The Impact of Social Security on Early Retirement:: A Cross-Country Analysis

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Abstract

This paper explores the relationship between social security wealth (SSW) and the decision to retire early in five countries: the United States, Germany, Denmark, Poland, and Australia. Individual probit regressions are used to analyze the impact of SSW on early retirement in each specific country. Next, a cross-country probit model including the United States, Germany, and Denmark is estimated to highlight the same relationship in three very different social insurance schemes. Finally, a counterfactual experiment is run in order to examine the impact of a 6.67 percent benefit cut on the likelihood of early retirement. This paper finds that SSW is associated with a greater likelihood of early retirement in the United States, Poland, and Denmark. However, these results are only statistically significant in the United States and Poland. Conversely, the relationship is statistically significant and negative in Australia, and statistically insignificant and negative in Germany. The counterfactual experiment reinforces these findings, demonstrating a particularly high responsiveness of a benefit cut in Denmark and Poland relative to the other countries. The results of the cross-country model finds that SSW has the largest positive effect on early retirement in the United States, followed by Germany, and finally Denmark. However, these contradictory results are not statistically significant. This paper presents interesting policy implications to consider in the United States. The statistically significant but small effect of SSW on early retirement in the United States indicates that policies aimed at reducing benefits as a means of decreasing the likelihood of early retirement may not be the most effective. Additionally, the creation of a system similar to Australia's low-cost superannuation may be worth investigating, as superannuation benefits appear to have a similar negative impact on early retirement as pension benefits in the United States.

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Introduction

In 1889, German Chancellor Otto Von Bismarck implemented the first modern social insurance system for German citizens. This system was designed to ensure that citizens were provided for in retirement. Other countries followed suit, each developing a social insurance system to provide similar coverage. However, not every social insurance system is identical, and qualifying conditions and the amount of benefits vary across countries. As a result, it is useful to view the unique impact that each country's social insurance system has on its citizens. For example, the impact of different country's social insurance benefits on elderly poverty rates could be examined. Similarly, a study could assess the impact of old-age benefits on retirees' health. In my research, I analyze the impact of old-age benefits in several countries on the incidence of early retirement.

Aside from unforeseen events, an individual's decision to retire early should be a factor of their perceived welfare in retirement. The common belief exists that retirement welfare provision should come from three pillars. According to Willmore (2000), the first pillar is a publically provided social assistance framework, in which means-tested benefits are provided to the neediest individuals in a society. The second pillar is public or private social insurance schemes. Unlike social assistance, social insurance benefits are a factor of what individuals contribute. The third pillar consists of other individual savings. Recently, the first pillar has come to include any publically provided social assistance or social insurance system. The second pillar has shifted to occupational social insurance plans, like employer pensions. While most public systems cover a significant portion of the population, access to private pensions and other retirement accounts are oftentimes necessary for adequate coverage in retirement. However, many people continue to rely solely on the publically provided social security to support

themselves in retirement. An analysis of the impact of a particular social security system on individuals' decision to retire early provides insight into the perceived adequacy of a particular social security system.

In the provision of old-age social insurance, countries have taken different approaches. A primary difference between countries is the age at while individuals can start receiving retirement benefits, often referred to as the Full Retirement Age (FRA). Individuals face the choice of when to retire relative to their country's FRA. In addition, countries have different criteria for the benefit calculation, resulting in varying levels of payments. I use survey data to analyze the impact of the level of expected public old-age benefits on the decision of an individual to retire early. By controlling for other factors including occupational pensions, individual savings, and health, the impact of each country's social security provision on the decision to retire early is isolated.

I have selected five countries for analysis: the United States, Germany, Poland, Denmark, and Australia. Each country has approached the public provision of retirement income differently, and therefore has varying levels of benefits for recipients. I estimate econometric models for each country to analyze the impact of social security wealth (SSW)[1] on the decision to retire early.

This paper begins with a review of the literature relevant to the impact of SSW on the decision to retire early. Additionally, I turn to the socio-economic literature to identify logical divisions between countries. Once a framework for country comparison is established, I overview the public social insurance schemes provided by the selected countries. These crucial differences in benefit receipt and qualifying conditions are the primary factors workers should take into account when assessing the adequacy of their SSW as they approach retirement. I then

[1] SSW is measured as the discounted expected value of total social security benefits.

discuss the datasets used in this paper. All the datasets used are compiled from household surveys and allow for the tracking of individuals across waves. Having discussed the data being used, I then outline the empirical approach this paper follows. I utilize probit regressions to analyze the impact of SSW on the incidence of early retirement. The following section discusses the results of individual probit models for each country. This is followed by a discussion of the results from the cross-country model, in which country-SSW interaction terms are included in the regression. I then create a counterfactual scenario in which SSW is reduced by a set percent across individuals and countries. Using predicted probabilities of early retirement, I estimate the impact of this benefit reduction on the incidence of early retirement. This paper concludes with a discussion of the implications of the findings, and highlights some potential avenues for future research. This paper finds that SSW has a positive and statistically significant impact on the decision to retire early in the United States and Poland, and a negative and statistically significant impact in Australia. The findings also indicate that SSW in Denmark and Germany has a positive and negative effect respectively, but these results lack statistical significance. The results of the cross-country model are less reliable, but do reinforce the significance of SSW's impact on early retirement in the United States. The counterfactual benefit cut is consistent with the findings of the individual country models, and demonstrates the high responsiveness of a benefit cut in Poland and Denmark relative to the other countries.

Literature Review

In order to carry out a cross-country analysis, a logical division between countries is required. The socio-economist Gøsta Esping-Andersen, in his *The Three Worlds of Welfare Capitalism* (1990), identifies three major "welfare regimes" to which developed countries tend to

conform. The first is the liberal regime, which emphasizes the role of the market in providing social welfare for individuals. When the government steps in to provide welfare, benefits are based on a means test and are intended to provide a minimum for the poorest members of society. The United States, for example, was classified as a liberal regime. The second regime type is the conservative or corporatist model, which focuses on the state provision of welfare, so long as individuals pay into the system. This type does not necessarily provide a minimum benefit. Germany is one of the typical examples used by Esping-Andersen. The third regime is the social democratic model. This regime is characterized by universal government provision of welfare. Denmark is a good example of the social democratic regime type. As the provision of welfare to retirees is considered a social problem, it is understandable that these regime types should have distinct pension systems that provide varying levels of support to those in retirement.

I selected the United States, Germany, and Denmark as representations of Esping-Andersen's three regime types, but wanted to include additional countries that exhibited unique public pension schemes. Natali and Stamati (2013) further divide social security systems into first- and second-generations in an attempt to identify reform patterns. They classify Poland's social security system as second-generation, with significant reforms following the fall of Communism. Accordingly, I have decided to include Poland as a representative of second-generation pension systems with recent reforms.

