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Social Policy Expenditures and Life Expectancy in High-Income Countries

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Abstract

Introduction The US spends more than any other country on healthcare, yet Americans have lower life expectancy than most industrialized countries. Recent studies suggest that lower expenditures on social policies in the US may contribute to less favorable trends in life expectancy. This study tests the hypothesis that greater social spending will be positively associated with life expectancy across the countries of the OECD and that the magnitude of these associations will outweigh those between government healthcare spending and life expectancy.

Methods In 2016, longitudinal data on six domains of social expenditures for the US and 19 other wealthy nations between 1980 and 2010 was used to estimate the associations between prior-year expenditures on education, family, unemployment, incapacity, old age and active labor market programs (ALMP) and period life expectancy using fixed effects models.

Results Controlling for a wide set of confounders and government healthcare expenditures, a one percent increase in prior-year education expenditures was associated with 0.160 (95% confidence interval 0.033 0.286) of a year gain in life expectancy, while a one percent increase in prior-year incapacity benefit expenditures was associated with 0.168 (0.003 0.333) of a year gain in life expectancy. Counterfactual models suggest that if the US were to increase expenditures on education and incapacity to the levels of the country with the maximum expenditures, life expectancy would increase to 80.12 years.

Conclusions The US life expectancy lag may be considerably smaller if US expenditures on education and incapacity programs were comparable to those in other high-income countries.

Introduction

The United States spends more than any other country on healthcare, yet Americans have worse health and lower life expectancy than most industrialized countries. In 2016, the US ranked 42nd in global life expectancy, below most industrialized nations. Proposed explanations include differences in healthcare, behavior and the built environment, all of which appear to play some role but do not fully explain the US health disadvantage. [1] Recently, focus has shifted towards the potential role of social policy, with reports suggesting that lower social expenditures in the US relative to peer nations may contribute to less favorable life expectancy trends. As yet, however, few studies have examined whether higher social expenditures lead to life expectancy gains.

Emerging research from within the United States provides evidence that social expenditures may bring benefits to health. In a recent study, a higher ratio of state social welfare spending relative to healthcare spending was associated with significant improvements in a variety of health outcomes. [2,3] Cross-national evidence suggests that several social programs may have positive associations with health including parental leave, child allowances and subsidized child care, [4-6] unemployment benefits and education. [7,8,9,10] Experimental evidence from the US also suggests that social programs, such as intensive early childhood interventions[11], might bring some benefits to health, while other social investments such as welfare reform[12], housing relocation[13] and small class sizes[14] had both positive and negative health effects. Interestingly, experimental evidence from the Oregon Health Study shows that randomized assignment to Medicaid among uninsured Americans led to no significant improvement in physical health. [15]

There are at least three potential mechanisms through which social expenditures may lead to better population health. First, higher social spending may insure individuals against poverty, which may in turn translate into better health outcomes and lower risk of death. Second, social spending may promote human capital investment by increasing access to early childhood programs, education and training, which may translate into better health in the long-run. Third, social spending may provide reliable safeguards that reduce chronic stress pathways linked to HPA-axis dysregulation and subsequent metabolic, cardiovascular and inflammatory changes.

This study uses data from the United States and 19 other wealthy nations to examine whether greater social spending is associated with larger gains in life expectancy. Associations with health are examined across six domains of social spending, accounting for confounding with government healthcare spending. The contribution to life expectancy gains of spending on social welfare relative to spending on healthcare is also evaluated. The central hypothesis of the study is that greater social spending will be positively associated with life expectancy across the countries of the OECD and that the magnitude of these associations will outweigh those between government healthcare spending and life expectancy.

Methods

Study sample

Data were drawn from the Organisation of Economic Co-operation and Development (OECD) Social Expenditure Database, which provides yearly data on social spending as a percentage of

gross domestic product (GDP) spanning 1980 to 2010 for 20 countries: Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and the US. Data on Australia and Luxembourg were also available but were excluded from the analysis as they did not cover all years and variables required for the analysis.

