptotes towards zero as the fraction enrolled climbs towards 100%. We therefore consider a second measure of DI efficiency: the fraction of DI recipients whose health is in the bottom quintile (20%) of the health index distribution.

Countries may also differ with regard to their reliance on DI programs versus other types of social insurance, leading to systematic biases of sicker people in their 50s or early 60s opting for early retirement rather than applying for DI benefits. To test for this effect, we also consider measures below that include successively more comprehensive support: (a) receipt of any public pension including DI, or (b) any public pension including DI, or any private pension.

Disability Insurance as Social Insurance

Disability insurance can also serve to provide support for those with both disabilities and poor market opportunities. Thus a worker whose current job involves physical labor rather than

[7] Our calculations presented below rank individuals by exact centile, and not by decile as shown in Figure 1.

desk work may be adversely affected to a greater extent by a given disability such as muscle weakness or back pain. To capture the influence of labor market opportunities in the disability decision, we consider a more complicated model of Type I/II error with a single-equation model of the application process:[8] Let

$$
(1) \qquad \begin{aligned}
&Y_{ij}^{*} = \beta_j X_{ij} + \alpha_j (h_{ij} - H_j) + \gamma_j (w_{ij} - W_j) + u_{ij} \\
&Y_{ij} = 1 \quad if \quad Y_{ij}^{*} > 0 \\
&Y_{ij} = 0 \quad otherwise
\end{aligned}
$$

where Y_{ij}^{*} is a linear index for individual i and country j which, if positive, implies that the application (or receipt) $Y_{ij} = 1$ occurs, and where Y_{ij} is zero otherwise. The likelihood that Y_{ij}^{*} is positive in turn depends on the health h_{ij} of the individual, and whether it exceeds the country-specific benchmark H_j. (Note that better health corresponds to a higher h, which means that $\alpha_j <$ 0.) Similarly, labor market opportunities will be measured by the market wage w_{ij}, which given the difficulty in measuring wages for workers often on the periphery of market work, we proxy by using education.[9] We assume that higher wages make DI insurance applications less likely, so $\gamma < 0$. We can summarize the country-specific requirements for DI enrollment by combining the benchmark health and wage requirements by state as a weighted sum C_j, reflecting the ease of qualifying, as follows:

[8] DI receipt occurs through a two-step process. First, the individual chooses to apply for DI insurance, and then the application is reviewed (and perhaps initially rejected) by the DI agency. Thus receipt of benefits is the product of the binary variable of whether one applies, and whether the application is approved. In theory, this model can be estimated using a partial-observation probit model (Poirier, 1980) where one only observes a positive value for both the application being filed and the application being approved by the DI program. However, Meng and Schmidt (1985) have pointed out that the efficiency of the estimator is poor, and at this stage the poor identification of the different equations makes such an approach problematic. Our reduced form model above is a linear combination of the application coefficients and the approval coefficients in a logistics model (the analytics are more difficult in the probit model).

[9] Note that education also predicts health, but we will condition on at least self-reported health.

(2')
$$
\begin{aligned}
&V_{ij}^{*} = \beta_j X_{ij} + \alpha_j h_{ij} + \gamma_j w_{ij} + u_{ij} \\
&Y_{ij} = 1 \quad if \;\; V_{ij}^{*} > C_j = \alpha_j H_j + \gamma_j W_j \\
&Y_{ij} = 0 \;\; otherwise
\end{aligned}
$$

Figure 2 illustrates the simple model for the health and wage (or market opportunity) dimensions. The ellipse represents the distribution of health (h) and wage opportunities (w) in this general population. We draw an ellipse rather than a circle to reflect the observed correlation between health and wages.

Consider first the red line (mm') with an intercept on the Y axis equal to $[C_j - X\beta]/\gamma$, and with a slope equal to $-\alpha/\gamma$. (Since we would expect both α and γ to be negative, this slope should also be negative.) In this deterministic model, everyone below the line mm′ should be on DI, such as A, while everyone above the line should not be on DI, such as person B. But suppose we consider B′; this individual does receive DI, and thus would qualify as a Type I error.

The more interesting case is for A′; suppose she does not receive any DI benefits. For our first country, whose DI program's tradeoff is given by mm′, this is entirely appropriate; she is not deemed to require DI given the combination of health and earning ability. But suppose this same individual lived in a different country, whose tradeoffs are given by nn′ (the blue line). In this country, A′, who is still not receiving any DI benefits, would be reclassified as contributing to Type II error; someone who should get benefits, but who doesn't. Figure 2 illustrates the simple model for the health and wage (or market opportunity) dimensions for two countries with the same distribution of health (h) and wage opportunities (w) in the population (conditional on X), but different DI policies. The ellipse represents the distribution of health (h) and wage opportunities (w) in this general population. We draw an ellipse rather than a circle to reflect the observed correlation between health and wages.

Recall that the ratio γ/α indicate the implicit (or empirical) relative weights of health and employment opportunities, or the (inverse) slope of the lines mm′ or nn′ in Figure 2.[10] In the empirical model, we calculate the tradeoff by comparing the coefficient in a DI estimation equation for tertiary or college (compared to primary or non-high school) education divided by the coefficient reflecting the increased probability of health decile 1 qualifying for DI relative to decile 10.

Note also that countries may differ with regard to the variance of the error term, where $\sigma_j^2 = \mathrm{Var}(u_{ij})$. The larger is σ_j^2, the more likely that we would observe Type I error (healthy people qualifying for DI) and Type II error (unhealthy people not qualifying). Since probit models impose unit variance, the coefficient estimates are C_j/σ_j, α/σ_j, and β/σ_j. In the extreme where the selection process is nearly random, so that the variance of the error term is large, the magnitude of both regression coefficients would be small, meaning that neither labor market opportunities nor health were predictive of DI enrollment. We therefore also consider the absolute magnitude of the coefficients on health (and possibly education), and the relative fraction of disability payments going to people in poor health, as markers for the efficiency of the country-specific disability insurance program.

3. Data

We use data from SHARE and HRS for the years 2004, 2006, and 2010 (waves 1, 2, and 4 for SHARE and waves 7, 8, and 10 for HRS)[11]. We focus on the ten European countries that participated in every wave of SHARE. They are a balanced representation of the various regions in Europe, ranging from Scandinavia (Sweden and Denmark) through Western and Central Europe (the

[10] We report the inverse of the slope because empirically, γ is often close to zero.