I have also selected Australia as a country for comparison. Agnew (2013) highlights the Australian system as one of the world's best. Specifically, Agnew emphasizes that Australia has managed to keep the cost of their system relatively low. Agnew attributes this to the division of the provision of retirement income between a public means-tested pension and the

superannuation system. The superannuation system consists of mandatory savings accounts contributed to primarily by employers. This unique retirement income feature is the primary reason for my inclusion of Australia.

Gruber and Wise (1997) look at macro trends in the labor market of eleven industrial countries to determine the impact, if any, of social security provisions on the decision of individuals to retire early. Gruber and Wise observed that, despite aging populations of industrialized countries, labor force participation rates of older workers were declining. They postulated that the existence of generous social security provisions incentivized workers to forgo extra years of work in favor of these benefits.

Gruber and Wise summarize the findings of eleven individual papers, each focusing on one of the eleven countries in the overall study. In each country, they notice a spike in individuals leaving the labor force at the earliest available age of benefits. They utilize an accrual value of SSW to observe how changes in SSW of workers nearing retirement impacts retirement decisions. They conclude that social security provisions have influenced the reduction in labor force participation of older workers worldwide. Specifically, the generosity of social security benefits at younger ages provides incentive to retire early. Further, Gruber and Wise identify that waiting to retire often decreases the total SSW of pre-retirees, so an incentive exists to retire when SSW is at its maximum amount.

Gruber and Wise (2002) elaborate on the original study, but instead focus on micro estimations to determine the impact of reform that delays benefit eligibility. With this approach, they intend to illustrate that such a reform would reduce the percentage of aging workers leaving the workforce early. They find that, on average across the twelve countries included in their study, a reform that delays benefit eligibility by three years reduces the proportion of men aged

56 to 65 out of the labor force by 23 to 36 percent. Gruber and Wise reaffirm their earlier conclusion, that social security provision has a strong impact on workers' retirement decisions.

Munnell *et al.* (2004) analyze the impact of pensions and pension wealth on expected and actual retirement age. In their analysis, they address differences between defined benefit and defined contribution retirement plans. They find that both higher pension wealth and higher defined contribution wealth increase the likelihood of an individual retiring earlier than expected. They also make an important decision regarding both pension and Social Security wealth. In their regression, they use the level of pension and Social Security wealth, as opposed to variables accounting for a change in these values. In a preliminary regression, Munnell *et al.* determined that these variables were statistically insignificant, speculating that changes in SSW and pension wealth are anticipated, and therefore should not have an impact on an individual's decision to retire. I similarly use the level of SSW as opposed to an accrual value.

Having decided on the countries for comparison, Munnell *et al.* (2015) provide guidance on the method of comparison. Munnell *et al*. create a probit model to shed light on what factors influence workers to retire before their planned retirement age. Specifically, they focus on changes in health, employment, family, and finances. The effect of each of these "shocks" is derived from the model. They conclude that health changes are the largest determinant of early retirement. Layoffs and business closings are the second most important factor. Familial changes are the next greatest determinant. They find that wealth changes are the least influential factor, at best providing a minimal impact.

While Munnell *et al*. focuses on the U.S. specifically, they create an empirical framework that will influence my own analysis. Munnell *et al.* use the *Health and Retirement Study* (HRS) for their empirical analysis. Using survey data such as the HRS, researchers can follow cohorts

and individuals across waves. Pairing HRS with a similar survey like SHARE adds the further dimension of cross-country analysis.[2] With this empirical approach, the factors in the survey year of, and prior to, an individual's retirement can be pinpointed as independent variables for regression analysis.

Country Descriptions

United States

The United States' public pension system is a social insurance and social assistance model that includes a redistributive element. Old age benefits were established in 1935, and are based on a progressive scheme in which individuals with lower incomes receive a higher proportion of their incomes as benefits. For needy citizens, there is a social assistance aspect. Social Security has a pay-as-you-go structure, with current workers covering the benefits of retirees. Workers pay 6.2 percent of covered earnings as a tax, while their employers match an additional 6.2 percent. Covered earnings are capped at $118,500. The government covers costs associated with the social assistance program.

In order to receive full benefits from the United States' Social Security system, individuals must be 66 years of age. This FRA will gradually increase until reaching 67 in 2027. Individuals must also have 40 years of coverage, with minimum earnings of $1,260 in each quarter. Old age benefits are based on the average of the top 35 years of earnings, with a maximum monthly pension benefit of $2,639. Individuals can choose to receive social security early at the age of 62, but benefits are reduced accordingly. Similarly, individuals can defer their pension up to age 70, with an 8 percent increase in benefits per year after the FRA.

[2] The SHARE dataset was established as a European retirement study comparable to the HRS. HILDA is not focused on retirement specifically, but remains fairly comparable to the HRS survey for the purposes of this paper.

Poland

Poland's old age social insurance system is comprised of three options, a social insurance option, a notional defined contribution (NDC) option, and the availability of individual accounts. Individuals can choose the general social insurance system, the NDC system, or a combination of the NDC option and individual accounts. For either the social insurance or standalone NDC options, 19.52 percent of covered earnings are taxed. This is split between the employee and the employer, each paying 9.76 percent accordingly. Contributions are capped at 30 times that national average monthly earnings, currently 3,713 zlotys (about $887). If individuals choose to combine a NDC account and an individual account, 6.84 percent of covered earnings go towards NDC and 2.92 percent towards individual accounts. In this scenario, employers continue to contribute the full 9.76 percent to the NDC account. The government covers the total cost of guaranteed minimum pensions, as well as making contributions for those on child-care leave.

In order to be eligible to receive old age benefits in Poland, an individual must have reached the FRA, which is 65 years for men and 60 for women. These ages will increase gradually to 67 by 2020 and 2040 for men and women respectively. Men require 25 years of coverage, and women require 21 years of coverage. The minimum guaranteed pension from any of the options is 844.45 zlotys (about $202) monthly. Pension benefits for the social insurance option are calculated as the sum of 24.0 percent of the base amount, 1.3 percent of earnings multiplied by the number of contributory years, and 0.7 percent of earnings multiplied by the number of noncontributory years. The earnings amount used in calculation is decided by the individual as either 10 consecutive years from the 20 years prior to the claim, or from 20 years selected from the overall coverage period. The maximum monthly pension is 250 percent of the

base amount in the previous year. The current base amount is 3,191.93 zlotys (about $763). For the NDC scheme, benefits are based on the total value of collected and indexed contributions, divided by the average life expectancy at the time of retirement. Individual accountholders are required to purchase an annuity based on the individual account amount divided by the average life expectancy at retirement.