Predictors

Data are provided for six domains which represent the largest social expenditures across nations and include both cash and in-kind public spending: education, family, unemployment, incapacity, old age and ALMP. *Education* is the sum of public spending on all levels from pre-primary to tertiary education. *Family* consists of primarily child allowances and credits, childcare support, income support during leave and sole parent payments. *Unemployment* includes unemployment benefit compensation and early retirement programs. *Incapacity* covers care services, disability benefits, benefits accruing from occupational injury and accident legislation, employee sickness payments and home-help and residential services for the working aged. *Old age* is comprised largely of spending on early retirement pensions, home-help and residential services for the elderly. *ALMP* includes expenditures on employment services, training, employment incentives, integration of the disabled, direct job creation, and start-up incentives.

Life expectancy data

Data were drawn from the OECD Health database, which provides internationally harmonized data on period life expectancy derived from the World Health Organization Mortality database. *Period life expectancy* measures the average number of years that a person can be expected to live from birth, assuming that age-specific mortality levels remain constant.

Covariates

All models included a linear time trend centered around the first year of observation, *GDP per capita* in millions of US dollars adjusted for inflation (base year 2010), *unemployment* rates measured as the percentage of unemployed out of the total labor force, *income inequality* measured using the Gini coefficient, and variables for the percentage of the population below age 15 (reference), 15-64 and 65 and above.

Statistical analysis

A fixed effects design was employed to address confounding by unmeasured differences between countries that are stable over time but might also be correlated with life expectancy. [16-18] Fixed effects models compare differences in life expectancy across years *within* countries, exploiting

only within-country variation in social expenditures for estimation. The basic model specification was as follows:

$$y_{it} = \beta_0 + X_{it-1}\beta + \upsilon_i + \varepsilon_{it}, \quad (1)$$

where y_{it} is a measure of life expectancy for country i at time t, β_0 is the intercept, $X_{it}\beta$ is a country-level measure of social expenditures and other covariates for country i at time t, υ_i is the unobserved time-invariant characteristics of each country and ε_{it} is the residual for a country in a given year.

A test for serial correlation between successive time points was conducted using Stata's xtserial command. [19] The null hypothesis of no first-order autocorrelation was rejected at a significance level of .07. Therefore, models were fit specifying a first-order autoregressive process. Specifying a first-order autoregessive process models the error term in equation (1) as $\rho\varepsilon_{i,t-1+}\ \eta_{it.}$, where the absolute value of ρ (rho, the autocorrelation coefficient) is less than 1 and η_{it} is independent and identically distributed with mean 0 and variance $\sigma^2_{\eta.}$ To account for potential delays in the effect of a given expenditure, models were fit including contemporaneous, one and two-year lags of social expenditures. These analyses show the largest effect sizes at t-1, pointing to a one-year lag as the preferred temporal specification of the relationship between social spending and life expectancy. All standard errors were clustered at the country level. Two-tailed tests with an alpha of 0.05 were used throughout. Analysis was conducted in Stata 13 (College Station, Texas, USA) and included use of the margins command suite.

Results

Figure 1 shows time trends in the six domains of social expenditure. There has been considerable temporal variation. Expenditures on education, family and incapacity showed declines from 1980 to 1990, while old age, ALMP and unemployment expenditures increased during this period. From 1990 to 2000, spending in all domains increased. While spending in education, family and old-age benefits continued to increase from 2000 to 2010, spending in unemployment, incapacity and ALMP declined over the same period.

[FIGURE 1 ABOUT HERE]

Table 1 shows that within countries there have been substantial changes in expenditures in each domain. For example, expenditures on education was as low as 3.5% for New Zealand in 1986 in contrast to 7.2% in 2010. In the UK, family expenditures were 1.9% of GDP in 1990 compared to 3.9% in 2009, the year with the highest family expenditure. Expenditures varied considerably between countries as well (Appendix A). For example, maximum expenditures on family benefits was 0.8% of GDP in the US in 2002 compared to 4.85% in 1992 in Sweden. It is worth noting that the United States had the lowest average expenditures across all domains, while Sweden had the highest (not shown).

[TABLE 1 ABOUT HERE]

Figure 2 plots life expectancy against social expenditures as percentage of GDP, superimposing a local linear smoother upon the data points. With the exception of unemployment, the bivariate relationship between social spending and life expectancy is positive.