[11] The 2008 wave of SHARE (Wave 3- SHARELIFE), was designed to capture information about respondents' life histories, and contained very different questions from the other waves; we therefore excluded this year from both data sources.

Netherlands, Belgium, France, Germany, Switzerland and Austria) to the Mediterranean (Spain, Italy). Properties of the SHARE data, such as response rates and sample sizes, have been reported elsewhere (e.g., Börsch-Supan, 2007). About two-thirds of the variables in SHARE are identical to variables in HRS, and most of the remainder is fairly comparable (Börsch-Supan, 2007). Some transformations of the original variables have been necessary to ensure close comparability between the two data sets.

Receipt of disability benefits was determined by responses to questions specific to each survey. For HRS respondents, we used a derived variable provided by RAND that describes the respondent's disability status in each wave. Respondents were considered to be receiving disability benefits if this variable indicated that they were currently receiving benefits from SSI, SSDI, or both. For SHARE respondents, we determined disability benefit receipt by recoding answers to country-specific questions about receipt of different pension types.[12]

In addition to self-rated health, we also created a health index from a battery of questions about respondents' functional health and health history. We used 23 different items representing respondents' BMI, their functional health limitations (e.g. climbing stairs or lifting heavy objects), their previous disease diagnoses, and their use of health care services in the past year or two. As in previous work (Poterba, Venti, and Wise, 2010), data were pooled across years, and a series of country-specific principle components analyses (PCA) were performed; we retained the first component and used this to create country- and year-specific percentile scores. These percentile scores were strongly related to respondents' self-rated health, as well as their grip strength (a reliable indicator of health status), neither of which was included in the final index.

[12] Details and specifications for questions to be listed in Appendix C (not yet complete).

The study population was limited to respondents between the ages of 50 and 64, and to those with a non-missing and non-zero population weight. We further limited the sample to individuals not missing data for our dependent variable (whether receiving disability payments) nor for the self-rated health question or any of the functional health variables used in the health index.

Education was split into primary, secondary, and tertiary. For SHARE, we relied on the ISCED-97 coding provided in the generated variables file.[13] For the HRS, primary corresponded to 11 years of education or less, secondary was 12 years, and tertiary was more than 12 years of education.

To characterize disability policies across countries, OECD (2003, 2010) proposed two indicators: the first indicator focuses on compensation measures or benefit programs (the OECD generosity/compensation score), while the second indicator focuses on employment or integration measures (the OECD employment score). Each of the two policy dimensions is divided into ten sub-dimensions. The sub-dimensions are all given equal weight and the same score range, from 0 to 5 points. The points for each sub-dimension are then added to obtain the overall score, with 50 being the possible maximum score for each indicator.

The generosity/compensation indicator focuses on dimensions such as the coverage of the program, the extent of disability needed to qualify for benefit entitlement, the duration and size of compensation, the type of medical assessment (if any) required to certify disability, the extent of vocational assessment, and so on. The employment/integration indicator focuses on the whole

13 The SHARE generated variables file provides the 1997 International Standard Classification of Education (ISCED-97) coding. We combined the ISCED-97 codes 0 (none), 1 (primary education), 2 (lower secondary education), into one category ("primary"), the codes 3 (upper secondary education) and 4 (post-secondary, non-tertiary education) into another category ("secondary"), and categories 5 (first stage of tertiary education) and 6 (second stage of tertiary education) into yet another category ("tertiary"). See separate Data Appendix for further details.

range of employment and rehabilitation measures, such as the type and extent of employment support, the timing and comprehensiveness of vocational rehabilitation programs, and the work incentives provided for beneficiaries. When a country's generosity/compensation score is greater than its employment/integration score, it indicates a strong focus on compensation over rehabilitation, and conversely (OECD, 2003, 2010). The average scores across the OECD countries are 25.8 for OECDg and 24.9 for OECDe.

4. Results

Summary statistics from the SHARE and HRS data are shown in Table 1 for the sample limited to people age 50-64.[14]In the first column we include the number of respondents for each country and year.[15] The next columns include the percentage of respondents who are female, receive disability insurance, or report their health to be fair or poor. There is a fair degree of temporal stability in all measures, except for a dramatic increase in the fraction on DI in the United States, from There is wide variation in DI receipt across countries, from less than 4% of French individuals aged 50-64 receiving DI benefits to roughly 26% in Sweden. Denmark and the Netherlands show a decreasing trend over time in DI enrollment over time, while in the U.S. rates have increased from 7.7% in 2004 to 9.7% in 2010. There are also differences across countries in the percentage reporting fair or poor health; these are likely to reflect both real differences in health, and differences in how people perceive their own health (Kapetyn et al., 2009); for this latter reason we eschew the use of self-reported health in the health status indices.

[14]

[15] Most SHARE countries were on a harmonized bi-annual schedule. However, the schedule of fieldwork in the different countries depended on the timing of partially de-centralized funding. SHARE wave 1 was fielded mostly in 2004, with some interviews taking place in 2005. SHARE wave 2 was fielded in 2006 and 2007. SHARE wave 4 was fielded mostly in 2011 with some interviews taking place in 2010 and in 2012. In this paper we associate SHARE wave 1 with 2004, SHARE wave 2 with 2006, and SHARE wave 4 with 2010.

Table 2 pools the data by country and reports enrollment and efficiency measures, along with characteristics of each country's disability policy. The fraction of people age 50-64 receiving any DI payments ranges from 2.8% in France to 26.4% in Sweden. One potential disadvantage of focusing solely on DI benefits is that other pension programs may also be available in each country; thus France may have an artificially low rate of DI use if most citizens in this age group are receiving either a public pension (Column 2) or public and private pensions (Column 3) in addition to DI. France does experience a much larger fraction of individuals receiving public pensions (including DI) of 31.5%, not much different from Sweden, with 34.0%. Yet as we show below, the pattern of who exactly receives those benefits is much different in France than in Sweden.