Denmark

Denmark's old age social insurance system was established in 1891, and is characterized by both a universal pension system and a labor-market supplementary pension (ATP). The government covers the cost of the universal pension system with either monthly or quarterly contributions. The ATP supplementary pension is funded individual contributions of up to 1,134.80 kroner (about $161.80) per year, and employer contributions of up to 2,272.20 kroner (about $324) a year. Both individuals and their employers make contributions either monthly or quarterly. Denmark also offers a universal pension supplement designed to care for needy pensioners.

In order to be eligible to receive Denmark's universal old age pension, an individual must be 65 years of age. This full retirement age will increase to 67 between 2019 and 2022, and to 68 by 2030. Danish nationals must have lived at least three years in Denmark between the ages of 16 and 65, and foreign nationals must have lived at least 10 years in Denmark, with the last five years prior to retirement spent in Denmark. Individuals with at least 40 years of residence in Denmark receive the full pension amount, while a partial pension is paid to individuals with less than 40 years of residence who have met the minimum requirements. Individuals eligible for the universal old-age pension receive 72,756 kroner (about $10,374) a year. For individuals with

annual earnings over 310,000 kroner (about $44,200), the pension benefit is reduced. The ATP supplementary pension has the same age requirements, and requires continuous contributions since the start of the program in 1964, or since age 16 for individuals born after the inception date. The maximum annual amount for the ATP supplementary pension is approximately 25,000 kroner (about $3,565). The ATP supplementary pension benefits can be deferred, and increase by 5.0 percent for each deferred year. The universal pension supplement is income-tested, with reductions for single individuals with income greater than 64,900 kroner (about $9,254) per year or married couples earning 137,300 per year (about $19,577). The benefit received by an unmarried individual eligible for the universal supplement is 76,788 kroner (about $10,949) per year. Married individuals each receive 37,632 kroner (about $5,366) per year. [3]

Australia

Australia's old age social insurance program is comprised of a universal pension and a mandatory occupational pension system (superannuation). The universal pension system is funded in full by general revenue. Employers fund the superannuation, providing 9.5 percent of employee's earnings. Individuals can contribute voluntarily. The government matches A$0.5 for every A$1 of voluntary individual contributions up to A$500 (about $373) a year for after-tax incomes up to A$34,488 (about $25,725), with the match decreasing steadily for higher incomes.

In order to be eligible to receive Australia's universal pension, individuals must be 65 years of age and must have been an Australian citizen for 10 years, 5 of which having been continuous. Single individuals can receive up to A$766.70 (about $572) every two weeks. Married persons can each receive up to A$585.50 (about $437) every two weeks. Additionally,

[3] All country data provided by the Social Security Administration (2016).

individuals who choose to work beyond the full retirement age can earn up to A$250 (about $186) every two weeks without a reduction in benefits.

Germany

Germany's social security system is a social insurance scheme that covers all employed persons. The German system is pay-as-you-go; current workers pay taxes to cover the current pension costs of retirees. The German first-pillar social security system is incredibly extensive, with 85 percent of pension income coming from this system.[4] For workers making over €850 (about $900) per month, 18.9 percent of total income is collected as a tax to finance the system. The individual pays 9.45 percent and the employer pays 9.45 percent on their employee's behalf. The government only steps in to subsidize certain costs. Employees making between €450 and €850 a month contribute a reduced portion of their income, with the remainder subsidized by the government. The government covers contributions for individuals making less than €450 a month.

In order to receive benefits from the German system, individuals must be 65 years and 3 months of age. This FRA is in the process of rising to 67 by 2029. The early retirement age is currently 63, and will increase to 67 by 2029, at which point early retirement benefits will cease to exist. Individuals receive earnings points which are calculated as lifetime earnings divided by the average national earnings amount, which is currently €34,857 (about $36,970), multiplied by the normal entry factor, which starts at 1.0 and changes depending on age relative to the FRA.

Data

[4] Huang (2010).

For data pertinent to the United States, I have utilized waves 8 through 12 of the RAND Corporation's compilation of the Health and Retirement Study (HRS). The HRS is conducted by the Institute for Social Research at the University of Michigan and is sponsored by the National Institute on Aging. The HRS follows individuals ages 50 an older based on cohorts by birth year, and collects responses regarding health, retirement, and aging every two years. The RAND Corporation has compiled the overall HRS survey and responses into accessible datasets with comparable variables across cohorts. The RAND dataset is comprehensive, but allows for merging of additional variables from the larger HRS dataset.

For aging and retirement data for Poland, Germany, and Denmark, I have utilized waves 2 through 5 of the Survey of Health, Ageing, and Retirement in Europe (SHARE). SHARE is a multi-national survey similar to HRS, which collects data from several European countries. Waves 2, 4, and 5 provide relevant employment data based on the same survey questions. The third wave used a different survey that focused on qualitative and employment data, and includes the Job Employment Panel (JEP) dataset. SHARE researchers used the JEP dataset to generate the SSW variable. Initially, I used the easySHARE dataset, which condenses the larger dataset to include a short list of relevant variables. I merged easySHARE with aspects of the larger SHARE dataset to account for SSW and pension benefit data. Individuals are tracked across wave, so changes in their employment, wealth, and health as they approach retirement can be observed.

For Australia, I utilized waves 8 through 15 of the Household, Income, and Labor Dynamics in Australia (HILDA) survey. HILDA is a panel dataset that has tracked respondents since 2001. The HILDA survey is carried out yearly, and there are currently 15 waves of collected information. Relevant social security and superannuation data is collected from waves 8 onward.

The SHARE, HRS, and HILDA datasets have individual variables that account for retirement income. Each country's unique social security system is accounted for by a social security wealth (SSW) variable.[5] Other variables are included as controls, accounting for individual's health, financial situation, marital status, private pensions and savings, and presence of a dependent living in household, among other factors.

In both the HRS and SHARE datasets, SSW has been generated for respondents. Coile and Gruber (2000), a United States-specific paper that contributed results for Gruber and Wise (2002), generated SSW for HRS respondents using Social Security Administration earnings histories for each individual respondent. The variable SSW reflects the expected net present discounted value of social security wealth.[6] They cross-checked their simulation model with the Social Security Administration's ANYPIA model, which can be used to calculate benefits. Since this publication, the HRS dataset has calculated a SSW variable using the Social Security Administration's ANYPIA model. The HRS survey provides three calculations of SSW for each individual to account for early, normal, and late retirement. In my model, I have decided to utilize the value of SSW that accounts for early retirement.