[FIGURE 2 ABOUT HERE]

Table 2 provides estimates from fixed effects models with each domain separately. The purpose of this table is to test the hypothesis that greater social spending will be positively associated with life expectancy and that the magnitude of observed associations will outweigh those between government healthcare spending and life expectancy. Greater expenditures in the previous year on education (Model 1; b = 0.177; 95% confidence interval [CI]: 0.060, 0.294; *P* <.001) and incapacity (Model 1; b = 0.292; 95% CI: 0.154, 0.429; *P* <.001) were associated with significant gains in life expectancy. Results in Model 2, show that estimates of lagged education and incapacity expenditures remained significant in models that simultaneously controlled for all domains of social expenditures (b = 0.165; 95% CI: 0.045, 0.286; *P* < .01 and b = 0.172; 95% CI: 0.010, 0.334; *P* < .05, respectively). Estimates in Model 3 show that these results were also robust to additional controls for government healthcare expenditures (b = 0.160; 95% CI: 0.033, 0.286; *P* < .05 and b = 0.168; 95% CI: 0.003, 0.333; *P* < .05, respectively).

[TABLE 2 ABOUT HERE]

To contextualize these findings, the parameter estimates for prior-year education and incapacity expenditures are applied to the US case with an observed value of 78.5 in 2009. If the US were to increase education spending from 5.4% of GDP to 8.7% of GDP (the pooled sample maximum), life expectancy would increase 0.53 years. Increasing incapacity spending from 1.71% of GDP to 7.0% of GDP (the pooled sample maximum) would result in an increase of 0.89 years in life expectancy. In total, these increases in education and incapacity benefits would increase US life expectancy to 80.12. Again, the specification of these models presumes such expenditures occur the year prior to observation of the outcome.

Robustness checks

Given its relatively low rates of social spending and life expectancy, models were replicated excluding the United States. The sensitivity of results to the exclusion of Southern European nations, which differ from Northern European nations in terms of economic performance and history of development, were also tested. Appendix B (Columns 1 and 2) shows the results of these sensitivity analyses. Overall, this table shows that coefficients were nearly identical as for the total sample. Results were also robust in models that did not include government-mandated private expenditures (Column 3); and that incorporated total fertility rate, net migration and population size as additional demographic controls (Column 4).

Discussion

Life expectancy is a key indicator of population health and human development. Results from this study show that investments in education and incapacity programs contribute to gains in life expectancy and may contribute to the smaller gains in life expectancy observed in the US relative to other wealthy nations. These findings suggest that social policies may be important determinants of health and life expectancy and may offer an important pathway to improving population health.

In this study, the associations between population health and prior-year spending on education and incapacity were stronger than between population health and spending on healthcare. While positive, the association with government healthcare spending was small in magnitude and not statistically significant in models that controlled for all domains. These findings support the conclusions of Bradley et al. that spending on social policy may be more effective at improving health than spending targeted strictly to health. [2,3] This finding might be due to the fact that the impact of investments in areas of healthcare known to be effective, such as hypertension or cholesterol control, is overshadowed by increasing costs in medical technologies or drugs that may be less effective. For example, evidence suggests that faster uptake of new and more expensive prescription drugs is an important contributor to higher per capita spending in the US relative to other OECD countries that employ stricter health technology assessments requiring clear evidence of the value of new drugs. [21] Although widely publicized, the proposition that costly medical technologies ultimately increase US longevity has been challenged by findings suggesting that the beneficial effects observed in randomized control trials (RCTs) do not obtain

when implemented outside of the laboratory environment. (For a comprehensive treatment of the limitations of, and effective companions and alternatives to, RCT-based evidence see the Institute of Medicine's 2008 report which addressed this and related issues. [20])

Findings for education are in line with a wealth of evidence suggesting that more schooling and higher educational attainment is associated with better health. Education is crucial to labor market success, [22-27] and may promote healthier behavioral choices [28] and increase access to social networks, power and prestige, healthcare and other mechanisms conducive to better health. [29] Studies of the Perry School Program in Michigan and The Abecedarian program in North Carolina show consistent benefits of intensive early education programs on educational, labor market and cognitive outcomes, all of which predict better health later in life. [30,31] Studies have also shown that compulsory education laws led to reductions in mortality and improvements in health, [11,32] although evidence is contradictory for some countries such as Britain and France. [33,34] Overall, these results are in line with the hypothesis that larger investments in education may lead to gains in life expectancy. Increased spending in education may also signal investments to improve the quality of education, [29] although there is limited evidence on whether these improvements translate into health benefits.