Colum 4 reports the combined Type I/II error measure. It is clearly correlated with the size of the DI program, ranging from 2.3 percent in France to 11.1 percent in Sweden, but there are differences even among countries with similar sized DI programs – a topic to which we return below when considering graphical representations of DI efficiency. Column 5 shows our alternative measure of DI efficiency; the fraction of recipients in the bottom quintile of the health index. Here the measures from 49.7 percent in Sweden (meaning that only half of DI recipients are in the bottom quintile of the health distribution), to 77.1 percent in the U.S.[16]

Finally, we report the two OECD measures of system generosity in Columns 6 and 7. For the generosity of the DI program (OECDg), Sweden leads the list (with a score of 37 out of 50), followed by Denmark (32) and Switzerland (32), and with the U.S. the least generous (17). The employment/integration indicator (OECDe) is highest in Denmark (37) and lowest in Italy (18). Both measures are positively associated with the fraction of the population receiving DI

[16] In the case of Sweden, given that the program covers 26.4% of the population, the best it can do under this measure is 0.76=20/26.4.

benefits (correlation coefficient of 0.50 ($p = 0.11$) and 0.47 ($p = 0.15$), respectively) and are positively associated with Type I/II error (but with only OECDe marginally significant at the 0.07 level). Finally, both measures are negatively associated with the alternative measure of DI efficiency (the fraction of DI recipients in the bottom quintile of the health index), but are not significant at conventional levels.

Figure 3 provides a comparison of the distribution of DI enrollees by health status index decile, for the entire 2004-10 data, for two countries with similar fractions of people age 50-64 with disability benefits: Belgium (8.4%) and the U.S. (8.6%) The distribution of benefits in the U.S. is skewed more to the left, meaning that a larger fraction of DI benefits accrue to people who report worse health. The Type I/II error measure is 4.8% in the U.S. compared to 5.7% in Belgium, while the percentage of people in the bottom quintile of health status receiving DI benefits was 54.9% in Belgium, compared to 77.1% in the U.S.

Figure 4 compares two Scandinavian countries, Denmark and Sweden, and contrasts the fraction of people who are receiving DI benefits by their (relative) health status index. As noted earlier, a much larger fraction of the population receives disability benefits in Sweden (26.4%) compared to Denmark (13.9%). Not surprisingly, Sweden also exhibits considerable higher Type I/II error (10.7% versus 6.6%), given the greater size of the program. The largest difference in the programs comes not from the better Swedish support of those in the bottom decile of the health index, where they both do well, but in support of people in health index deciles 4-6, where support rates in Sweden are greater than 20% but average just over 5% in Denmark. This likely reflects differences in policies towards encouraging people who are not in perfect health to continue working between Denmark and Sweden. As an OECD (2009) study found,

> *Sweden* is a nation with an historically strong ethos of social protection and it is seeking to tackle the capacity assessment challenge through a Work Capacity

> Commission tasked with receiving submissions and providing a forum for public discussion.
>
> The disability scheme in *Denmark* which was reformed in 2003 incorporates a most fundamental conceptual shift. Disability assessment is now focused on what a person can do rather than their loss of capacity; more precisely, the extent to which a person is able to carry out a subsidised job (a so-called "flex-job"). A disability benefit is only granted where capacity is held to be permanently reduced to the extent that a flex-job cannot be performed, and participation in rehabilitation would not help to restore this capacity. In determining capacity, a comprehensive individual resource profile is being put together which includes measures of health, social and labour market proximity criteria. In this respect, Denmark is a best-practice example within the OECD (p. 19).

In sum, it would appear that Denmark's policies are relatively effective in reducing Type I error by keeping workers with middling levels of health off of the disability program.

As noted above, France relies more on other pension programs beside just their DI program, and so it is useful to consider also broader classifications of pension support beyond DI. Figures 5 and 6 show the distribution of pension or DI support for France and Sweden, respectively, by health status decile. The red column shows the additional coverage by non-DI public pensions, the green next column reflecting private pensions, and the remaining top segment the share of the decile not receiving any pension. (Appendix A provides these same graphs for all countries in the analysis.)

The total fraction of the population receiving any pension is 36.2% in Sweden, just slightly higher than the comparable measure in France, 32.5%. Yet the distribution by health status of public pensions (including DI benefits) is far different in the two countries. For the sickest decile of the population, just half of the population in France receives any pension benefits, in contrast to more than four-fifths in Sweden. In the highest health decile, 20% of the French are receiving some kind of pension, in contrast to 12% in Sweden.

Perhaps the reason why Sweden has so many DI recipients clustered around the median level of health is because their program also serves as insurance against poor labor market opportunities. We present the full set of country-level probit regression analysis (with fitted probabilities reported) in Appendix B; these include the health deciles (with the healthiest decile 10 excluded from the regression), along with our measures of labor market opportunity (secondary or tertiary education, with primary excluded) and standard covariates such age five-year age categories, sex, and retirement status. Given that the fraction of the healthiest decile receiving DI benefits is typically close to zero, the coefficients on Decile 1 can be interpreted as the share of people in this health category who are receiving DI benefits, even after adjusting for education, sex, age, and retiree status.[17] In general, the probability estimates in the probit equation are larger than what we see in the simple tables, suggesting the existence of a tradeoff between market opportunities and health status in becoming eligible for DI. Put another way, some of the people in the bottom quintile of health status may not be eligible (or have even applied) for DI because their job allows them to continue working, despite physical infirmity.

Figure 7 shows the calculated ratio γ/α as discussed in Section 3; this reflects the implicit tradeoff between labor market opportunities (the tertiary or college coefficient) divided by the health status different (the Decile 1 coefficient). If the coefficient is 0.1, for example, it means that the country implicitly places a weight on education (college versus primary) that is 10 percent of the weight it places on being in the worst decile of health. As is clear from Figure 7, the relative weights placed on education are quite modest, except in Denmark where the ratio is 0.20. In Denmark, the probability of receiving DI insurance is 12.1% lower for those with a tertiary education (Appendix B) compared to a primary education, holding health status, age, retiree status, and sex constant. The corresponding coefficient in Sweden is 7.9%, but generally

[17] The coefficients for Germany should be interpreted with considerable caution.

the impact of education is much less; In Belgium and the U.S., the probability is just 2% lower, and in Austria, France, and Germany the education coefficient is not significantly different from zero.