The SHARE dataset has also included a variable to account for SSW. Belloni et al (2016) details the process through which these values are calculated. They generate the SSW variable using reported information on individual's incomes and expected benefits. Their calculation of SSW estimates the lower bound of an individual's social security wealth.[7] Accordingly, SHARE's SSW variable should be fairly comparable with the HRS SSW variable, which estimates the social security wealth of individuals assuming an initial claim at age 62. If an

[5] The HILDA dataset doesn't have a SSW variable, but instead includes variables that account for the annual income from social security and superannuation benefits.
[6] Coile and Gruber (2000)
[7] SHARE SSW variable is reported in 2010 Euros.

individual is missing SSW for the wave in which they retire, I have used the most recent value calculated prior to their retirement.

For each country, I have reduced the sample to only those individuals who reported that they have retired, and are age 55 or older at the time of their retirement. I dropped any individuals who are reported as retired during their first observable wave, as these individuals may have initially retired in a previous wave. Similarly, I drop any observation after an individual has retired for the first time. Based on their age and the social security rules of the country that they live in, I was able to determine when an individual retired relative to the FRA of their country. Individuals retiring before their associated FRA are classified as early retirees.

The descriptive statistics of the variables included in each model are found in Tables 2, 3, 4, 5, 6, and 7 below. I have indexed all monetary variables to the year 2011.[8] The sample probability of early retirement in the United States is .7229, in Poland is .3714, in Denmark is .2917, in Australia is .5552, and in Germany is .4145. These probabilities indicate that the probability of an individual retiring early in the sample is largest in the United States and smallest in Denmark.

Methodology

With these datasets, I estimate probit regressions that analyze the impact that social security benefits (either as an expected wealth value, or as an actual stream of benefits) have on the decision of an individual to retire early. The magnitudes of coefficients of independent variables in a probit model are largely unimportant on their own; only the sign and t-statistic values provide relevant information. From this basic model, it can only be concluded if certain

[8] Net worth values are further indexed to US 2011 dollars using purchasing power parity (PPP) values in the cross-country model.

variables have a statistically significant impact on the dependent variable. Accordingly, I follow up the probits with an analysis of the marginal effects of each independent variable on the dependent variable. By presenting marginal effects and the associated standard errors, I can make more definitive claims as to the impact of SSW on the decision to retire early.

The model that is estimated is below:

$$earlyretire_i = \beta_0 + \beta_1 \ln(SSW_i) + \beta_2 x_i + \varepsilon_i$$

Where:

earlyretire is a value of 0 or 1

SSW is the discounted expected value of social security benefits received[9]

x are other dependent variables (see Table 1)

ε is the error term

Results

Individual Country Models

For each country, I estimate a probit model with *earlyretire* as the dependent variable and the natural log of *SSW* as the primary explanatory variable of interest. The additional explanatory variables are listed in Table 1. The results for the United States, Poland, Denmark, Australia, and Germany are below.

United States

[9] The initial SSW variable is adjusted for inflation, then the log is taken so that the coefficient can be interpreted as the percent change in SSW.

The results of the United States model are found in Table 8. The model estimates the probability of early retirement using a sample of 1,547 individuals across the years 2008, 2010, 2012 and 2014. The base year is 2010 and the base region is the Midwest. Of the individuals included in the sample, 72.27 percent retired earlier than the FRA. Marital status was omitted from the regression due to collinearity.

The results of the probit regression indicate that SSW has a positive and statistically significant impact on the decision to retire early. For every additional 1 percent increase in SSW, an individual is 0.025 percentage points more likely to retire early. Conversely, pension value had a statistically significant negative impact, with a 1 percent increase predicting a 0.006 percentage point reduction in the likelihood of early retirement. Household net worth also had a negative and statistically significant impact, with each additional $100,000 resulting in a 0.002 reduction in the likelihood of early retirement. The model also predicted that individuals that have fair or poor health, have recently experienced a health shock, are depressed, and have living parents are more likely to retire early. Blacks and Hispanics are also statistically significantly more likely to retire early. The age difference with an individual's spouse, whether their spouse is retired, and whether their spouse reported poor or fair health have statistically significant negative effects on the decision to retire early.

Poland

The results of the Poland model are found in Table 9. The model estimates the probability of early retirement using a sample of 175 individuals across the years 2011, 2012, and 2013. Of the individuals included in the sample, 37.14 percent retired earlier than the FRA. Pension value,

marital status, and the dummy variables representing the years 2012 and 2013 are omitted from the regression due to collinearity.

The Poland model indicates that SSW has a positive and statistically significant impact on the decision to retire early. For each additional 1 percent in SSW, an individual is 0.245 percentage points more likely to retire. Other individual retirement savings do not have a statistically significant impact on the decision to retire early. Women are statistically significantly less likely to retire early. Additionally, having a higher body mass index, having spent an overnight in the hospital over the past year, and the age difference with an individual's partner have statically significant negative effects on the likelihood of early retirement.

Denmark

The results of the Denmark model are found in Table 10. The model estimates the probability of early retirement using a sample of 144 individuals across the years 2011, 2012, and 2013. Of the individuals included in the sample, 29.17 percent retired earlier than the FRA. Additionally, the year dummy variable for 2012 is omitted from the regression due to collinearity.

The probit estimates indicate that SSW has a positive, but statistically insignificant, impact on the decision to retire early. For every additional 1 percent in SSW, the model predicts a 0.147 percentage point increase in the probability of early retirement. An individual's pension value has a statistically insignificant negative impact on the decision to retire early. The marginal effects indicate that for each additional 1 percent in pension value, an individual is 0.003 percentage points less likely to retire early. Other individual retirement savings do not have a statistically significant impact on the decision to retire early. However, an individual's earnings

from the previous year have a statistically significant positive impact. The marginal effects indicate that for each additional 1 percent in earnings, an individual is 0.051 percentage points more likely to retire early. The results also suggest that having fair or poor self-reported health and having spent an overnight in the hospital over the past year have statistically significant negative effects on the decision to retire early.

Australia

The results of the Australia model are found in Table 11. The model estimates the probability of early retirement using a sample of 281 individuals across the years 2010, 2011, 2012, 2013, 2014, and 2015. The base year is 2010 and the base region is the Northern Territory. Of the individuals in the sample, 55.52 percent retired earlier than the FRA. The year dummy variables for 2011, 2012, 2013, and 2015 were omitted from the regression due to collinearity.

The Australia model indicates that social security has a negative and statistically significant impact on the decision to retire early.[10] The marginal effects indicate that for each additional 1 percent in social security benefits, an individual is 0.053 percentage points less likely to retire. Similarly, individuals with larger superannuation funds are statistically significantly less likely to retire early. The marginal effects indicate that for each additional 1 percent in superannuation benefits, an individual is 0.019 percentage points less likely to retire early. Net worth also has a negative and statistically significant impact on the decision to retire early, with a 0.004 percentage point decrease in the probability of early retirement for each additional A$100,000 in net worth. The results also suggest that women and individuals with fair or poor self-reported health are statistically significantly more likely to retire early.