Results for incapacity benefits are difficult to interpret. One possibility is that incapacity spending addresses the social and economic consequences of poor health and disability, which may revert back into benefits to life expectancy. For example, financial resources may help incapacitated individuals to effectively manage illness, above and beyond the diagnoses and treatments covered under healthcare spending. This could explain why similar associations were

not observed with unemployment or old age benefits, which, while also a form of income replacement, are not targeted at the already ill and disabled. Even if some specific components of family, unemployment, old-age pensions and ALMP may lead to health gains, the current mix of funding allocation across these programs may not translate into gains in life expectancy.

This study has several strengths, but some limitations should be considered. First, life expectancy is driven heavily by infant mortality and there are cross-national differences in the reporting of such deaths that could introduce measurement error. While this may be the case, alternative measures such as survival are likely to disproportionately reflect the impact of healthcare rather than the broad-based impacts of social expenditures that serve as the focus of this investigation. Moreover, because these models include country fixed effects, they do not compare infant mortality between countries, but rather examine variation over time within countries alone. Together, these factors minimize potential measurement-related biases.

Second, this analysis investigates the short-term associations between social policy and life expectancy. Preliminary analyses suggest a one-year delay in the effect of expenditures on longevity. That said, life expectancy reflects a series of health advantages and insults that accumulate over multiple points in the life course. The association between spending and life expectancy the following year will not accurately capture the full and long-term associations with health and mortality of social investments over a lifetime. In particular, investments early in life might lead to long-run benefits for health that only materialize decades later. Future studies should explore this question using individual-level data linked to aggregate expenditures throughout the life-course.

Finally, although time trends and a variety of confounders were included, social expenditure variation may also partly reflect unaccounted for demand-side changes. Trends in social expenditures similarly reflect a complex pattern of supply-side factors related to the adjustment of eligibility and coverage restrictions. For example, mid-90's welfare reform in the United States led to a shift of Americans from welfare rolls to Supplementary Security Income. Likewise, in many other OECD countries, pension reforms have affected old age expenditures just as benefits and duration caps affected unemployment expenditures. This study does not capture the myriad impacts of these types of reforms; however, it does provide a sense of how overall changes in social expenditure arising from these policy changes relate life expectancy and helps to set the agenda for future research on the subject. Another limitation is that these estimates do not capture changes in the quality of predictors or outcomes. In other words, little can be gleaned from these data about the caliber of education or life satisfaction during years-of-life gained. Lastly, research on poverty and inequality suggests that more universal social expenditures have stronger outcome-improvement effects than targeted benefits. [38,39] The present analysis, though, does not tell us whether the magnitude of the observed effects are larger (or smaller) as spending levels increase.

Notwithstanding the limitations, these results have important implications for policy. Life expectancy gains in the US have slowed significantly in recent decades, while other wealthy nations have continued to enjoy significantly larger gains. This has left the US farther and farther down the rankings relative to peer nations. [1,36] The fact that increased education and incapacity spending are favorably associated with life expectancy gains suggests that the comparatively low

spending levels in these areas may have contributed to this large and growing lag in US life expectancy.

This study also advances knowledge on the relevance of health policy vis-a-vis other policy domains. Empirical work has paid considerable attention to the relationship between population health and healthcare policy. [3,37-42] This is understandable given the intuitive link between healthcare and health. Yet, these findings support prior evidence that healthcare explains only a fraction of gains in life expectancy. [43,44] Furthermore, the position of the US in international life expectancy rankings does not seem to have benefited from increasingly higher overall spending on healthcare. [1,36] These results suggest that the disproportionate focus on healthcare policy could shift attention away from other policies outside healthcare that may be improve health and reduce mortality in the US and that conceiving social policy as health policy may constitute a promising approach to improving population health.

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Table 1. Country-Specific Minimum and Maximum Social Expenditures as a Percentage of GDP between 1980 and 2010.