5. Conclusion and Discussion

There are few metrics for judging the effectiveness or efficiency of public disability insurance programs. In this paper, we study the reported health and work opportunities of the population age 50-64 enrolled in a disability insurance (DI) program across a sample of 10 European countries and the United States. We observed considerable differences across countries with regard to the composition of people eligible for DI benefits – relative to those without DI benefits. While previous work has sought to describe the institutional features of individual country-level programs, as in OECD (2003, 2010), this paper attempts to infer characteristics of DI programs based on micro-level data from SHARE and the HRS on DI enrollees and non-enrollees.

We developed several measures to quantify the potential inefficiency inherent in the selection of enrollees in disability programs. We first considered Type I error (individuals without severe health impairment who receive disability insurance) and Type II error (individuals with severe health impairment who do not receive disability insurance) across the 11 countries in our sample. We also developed a related measure that is less sensitive to the absolute size of the program: the fraction of DI enrollees in the bottom quintile of the health distribution. A third measure captures the health-related distribution of all pension programs that supplement standard DI payments. While not all of the measures yield consistent answers, Denmark, Switzerland, and the U.S. scored reasonably well, while France, Belgium, and (on two measures) Sweden do less well.

It may appear surprising that the U.S. DI program scored so well, given the very long waiting period and extensive appeals for people with what appear to be serious disabilities (Eckholm, 2007). Yet it may be precisely this process that restricts DI eligibility to the sickest group, leading to low levels Type I error. More worrisome is if the long periods of time spent out of the labor force during the stressful application process has an independent impact on health status, leading to low *apparent* Type I error (Maestes et al., 2013; Atlas and Skinner, 2009; Meara and Skinner, 2011).

We also developed a regression model that captures differences across countries in the degree to which they weight health status versus market opportunities. For example, even holding health status constant, Denmark shows a much stronger gradient of DI eligibility by education, suggesting that even disabled college graduates are encouraged to find work. Most countries, however, showed only modest differences (or none at all) in DI eligibility across education groups. As income (and educational) inequality continues to rise, there may be greater opportunities to sidestep DI enrollment for people with higher education who may continue to work. The recent successes of supportive employment in the U.S. and Europe, by which mentally disabled people are encouraged to return to appropriate work, shows considerable promise (Burns et al, 2007), and there is at least suggestive evidence that at least in the U.S., such programs can pay for themselves by reducing disability and medical costs (Drake, et al., 2009).

There are several limitations in this study. First, the health status index may not fully reflect the ability to work, particularly when interacted with the type of industry. A broken leg will be more of a problem for construction workers than for computer programmers. In theory, this is not a fatal problem if the degree of bias is similar across countries, but we do not know how the degree of bias differs across countries. Second, even the index measures of health care is intrinsically ordinal, and while deciles (or even centiles) of responses by country and by year avoids stronger assumptions about cardinality, they also abstract from real differences in health across countries. For example, someone in the 15th percentile in the U.S. may experience far more real pain from working than someone in the 15th percentile in Sweden.

The primary concern of many policy makers has been with the rapid and unsustainable growth in DI programs worldwide that do not appear to be associated with worsening health (Milligan and Wise, 2012; Borsch-Supan, 2007; Börsch-Supan and Roth, 2010). Our new measures of disability insurance efficiency cannot answer the question of what is the appropriate size of DI programs in a particular country, which is fundamentally a political issue. But we can provide those seeking more efficient disability insurance programs with new tools to both measure and monitor how well country-specific DI programs are fulfilling their task of providing financial support for people who are in the poorest health or are least able to work.

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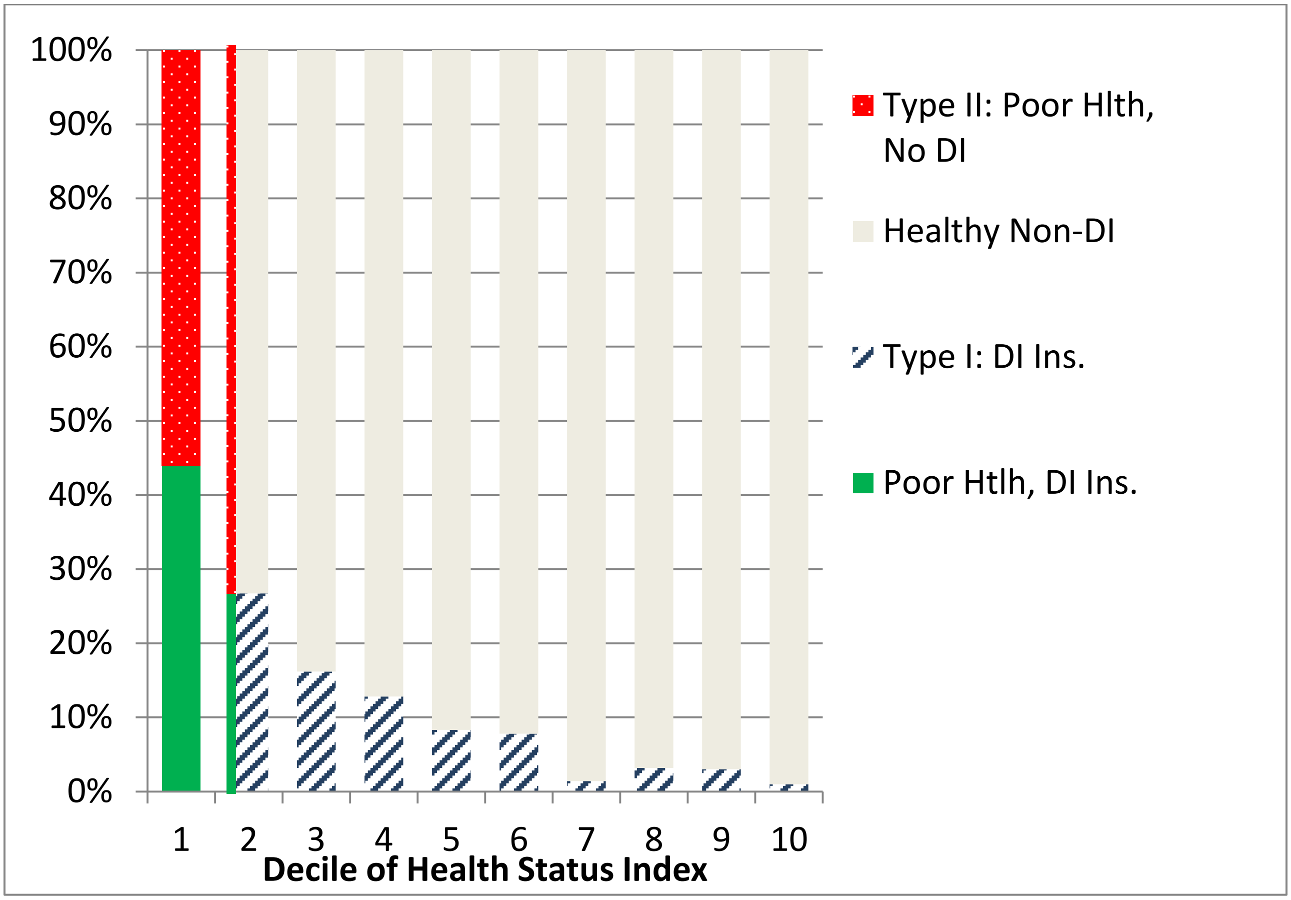