[10] It is important to note that the log of social security variable was replaced with zeroes for individuals that reported no social security income in Australia. Since social security in Australia is a social assistance program, the regression would omit a significant portion of the population otherwise.

Germany

The results of the Germany model are found in Table 12. The model estimates the probability of early retirement using a sample of 152 individuals across the years 2011, 2012, and 2013. Of the individuals included in the sample, 41.45 percent retired earlier than the FRA.

The probit estimates indicate that SSW has a negative, but statistically insignificant, impact on the decision to retire early. Although insignificant, the marginal effects indicate that for each additional 1 percent increase in SSW, an individual is .029 percentage points less likely to retire early. Conversely, for every 1 percent increase in pension value, an individual is .006 percentage points more likely to retire early. However, the effect of pension value is not statistically significant in the estimation. Individual retirement savings does have a statistically significant positive impact on the decision to retire early. The marginal effects indicate that for each additional 1 percent in individual retirement savings, an individual is 0.19 percentage points more likely to retire early. The results also suggest that an individual's age difference with their partner and their number of grandchildren have are statistically significant negative effects on the decision to retire early.

Cross-Country Model

Consistent with the framework created by Esping-Andersen (1990), I next estimate a model that includes individuals from the United States, Germany, and Denmark. These countries were selected to represent the liberal, corporatist, and social democratic welfare state regimes as detailed in *The Three Worlds of Welfare Capitalism*. An additional benefit is that the SSW values for these countries are measured similarly. Therefore, a model that includes these three countries

may provide insight into how each country's social security system impacts the decision to retire early.

The structure of the cross-country model is the same as the individual country models, with the inclusion of country dummy variables, country-SSW interaction terms, and country-pension interaction terms. The model to be estimated is below:

$$earlyretire_i = \beta_0 + \beta_1\, SSW_i + \beta_2\, SSW{*}Germany_i + \beta_3\, SSW{*}Denmark_i + \beta_4\, x_i + \varepsilon_i$$

When this model is estimated, the coefficient on *SSW* is interpreted as the impact of SSW on early retirement for individuals from the United States. The impact of SSW for an individual from Germany is the coefficient of *SSW* plus the coefficient of *SSW*Germany*. For an individual from Denmark, the impact of SSW is the coefficient of *SSW* plus the coefficient of *SSW*Denmark*. The additional dependent variables included in the cross-country model are listed in Table 1.

The results of the cross-country model are found in Table 13 below. The model estimates the probability of early retirement using a sample of 557 individuals across the years 2008, 2009, 2010, 2011, 2012, 2013, and 2014. The base year is 2008. Within the sample, 51.62 percent of individuals retired before reaching the FRA in their country. The dummy variables for the years 2009, 2010, 2013, and 2014 are omitted from the regression due to collinearity.

The coefficient of SSW in the United States is statistically significant, but the Germany and Denmark SSW interaction terms are not. Nevertheless, there are some interesting takeaways from the model. First, the marginal effects of the social security wealth and SSW-country interaction terms suggest that an increase in SSW by 1 percent has the largest effect on early

retirement in the United States, followed by Germany, and the smallest in Denmark. At the same time, the model predicts that a 1 percent increase in pension value has the largest effect in Germany, followed by the United States, and the smallest in Denmark. These results appear to contradict the individual country models and the upcoming results of the counterfactual predictions. However, the lack of statistically significance on the majority of the variables weakens these findings.[11]

Counterfactual Predictions

Despite the lack of statistically significant results on some key variables in the cross-country model, it is beneficial to conduct a counterfactual prediction in which a benefit reduction is applied across the board to the SSW of individuals. A logical benefit reduction that can be applied is a cut of 6.67 percent. This amount comes from the benefit reduction associated with an increase of the FRA from 66 to 67 in the United States.

The process of calculating the difference in predicted probabilities of early retirement starts with the probit estimation for each individual country, carried out above. The 6.67 percent benefit cut is then applied to the SSW variable, and the predicted probability of early retirement is recalculated using the same estimated marginal effects. With this approach, the new predicted probability as a result of the benefit reduction is compared to the benchmark probability. The responsiveness of benefit reductions should differ by country, and provide an additional method of cross-country analysis.

The results of the counterfactual exercise are pictured in Graph 1. In the United States, the predicted probability of early retirement was 71.77 percent before the benefit reduction. After

[11] The variable *pension*, which represents the effect of pension value in the United States, has a statistically significantly negative impact on the decision to retire early. The pension-country interaction terms for Germany and Denmark are not statistically significant.

the 6.67 percent reduction, the predicted probability of early retirement decreased to 71.65 percent. In Germany, the predicted probability increased from 41.35 percent to 41.55 percent. In Denmark, the predicated probability decreased from 29.24 percent to 28.22 percent. In Poland, the predicted probability decreased from 37.23 percent to 35.54 percent. In Australia, the predicted probability increased from 55.56 percent to 55.78 percent.

The results of the counterfactual benefit reduction reinforce the findings of the individual country models. In the United States, Denmark, and Poland, a benefit cut resulted in a lowered probability of early retirement. Based on the individual country model estimates, individuals with more SSW are more likely to retire early (though only modestly in the United States); the counterfactual exercise reinforces this relationship. The opposite result is seen in Germany and Australia, as the predicted probabilities of early retirement increased in both countries as a result of the counterfactual benefit reduction. The marginal effects of these individual country models had suggested that an increase in SSW (or social security benefits in Australia) would result in a decreased likelihood of early retirement. Therefore, a benefit reduction would result in a higher probability of early retirement, as evident from the counterfactual exercise.

Further, it appears that certain countries were more responsive to the cut. Poland and Denmark both experienced changes of 1 percentage point or larger, while the United States, Australia, and Germany experienced changes of less than 0.3 percentage points. These levels are also consistent with the individual country models. Poland and Denmark both had predicted marginal effects of a greater than 0.1 percentage point in absolute value, while the United States, Australia, and Germany had marginal effects of less than 0.1 percentage point.

Conclusion

The purpose of this paper was to analyze how different countries' social security systems impacted the early retirement decision of citizens. The attempt to better understand early retirement incentives that may exist in different social security systems started with an individual look at the impact of SSW on early retirement in the five countries featured in the paper. The individual country models yielded some interesting results. In the United States, Poland, and Denmark, SSW appears to have a positive effect on the likelihood of early retirement. However, only the results from the United States and Poland are statistically significant, though the effect in the United States is small. In Germany and Australia, SSW (or the level of social security benefits in Australia) appears to have a negative effect on the likelihood of early retirement. However, only the results from Australia are statistically significant, and both countries see small impacts on early retirement.