Country	*Education*		*Family*		*Unemployment*		*Incapacity*		*Old Age*		*ALMP*		*N(Years)*
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
Austria	5.01	6.25	2.54	3.34	0.40	1.29	3.15	4.13	8.93	11.96	0.26	0.85	30
Belgium	3.03	6.57	2.21	3.05	2.42	3.69	2.27	3.78	5.93	8.10	1.02	1.41	30
Canada	4.77	7.88	0.50	1.13	0.57	2.35	0.85	1.38	2.90	4.37	0.27	0.65	31
Denmark	5.70	8.74	2.57	3.90	1.73	5.27	3.15	5.16	6.67	8.44	0.71	1.91	30
Finland	4.77	7.65	1.85	4.42	0.65	4.74	3.33	5.55	5.12	10.20	0.73	1.63	31
France	4.38	5.90	2.33	3.31	0.00	2.32	1.84	2.90	7.64	12.33	0.60	1.24	30
Germany	4.43	5.06	1.55	2.32	0.50	1.89	3.06	4.18	6.83	10.24	0.51	1.48	31
Greece	1.77	4.09	0.18	1.43	0.22	0.72	0.83	1.83	4.63	11.10	0.06	0.40	30
Ireland	4.22	6.50	1.07	4.35	0.70	3.33	1.28	2.64	2.56	4.88	0.62	1.33	31
Italy	3.95	4.96	0.58	1.64	0.37	1.36	1.94	2.59	8.01	14.17	0.23	0.70	31
Japan	3.43	5.67	0.36	0.96	0.31	0.72	0.75	1.15	3.11	10.93	0.16	0.43	31
Netherlands	4.84	6.37	1.24	2.50	1.04	3.85	3.54	6.97	5.17	6.34	0.55	1.55	31
New Zealand	3.50	7.24	1.91	3.55	0.23	1.89	1.28	3.10	4.13	7.69	0.26	0.88	31
Norway	5.35	7.99	1.80	3.63	0.19	1.41	3.63	7.03	5.09	8.04	0.34	1.31	31
Portugal	3.09	5.79	0.59	1.51	0.17	1.37	2.15	3.01	3.04	10.65	0.16	0.77	30
Spain	3.22	5.01	0.15	1.52	1.68	4.69	2.28	2.74	4.59	8.45	0.18	0.86	31
Sweden	5.56	7.51	2.95	4.85	0.37	2.71	4.39	6.37	7.70	10.71	0.97	2.82	31
Switzerland	4.51	5.83	0.93	1.46	0.07	1.43	2.30	4.53	6.70	12.09	0.19	0.81	30

UK	4.37	5.60	1.92	3.88	0.39	2.10	1.26	3.07	3.96	7.43	0.22	0.83	30
US	4.76	5.77	0.42	0.78	0.23	1.12	1.24	1.73	5.00	6.12	0.11	0.27	31
Pooled N	1.77	8.73	.154	4.85	0.07	5.27	0.75	7.03	2.56	14.17	0.06	2.82	31

OECD = Organisation of Economic Co-operation and Development

ALMP = active labor market programs

Pooled N = average across full sample of country-years

Table 2. Fixed Effects Models of Life Expectancy on Lagged Social Expenditures as a Percentage of GDP and Relevant Controls, OECD Countries, 1980-2010.

Variable	Model 1 Separate		Model 2 Simultaneous		Model 3 Simultaneous with Healthcare Expenditures	
	ß	95% CI	ß	95% CI	ß	95% CI
Education	0.177	0.060, 0.294	0.165	0.045, 0.286	0.160	0.033, 0.286
Family	0.120	-0.074, 0.314	-0.041	-0.296, 0.214	-0.048	-0.308, 0.211
Unemployment	0.082	-0.064 - 0.228	0.054	-0.132, 0.241	0.053	-0.134, 0.240
Incapacity	0.292	0.154, 0.429	0.172	0.010, 0.334	0.168	0.003, 0.333
Old age	-0.015	-0.106, 0.076	-0.090	-0.204, 0.024	-0.095	-0.213, 0.024
ALMP	0.198	-0.050, 0.447	0.127	-0.187, 0.440	0.132	-0.184, 0.448
Country-years	252		327		328	
Countries	20		20		20	

Estimate unit is years of life expectancy

OECD = Organisation of Economic Co-operation and Development

ALMP= active labor market programs

Model 1 includes predictor variables separately and full set of controls (Gini, GDP per capita, unemployment rate, population age distribution and continuous year)

Model 2 includes predictor variables simultaneously and full set of controls

Model 3 includes predictor variables simultaneously, full set of controls and government healthcare expenditures.

Figures

Figure 1. Pooled Sample Mean of Social Expenditures as a Percentage of GDP by Year, OECD Countries, 1980-2010.