Figure 1: Type I and Type II Error Based on the Fraction of Individuals of a Certain Health Status Receiving (or Not Receiving) Disability Insurance: The Netherlands, 2004-10

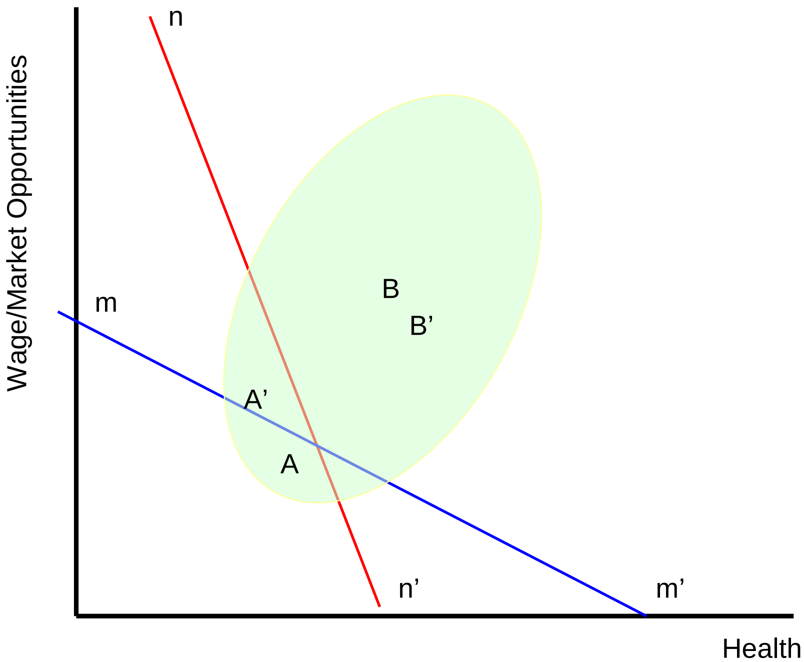

Figure 2: Type I and Type II Error When Disability is Awarded on the Basis of Both Health and Market Opportunities

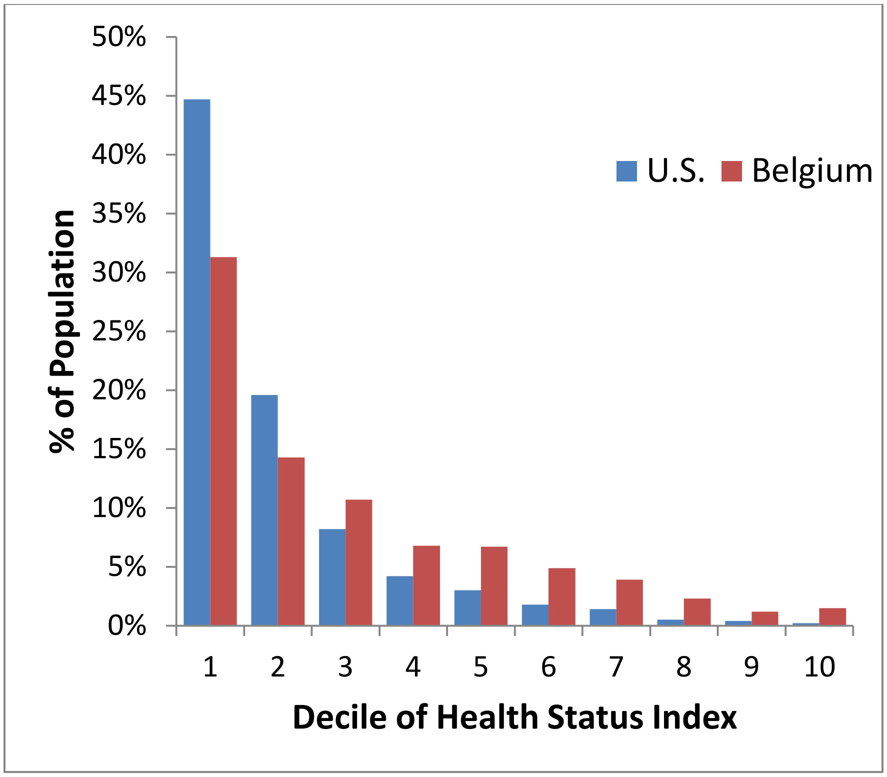

Figure 3: Percent of Population on Disability Insurance, by Health Status, the United States and Belgium: 2004-10