The next approach was a cross-country model that included the United States, Denmark, and Germany. These countries were selected to coincide with the three welfare state regimes described by Esping-Andersen (1990). The results of the cross-country model indicate that the SSW in the United States has the largest impact on the decision to retire early, followed by Germany, then Denmark. However, only the United States has statistically significant results, and potential differences in survey data across countries most likely decreased the accuracy and reliability of the results.

An additional method of generating cross-country results was a counterfactual exercise in which the predicted probabilities of early retirement were compared before and after a hypothetical benefit reduction. The results of this exercise reinforce the findings of the individual country models, with a benefit reduction resulting in a decrease in early retirement in the United States, Poland, and Denmark, and an increase in early retirement in Germany and Australia.

Looking forward, there are several takeaways and potential policy implications that can be drawn from the results. When Gruber and Wise (1997) started their research, they suspected that the social security systems in several countries were negatively impacting the labor force participation rates of older workers. They observed a spike in the number of retirees at the first availability of social security benefits, which poses a particularly sizeable problem in countries with aging populations. In the years since, measures have been implemented to create disincentives for individuals to retire before the FRA in their country. As mentioned in the counterfactual exercise, one method may be to increase the FRA, effectively increasing the penalty of claiming social security early. Interestingly, this may not be an effective method in decreasing the incidence of early retirement in the Untied States. Although SSW has a statistically significant effect on early retirement, this impact is small. Accordingly, reducing an individual's SSW in the United States will not have a large reduction on their likelihood of early retirement. Instead, it may be beneficial to find alternative methods of discouraging early retirement that are not dependent on reducing the level of benefits an individual expects to receive.

Another interesting finding is the significance of the superannuation system in Australia. This paper finds that an increase in superannuation benefits translates into a decreased probability of early retirement. In the United States, employer pensions have a similar negative relationship with early retirement. Agnew (2013) emphasizes that one of the attractive features of the superannuation system is the low cost to the government to provide adequate retirement income for individuals. As superannuation benefits in Australia and employer pension benefits in the United States appear to have similar impacts on early retirement, the creation of a similar

system in the United States may be beneficial in light of continuing debate over how to increase workers' access to retirement saving and improve the sustainability of Social Security.

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Table 1. Variables Included in Each Regression (by country)

Variables	United States	Germany	Denmark	Poland	Australia	Cross-Country
Social Security Wealth (log)	x	x	x	x	x*	x
Country*Social Security Wealth (log)						x
Pension (log)	x	x	x			
Country*Pension (log)						x
Superannuation (log)					x	x
Other Individual Retirement Savings (log)		x	x	x		
Net Worth (units of 100,000)	x	x	x	x	x	x
Earnings Previous Year (log)	x	x	x	x	x	x
Fair or Poor Health	x	x	x	x	x	x
Health Shock	x	x	x	x	x	x
BMI	x	x	x	x	x	x
Overnight Hospital Past Year		x	x	x		
Depressed	x	x	x	x		x
Married		x	x		x	x
Age Difference With Partner	x	x	x	x		x
Spouse Retired	x					
Spouse Fair or Poor Health	x					
Spouse Health Shock	x					
Living Parents	x					
Resident Child		x	x	x	x	
Number of Grandchildren		x	x	x		
Years of Education	x	x	x	x	x	x
Female		x	x	x	x	x
Black	x					
Hispanic	x					
Region Dummy Variables	x				x	
Country Dummy Variables						x
Year Dummy Variables	x	x	x		x	x

*Australia's social security variable is reported in the level of annual benefits, not as a wealth measure.

Table 2. Descriptive Statistics of Variables (United States)

	mean	std. dev.
Early Retire	0.7227	0.4478
Social Security Wealth (log)	11.5796	0.8168
Pension (log)	2.1771	3.9785
Household Net Worth (units of $100,000)	3.6555	9.0943
Earnings Previous Year (log)	6.2922	5.1139
Fair or Poor Health	0.2702	0.4442
Health Shock	0.2140	0.4102
BMI	29.5404	6.3377
Depressed	0.1209	0.3261
Age Difference	-0.1144	6.1522
Spouse Retired	0.4221	0.4941
Spouse Fair or Poor Health	0.2262	0.41853
Spouse Health Shock	0.2107	0.4080
Living Parents	0.3484	0.5705
Years of Education	13.0886	2.8833
Black	0.1345	0.3412
Hispanic	0.1222	0.3276
Female	0.5436	0.4983
Northeast	0.1364	0.3433
South	0.4215	0.4940
West	0.1855	0.3888
Year 2010	0.2204	0.4147
Year 2012	0.2754	0.4468
Year 2014	0.2676	0.4429
Number of Observations		1,547

Table 3. Descriptive Statistics of Variables (Poland)

Variable	mean	std. dev.
Early Retire	0.3714	0.4846
Social Security Wealth (log)	10.7011	0.6035
Other Individual Retirement Savings (log)	8.0226	0.5366
Net Worth (units of €100,000)	0.4485	0.4469
Earnings Previous Year (log)	3.5008	4.0105
Fair or Poor Health	0.4457	0.4985
Health Shock	0.3429	0.4760
BMI	28.5222	4.0490
Overnight Hospital Past Year	0.1543	0.3623
Depressed	0.88	0.3259
Age Difference With Partner	-0.64	4.5538
Resident Child	0.5371	0.5000
Number of Grandchildren	3.4743	3.1069
Years of Education	9.85714	2.56572
Female	0.54857	0.4991
Observations		175

Table 4. Descriptive Statistics of Variables (Denmark)

Variable	mean	std. dev.
Early Retire	0.2917	0.4561
Social Security Wealth (log)	11.5782	0.3571
Other Individual Retirement Savings (log)	6.7533	5.7060
Net Worth (units of €100,000)	5.2017	5.2439
Earnings Previous Year (log)	8.7810	3.4099
Fair or Poor Health	0.0903	0.2876
Health Shock	0.2639	0.4423
BMI	25.4293	3.4201
Overnight Hospital Past Year	0.0972	0.2973
Depressed	0.5486	0.4994
Age Difference With Partner	0.4583	6.1519
Resident Child	0.0764	0.2665
Number of Grandchildren	3.4722	2.8822
Years of Education	14.0104	2.9527
Female	0.5764	0.4959
Observations		144