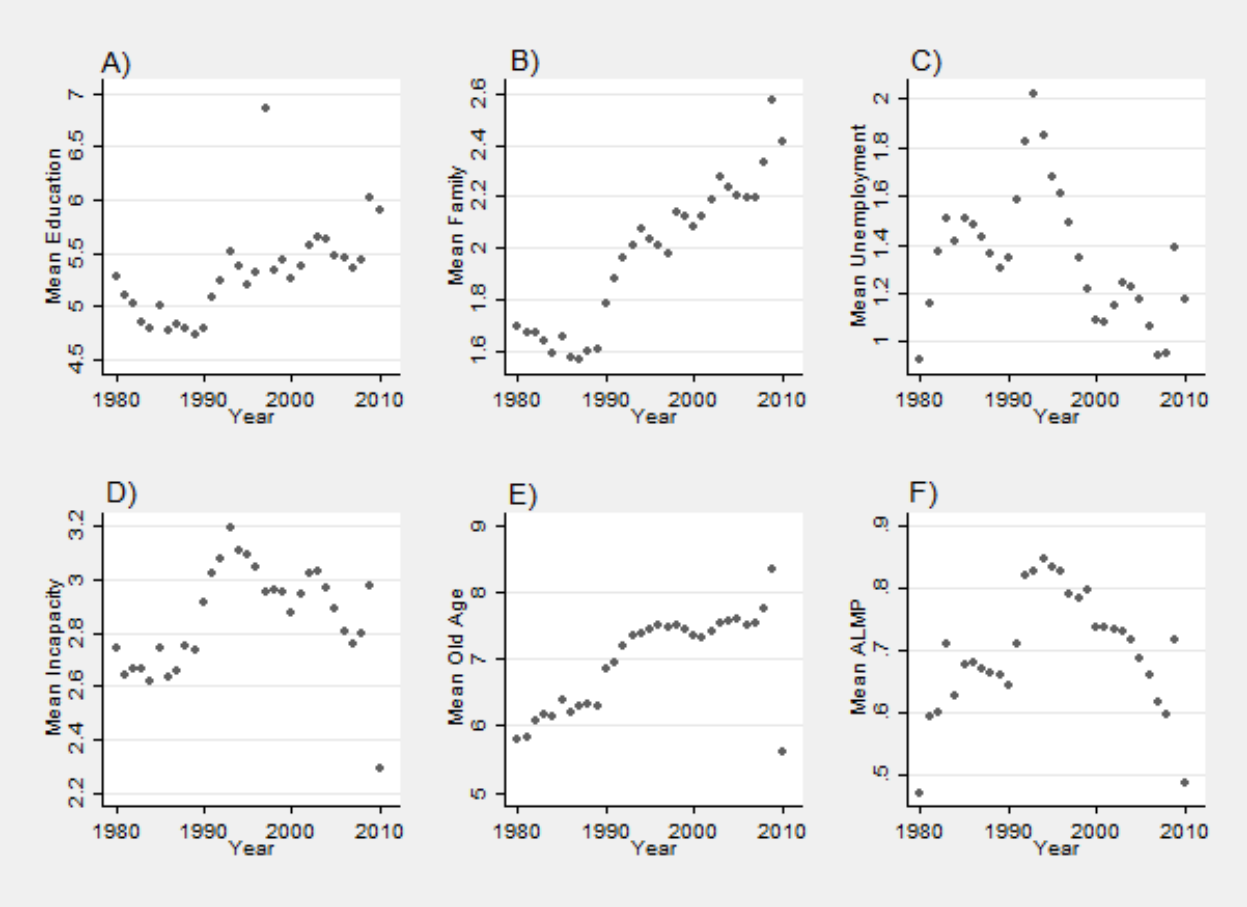
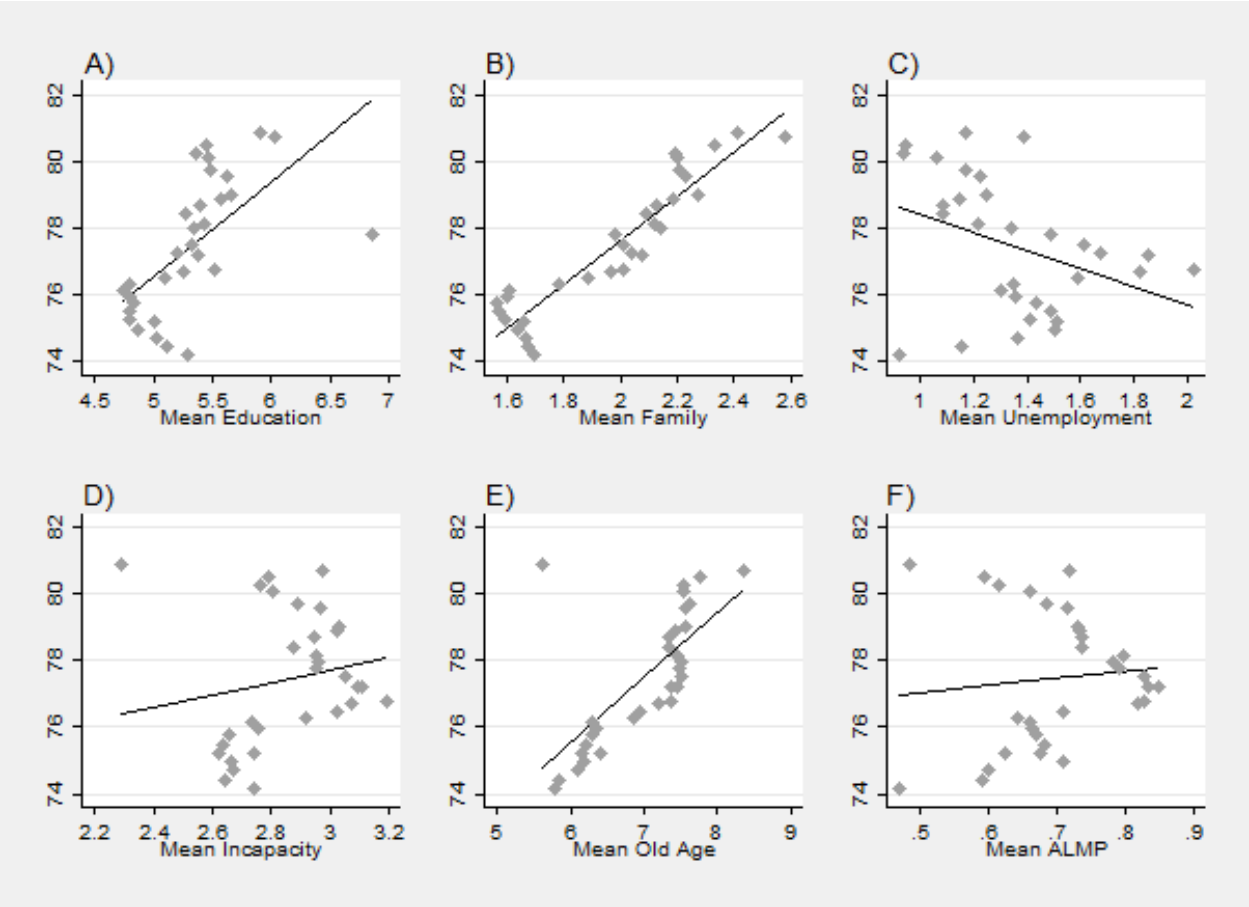