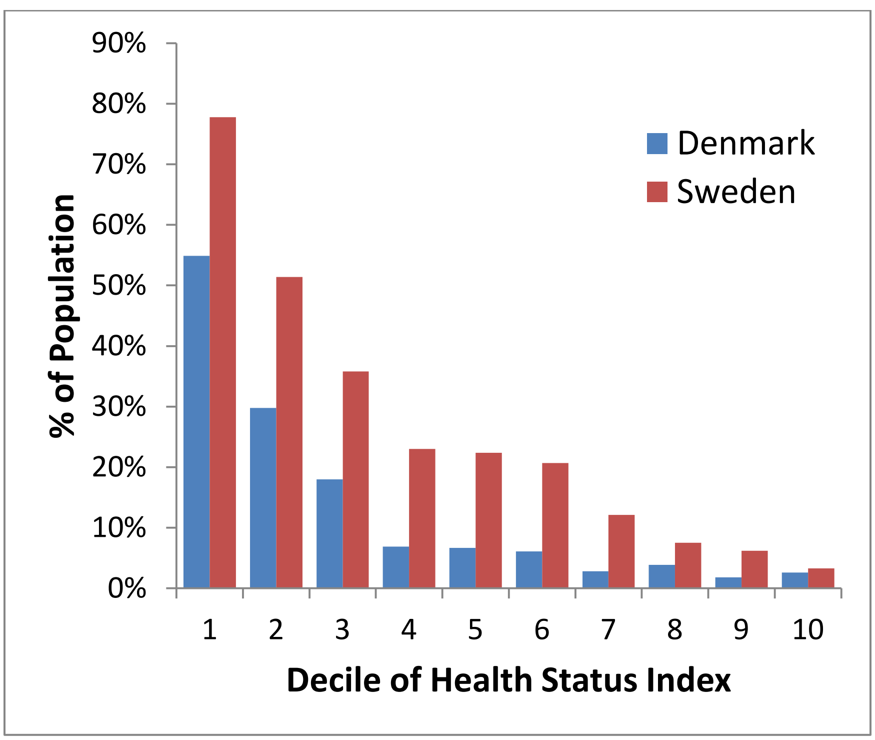

Figure 4: Percent of Population on Disability Insurance, by Health Status, Sweden and Denmark: 2004-10

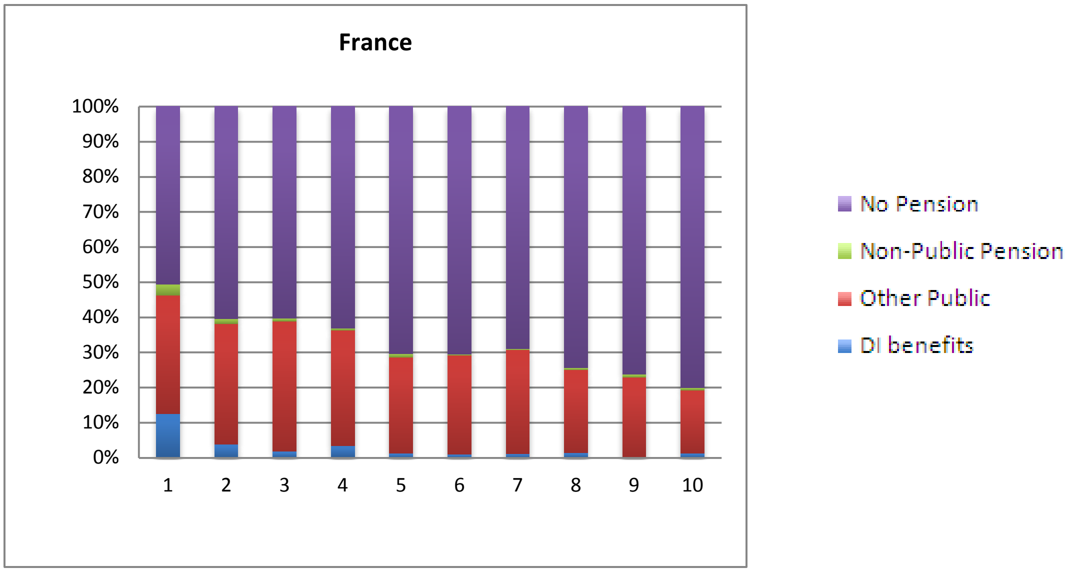

Figure 5: Disability Insurance Receipt, and Any Public Pension Receipt, by Health Status Index: France, 2004-10

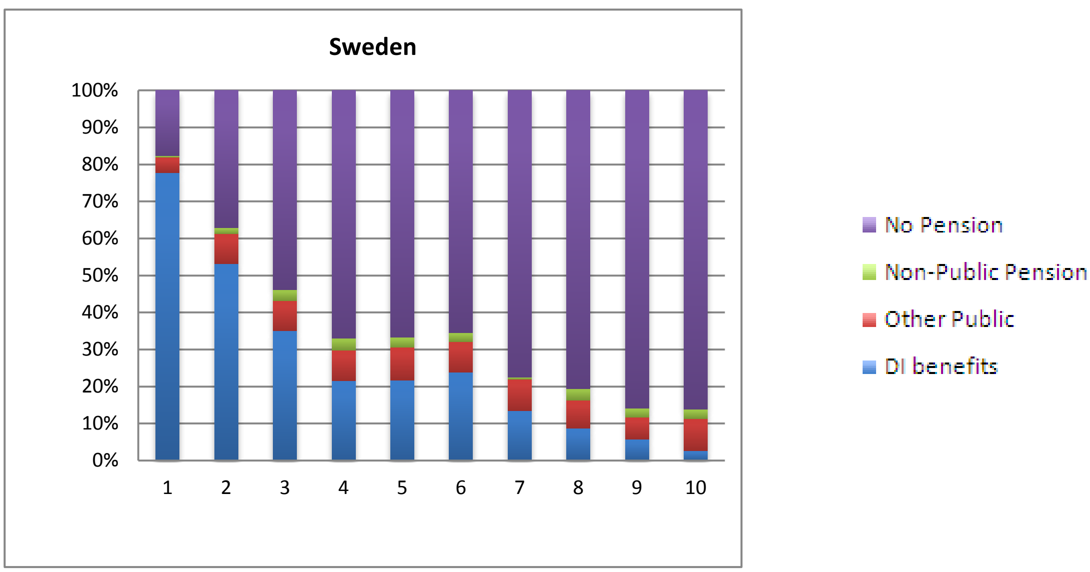

Figure 6: Disability Insurance Receipt, and Any Public Pension Receipt, by Health Status Index: Sweden, 2004-10