Table 5. Descriptive Statistics of Variables (Australia)

	mean	std. dev.
Early Retire	0.5552	0.4978
Social Security (log)	4.7672	4.6638
Superannuation (log)	3.4475	4.7687
Net Worth (units of 100,000)	11.0274	12.5555
Earnings Previous Year (log)	4.7506	4.9993
Fair or Poor Health	0.2847	0.4521
Health Shock	0.2028	0.4028
BMI	27.3050	5.3293
Married	0.6512	0.4774
Resident Child	0.1957	0.3975
Years of Education	10.4698	1.5024
Female	0.5302	0.5000
New South Wales	0.2562	0.4373
Victoria	0.2384	0.4269
Queensland	0.2349	0.4247
Tasmania	0.0320	0.1764
Australian Capital Territory	0.0249	0.1561
Western Australia	0.0854	0.2800
South Australia	0.1246	0.3308
Year 2014	0.5018	0.5009
Number of Observations		281

Table 6. Descriptive Statistics of Variables (Germany)

Variable	mean	std. dev.
Early Retire	0.4145	0.4943
Social Security Wealth (log)	11.5318	1.1031
Other Individual Retirement Savings (log)	5.2868	5.0924
Net Worth (units of €100,000)	2.5785	2.3251
Earnings Previous Year (log)	5.5532	4.5392
Fair or Poor Health	0.2895	0.4550
Health Shock	0.2697	0.4453
BMI	27.3026	4.9687
Overnight Hospital Past Year	0.2039	0.4043
Depressed	0.7434	0.4382
Age Difference With Partner	-0.4211	4.9387
Resident Child	0.1974	0.3993
Number of Grandchildren	2.25	2.5482
Years of Education	13.1381	3.4928
Female	0.5921	0.4931
Observations		152

Table 7. Descriptive Statistics of Variables (Cross-Country)

	mean	std. dev.
Early Retire	0.5162	0.5001
Social Security Wealth (log)	11.5623	0.7773
Social Security Wealth*Denmark (log)	2.4518	4.7367
Social Security Wealth*Germany (log)	2.5777	4.8358
Pension (log)	2.3049	3.9093
Pension*Denmark (log)	0.7506	2.4823
Pension*Germany (log)	0.3812	1.6297
Net Worth (units of $100,000)	4.4485	9.0575
Earnings Previous Year (log)	6.6452	4.8131
Fair or Poor Health	0.2294	0.4208
Health Shock	0.2426	0.4290
Married	0.9824	0.1318
BMI	27.9902	5.7575
Depressed	0.3456	0.4759
Years of Education	13.1419	3.1396
Female	0.5294	0.4995
Age Difference	0.1721	6.0008
Denmark	0.2118	0.4089
Germany	0.2235	0.4169
Year 2011	0.25588	0.4367
Year 2012	0.0147	0.1205
Year 2013	0.1647	0.3712
Number of Observations		680

Table 8. Marginal Effects on Probability of Early Retirement (United States)

	Marginal effect	
Social Security Wealth (log)	0.025	*
	(0.015)	
Pension (log)	-0.006	**
	(0.003)	
Household Net Worth (units of $100,000)	-0.002	*
	(0.001)	
Earnings Previous Year (log)	0.001	
	(0.002)	
Fair or Poor Health	0.074	***
	(0.029)	
Health Shock	0.052	*
	(0.027)	
BMI	0.002	
	(0.002)	
Depressed	0.081	**
	(0.039)	
Age Difference	-0.005	***
	(0.002)	
Spouse Retired	-0.100	***
	(0.023)	
Spouse Fair or Poor Health	-0.045	*
	(0.027)	
Spouse Health Shock	-0.001	
	(0.027)	
Living Parents	0.190	***
	(0.022)	
Years of Education	0.001	
	(0.005)	
Black	0.116	***
	(0.035)	
Hispanic	0.085	**
	(0.040)	
Female	0.022	
	(0.026)	
Northeast	-0.012	
	(0.036)	
South	-0.010	
	(0.027)	
West	0.025	
	(0.034)	

Year 2010	0.087	***
	(0.031)	
Year 2012	0.144	***
	(0.030)	
Year 2014	0.056	*
	(0.029)	
Sample size	1,547	
R-squared	0.1090	
Sample probability of early retirement	72.27%	

Note: *p<0.05, ** p<0.01, ***p<0.001

Table 9. Marginal Effects on Probability of Early Retirement (Poland)

Variables	Marginal effect	
Social Security Wealth (log)	0.245	***
	(0.066)	
Other Individual Retirement Savings (log)	0.010	
	(0.061)	
Net Worth (units of €100,000)	0.096	
	(0.075)	
Earnings Previous Year (log)	0.010	
	(0.008)	
Fair or Poor Health	-0.023	
	(0.072)	
Health Shock	0.011	
	(0.070)	
BMI	-0.018	**
	(0.008)	
Overnight Hospital Past Year	-0.197	**
	(0.099)	
Depressed	-0.132	
	(0.106)	
Age Difference With Partner	-0.017	*
	(0.010)	
Resident Child	0.096	
	(0.066)	
Number of Grandchildren	-0.006	
	(0.012)	
Years of Education	-0.002	
	(0.015)	
Female	-0.158	*
	(0.084)	
Sample size	175	
R-squared	0.2082	
Sample probability of early retirement	37.14%	

Note: *p<0.05, ** p<0.01, ***p<0.001

Table 10. Marginal Effects on Probability of Early Retirement (Denmark)

Variables	Marginal effect	
Social Security Wealth (log)	0.147	
	(0.107)	
Pension (log)	-0.003	
	(0.007)	
Other Individual Retirement Savings (log)	0.002	
	(0.006)	
Net Worth (units of €100,000)	0.008	
	(0.006)	
Earnings Previous Year (log)	0.051	***
	(0.019)	
Fair or Poor Health	-0.396	***
	(0.146)	
Health Shock	0.047	
	(0.066)	
BMI	0.007	
	(0.008)	
Overnight Hospital Past Year	-0.293	***
	(0.109)	
Depressed	0.020	
	(0.060)	
Married	-0.217	
	(0.162)	
Age Difference With Partner	-0.006	
	(0.005)	
Resident Child	0.083	
	(0.108)	
Number of Grandchildren	-0.019	
	(0.012)	
Years of Education	-0.006	
	(0.011)	
Female	0.072	
	(0.061)	
Year 2013	0.442	***
	(0.078)	
Sample size	144	
R-squared	0.4893	
Sample probability of early retirement	29.17%	

Note: *p<0.05, ** p<0.01, ***p<0.001

Table 11. Marginal Effects on Probability of Early Retirement (Australia)