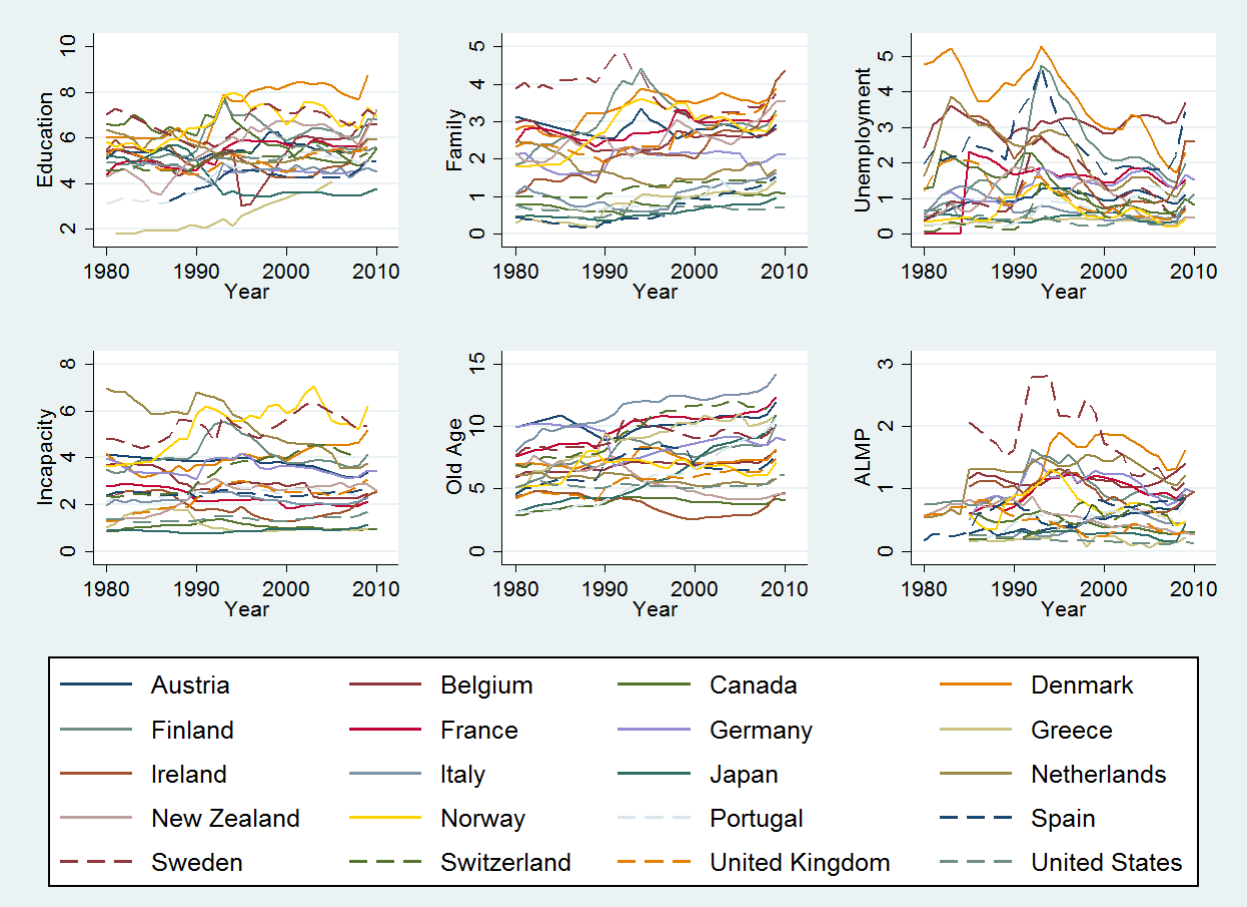