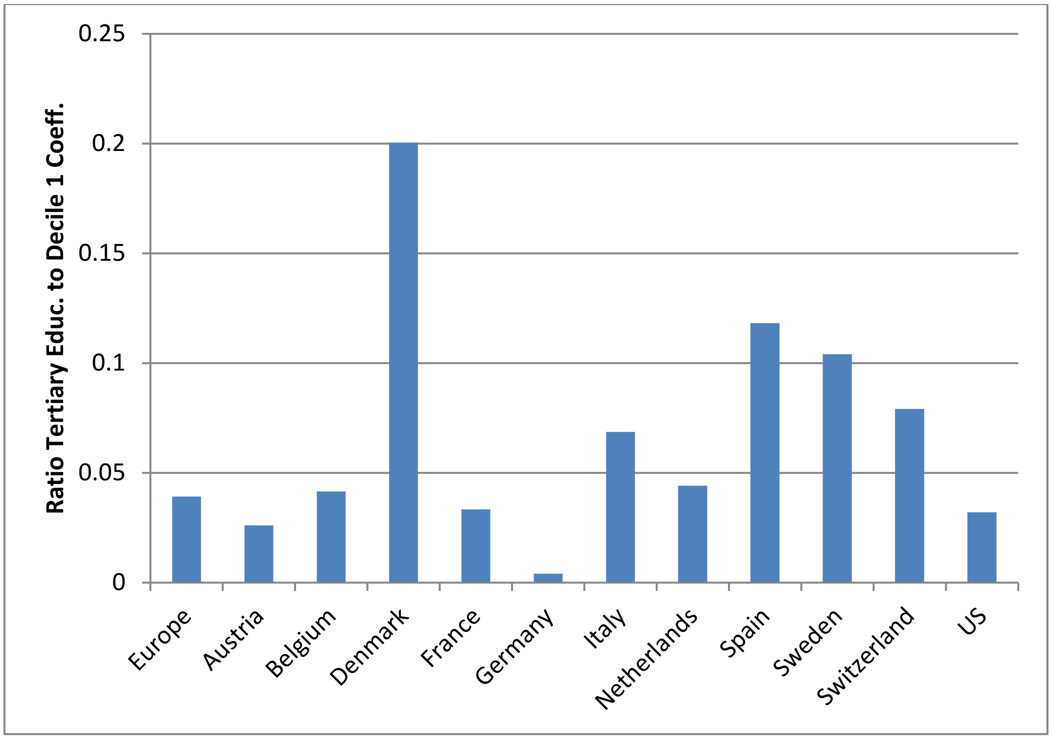

Figure 7: Ratio of Tertiary (College) Education Coefficient to Health Status Decile 1 Coefficient, by Country (Using Regression Results in Appendix B), 2004-10

Table 1: Descriptive Statistics

Country	Year	Number of observations	% Female	% Received DI benefits	Education Level % Primary	Education Level % Secondary	Education Level % Tertiary	% in Fair or Poor Self-Rated Health
Sweden	2004	1586	49.28	26.41	41.64	31.6	26.76	10.47
	2006	1,282	49.6	26.95	35.83	36.93	27.25	24.08
	2010	610	49.54	25.8	27.59	39.28	33.13	23.42
Denmark	2004	896	50.86	16.63	16.42	47.09	36.5	20.36
	2006	1,383	49.65	12.32	14.62	41.29	44.08	19.56
	2010	1,173	51.03	12.56	11.92	39.16	48.92	17.28
Netherlands	2004	1652	50.28	16.47	51.05	24.06	24.9	22.08
	2006	1,482	49.17	13.17	43.72	27.37	28.92	24.19
	2010	1,359	50.44	11.72	37.48	31.76	30.76	25.55
Germany	2004	1578	50.6	5.09	11.4	58.16	30.44	28.92
	2006	1,240	50.16	6.02	10.16	58.18	31.66	29.82
	2010	586	50.87	8.97	10.18	56.29	33.53	38.39
Belgium	2004	1883	50.16	7.3	41.35	29.33	29.32	20.18
	2006	1,605	49.8	8.68	40.82	30.13	29.05	22.48
	2010	2,695	50.22	9.12	37.48	29.2	33.32	22.83
France	2004	1533	51.12	3.78	40.33	34.48	25.19	22.68
	2006	1,448	51.36	1.59	36.57	37.82	25.61	24.95
	2010	2,764	51.9	2.98	30.94	43.4	25.66	25.74
Switzerland	2004	492	49.8	8.16	45.9	44.1	10	11.62
	2006	771	49.46	6.81	27.94	58.77	13.29	13.06
	2010	1,810	50.35	5.87	15.45	65.87	18.68	14.28
Austria	2004	943	50.42	4.41	21.75	53.33	24.92	22.53
	2006	563	50.45	7.34	22.41	52.58	25.01	28.63
	2010	2,422	51.4	8.96	17.46	54.97	27.57	23.09
Spain	2004	1018	50.68	7.61	72.01	14.67	13.32	28.85
	2006	910	50.64	8.91	72.94	12.91	14.14	32.38
	2010	1,382	50.92	8.12	67.7	17.36	14.94	33.04
Italy	2004	1326	51.68	5.33	67.79	24.48	7.73	29.96
	2006	1,394	51.62	5.5	61.45	30.19	8.35	32.66
	2010	1,551	51.21	4.19	55.97	36.61	7.43	22.28
US	2004	7256	50.1	7.71	13.6	30.04	56.36	21.88
	2006	5,688	50.8	8.87	13.12	29.33	57.55	21.91
	2010	3,541	51.52	9.69	11.02	28.23	60.75	22.55

Source: Authors' calculations using SHARE wave 1 (2004/2005), wave 2 (2006/2007) and wave 4 (2011/2012) and HRS wave 7, wave 8 and wave 10. Age 50-64. Population-weighted data.

Table 2: OECD Disability Scores, Percentage of Population Receiving Disability and Pension Benefits, Type I/II Error, and Fraction of DI Recipients in Bottom 20% of Health Status

Country	Percentage of Population Receiving: DI	Any Public Pension	Any Pension	Type I/II Error	Of Those Receiving DI: % in Bottom Quintile Health	OECDg	OECDe
Sweden	37	37	37	11.1	49.7	37	32
Denmark	28	28	28	7.2	62.8	28	37
Netherlands	24	24	24	8	56.7	24	35
Germany	32	32	32	5.6	48.8	32	35
Belgium	25	25	25	5.7	54.9	25	24
France	25	25	25	2.3	59.1	25	26
Switzerland	32	32	32	4.2	73.6	32	27
Austria	24	24	24	5.1	53.1	24	30
Spain	27	27	27	5.7	54.8	27	22
Italy	26	26	26	3.5	67.4	26	18
US	17	17	17	4.8	77.1	17	21

OECD generosity (compensation) score (column 1) and employment (integration) score (column 2); percentage of individuals receiving disability insurance (column 3), receiving any public pension (column 4), receiving any pension (column 5); percentage of individuals classified as Type I error (column 6), percentage of individuals receiving DI who are in the bottom 20% of health index (column 7). Source: OECD (2010) and authors' calculations using SHARE wave 1 (2004/2005), wave 2 (2006/2007) and wave 4 (2011/2012) and HRS wave 7, wave 8 and wave 10. Based on a longitudinal sample of # individual respondents, aged 50-64 in each wave. All figures, except for OECD scores, are population-weighted.