Variables	Marginal effect	
Social Security (log)	-0.053	***
	(0.005)	
Superannuation (log)	-0.019	***
	(0.006)	
Net Worth (units of A$100,000)	-0.004	*
	(0.002)	
Earnings Previous Year (log)	0.004	
	(0.005)	
Fair or Poor Health	0.149	***
	(0.057)	
Health Shock	0.002	
	(0.063)	
BMI	-0.001	
	(0.005)	
Married	-0.005	
	(0.053)	
Resident Child	0.074	
	(0.064)	
Years of Education	0.007	
	(0.018)	
Female	0.085	*
	(0.048)	
New South Wales	-0.990	
	(46.404)	
Victoria	-0.975	
	(46.404)	
Queensland	-0.954	
	(46.404)	
Tasmania	-0.828	
	(46.404)	
Australian Capital Territory	-1.037	
	(46.404)	
Western Australia	-1.071	
	(46.404)	
South Australia	-1.024	
	(46.404)	
Year 2014	0.033	
	(0.051)	
Sample size	281	
R-Squared	0.2890	

Sample probability of early retirement	55.52%

Note: *p<0.05, ** p<0.01, ***p<0.001

Table 12. Marginal Effects on Probability of Early Retirement (Germany)

	Marginal effect	
Social Security Wealth (log)	-0.029	
	(0.041)	
Pension (log)	0.006	
	(0.012)	
Other Individual Retirement Savings (log)	0.019	***
	(0.007)	
Net Worth (units of €100,000)	-0.014	
	(0.017)	
Earnings Previous Year (log)	0.011	
	(0.009)	
Fair or Poor Health	-0.094	
	(0.091)	
Health Shock	0.092	
	(0.085)	
BMI	-0.008	
	(0.008)	
Overnight Hospital Past Year	0.102	
	(0.097)	
Depressed	0.130	
	(0.092)	
Married	0.037	
	(0.187)	
Age Difference With Partner	-0.020	**
	(0.009)	
Resident Child	0.107	
	(0.092)	
Number of Grandchildren	-0.058	***
	(0.018)	
Years of Education	0.012	
	(0.012)	
Female	-0.042	
	(0.108)	
Year 2012	0.038	
	(0.147)	
Year 2013	0.073	
	(0.093)	
Sample size	152	
R-squared	0.1998	
Sample probability of early retirement	41.45%	

Note: *p<0.05, ** p<0.01, ***p<0.001

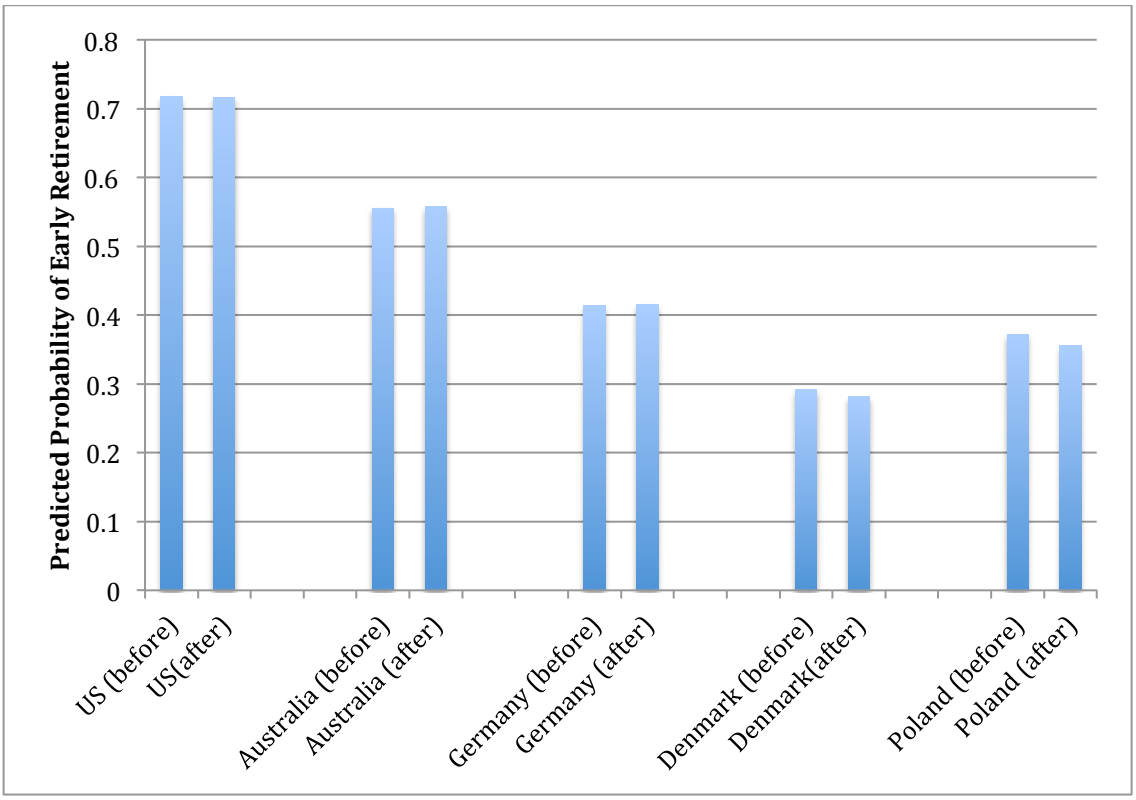
Table 13. Marginal Effects on Probability of Early Retirement (Cross-Country)

Variables	Marginal effect
Social Security Wealth (log)	0.096***
	(0.033)
Social Security Wealth*Denmark (log)	-0.0670
	(0.1341)
Social Security Wealth*Germany (log)	-0.050
	(0.046)
Pension (log)	-0.0097*
	(0.0058)
Pension*Denmark (log)	-0.0013
	(0.0115)
Pension*Germany (log)	0.0161
	(0.0128)
Net Worth (units of $100,000)	0.004
	(0.002)
Earnings Previous Year (log)	0.008*
	(0.004)
Fair or Poor Health	0.053
	(0.045)
Health Shock	0.067
	(0.041)
Married	0.078
	(0.145)
BMI	0.001
	(0.003)
Depressed	0.079*
	(0.047)
Years of Education	0.003
	(0.006)
Female	0.085**
	(0.043)
Age Difference	-0.007**
	(0.003)
Denmark	0.545
	(1.557)
Germany	0.551
	(0.528)
Year 2011	-0.364***
	(0.060)

Year 2012	-0.212 (0.151)
Sample size	680
R-squared	0.1521
Sample probability of early retirement	51.62%

Note: *p<0.05, ** p<0.01, ***p<0.001

Graph 1. Predicted Probabilities of Early Retirement Before and After 6.76% Benefit Cut



Graph 2. Change in Predicted Probabilities of Early Retirement