Figure 2. Life Expectancy by Social Expenditures as a Percentage of GDP with Local Linear Smooth, OECD Countries, 1980-2010.



Appendix

Appendix A. Social Expenditures as a Percentage of GDP by Country and Year, OECD Countries, 1980-2010.



Note: OECD = Organisation of Economic Co-operation and Development

Appendix B. Fixed Effects Models of Life Expectancy on Lagged Social Expenditures Under Different Samples, OECD Countries, 1980-2010.

	Excluding US		Excluding Greece, Portugal, Spain		Public Only		Demographic Variables	
	ß	95% CI	ß	95% CI	ß	95% CI	ß	95% CI
Education	0.154	0.023, 0.285	0.160	0.037, 0.284	0.160	0.032, 0.288	0.149	0.023, 0.274
Family	-0.070	-0.333, 0.193	-0.102	-0.362, 0.158	-0.040	-0.302, - 0.222	-0.105	-0.366, 0.156
Unemployment	0.063	-0.126, 0.252	-0.005	-0.223, 0.212	0.033	-0.155, - 0.220	0.047	-0.136, 0.231
Incapacity	0.176	0.011, 0.342	0.158	-0.006, 0.322	0.169	-0.023, - 0.360	0.144	-0.017, 0.305
Old age	-0.091	-0.210, 0.028	-0.082	-0.215, 0.051	-0.102	(-0.220 - 0.016	-0.094	-0.210, 0.022
ALMP	0.155	-0.165, 0.474	0.066	-0.264, 0.397	0.141	-0.177 - 0.459	0.097	-0.210, 0.404

Observations	207	193	224	220
Number of Countries	19	17	20	20

estimate unit is years of life expectancy