Appendix A: DI and other Public Benefits Receipt by Health Index Deciles and Country 2004-2010

Appendix B: Regression Analysis

	Europe	Austria	Belgium	Denmark	France	Germany
Decile 1	0.409	0.308	0.482	0.604	0.120	0.995
	(0.030)**	(0.117)**	(0.058)**	(0.056)**	(0.033)**	(0.001)**
Decile 2	0.253	0.179	0.266	0.373	0.028	0.992
	(0.027)**	(0.093)	(0.054)**	(0.060)**	(0.015)	(0.002)**
Decile 3	0.182	0.164	0.206	0.232	0.008	0.992
	(0.026)**	(0.090)	(0.048)**	(0.056)**	(0.010)	(0.003)**
Decile 4	0.135	0.127	0.129	0.096	0.023	0.986
	(0.022)**	(0.080)	(0.042)**	(0.046)*	(0.016)	(0.006)**
Decile 5	0.092	0.085	0.104	0.092	-0.000	0.984
	(0.020)**	(0.066)	(0.038)**	(0.046)*	(0.007)	(0.007)**
Decile 6	0.081	0.028	0.095	0.096	-0.005	0.981
	(0.019)**	(0.042)	(0.037)*	(0.048)*	(0.006)	(0.009)**
Decile 7	0.067	0.069	0.077	0.022	-0.003	0.983
	(0.020)**	(0.061)	(0.037)*	(0.037)	(0.007)	(0.008)**
Decile 8	0.029	0.008	0.013	0.041	0.001	0.936
	(0.014)*	(0.032)	(0.023)	(0.040)	(0.008)	(0.007)**
Dedile 9	0.018	-0.008	0.006	-0.019	-0.015	0.963
	(0.017)	(0.026)	(0.026)	(0.032)	(0.003)**	(0.026)**
Secondary	-0.010	-0.004	-0.013	-0.065	0.000	-0.002
	(0.004)*	(0.007)	(0.007)	(0.013)**	(0.004)	(0.007)
Tertiary	-0.016	-0.008	-0.020	-0.121	-0.004	-0.004
	(0.004)**	(0.008)	(0.007)**	(0.013)**	(0.004)	(0.008)
Male	0.032	0.028	0.053	-0.016	0.014	0.016
	(0.004)**	(0.007)**	(0.007)**	(0.011)	(0.004)**	(0.005)**
Age55_59	0.013	-0.014	0.009	-0.000	-0.000	0.011
	(0.005)**	(0.007)	(0.008)	(0.013)	(0.003)	(0.007)
Age60_64	0.003	-0.043	0.000	-0.016	-0.015	0.006
	(0.005)	(0.007)**	(0.009)	(0.015)	(0.005)**	(0.007)
Retired	0.000	0.089	-0.050	0.019	0.007	0.007
	(0.005)	(0.013)**	(0.006)**	(0.019)	(0.009)	(0.007)
N	44,291	3,927	6,181	3,451	5,738	3,400

* p<0.05; ** p<0.01

	Italy	Netherlands	Spain	Sweden	Switzerland	US
Decile 1	0.379	0.679	0.364	0.759	0.417	0.594
	(0.084)**	(0.063)**	(0.086)**	(0.030)**	(0.086)**	(0.068)**
Decile 2	0.203	0.568	0.212	0.644	0.147	0.390
	(0.071)**	(0.073)**	(0.072)**	(0.046)**	(0.059)*	(0.069)**
Decile 3	0.111	0.374	0.111	0.519	0.054	0.219
	(0.048)*	(0.077)**	(0.055)*	(0.057)**	(0.039)	(0.056)**
Decile 4	0.088	0.317	0.102	0.392	0.039	0.150
	(0.045)	(0.077)**	(0.055)	(0.064)**	(0.034)	(0.047)**
Decile 5	0.027	0.217	0.042	0.396	0.034	0.112
	(0.027)	(0.070)**	(0.039)	(0.065)**	(0.033)	(0.040)**
Decile 6	-0.001	0.215	0.063	0.420	0.011	0.057
	(0.016)	(0.071)**	(0.048)	(0.072)**	(0.026)	(0.029)
Decile 7	0.023	0.180	-0.001	0.284	0.000	0.062
	(0.025)	(0.072)*	(0.027)	(0.082)**	(0.024)	(0.031)*
Decile 8	0.050	0.093	-0.015	0.187	-0.007	0.009
	(0.041)	(0.059)	(0.023)	(0.073)*	(0.020)	(0.017)
Dedile 9	0.020	0.091	-0.006	0.117	-0.028	0.026
	(0.023)	(0.062)	(0.029)	(0.067)	(0.009)**	(0.024)
Secondary	-0.007	-0.006	-0.025	-0.054	-0.018	-0.013
	(0.006)	(0.012)	(0.011)*	(0.023)*	(0.008)*	(0.003)**
Tertiary	-0.026	-0.030	-0.043	-0.079	-0.033	-0.019
	(0.004)**	(0.011)**	(0.010)**	(0.022)**	(0.006)**	(0.004)**
Male	0.023	0.054	0.062	-0.030	0.014	0.015
	(0.006)**	(0.011)**	(0.010)**	(0.020)	(0.007)*	(0.002)**
Age55_59	0.007	0.018	0.008	0.006	-0.001	-0.003
	(0.008)	(0.014)	(0.012)	(0.027)	(0.008)	(0.003)
Age60_64	-0.008	0.077	-0.011	-0.043	0.010	-0.010
	(0.008)	(0.016)**	(0.011)	(0.025)	(0.010)	(0.003)**
Retired	-0.004	-0.089	0.032	0.326	-0.018	0.101
	(0.007)	(0.008)**	(0.018)	(0.030)**	(0.007)*	(0.008)**
N	4,271	4,493	3,309	3,478	3,073	16,485

* p<0.05; ** p<0.01