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The Effect of Redistribution on Income Risk: Estimates From the PACO Database*

By Edward J. Bird**

Summary

In cross-national data on individual and country-level characteristics, the variance of log annual income is shown to correlate positively with indicators of redistribution. The database comes from the Panel Comparability (PACO) project, affiliated with the Luxembourg Income Study (LIS), a first effort to provide comparable panel data across a broad range of countries. Countries in the sample include both eastern and western Europe and the United States. A random effects permanent income regression is used country-by-country to estimate individual-specific income variance. The variance estimates are then regressed on individual and country characteristics. The results indicate robustly that various measures of risk are higher in countries with a higher share of social spending in gross domestic product (GDP). The evidence can be interpreted as support for the argument that the welfare state encourages risk taking and thereby economic growth.

1. Introduction

One of the central issues in the long-running debate about the welfare state is its impact on individual behavior with regard to risk. Risk taking is a wellspring of economic growth, and it has been argued in theory that risk taking can be encouraged by redistributive spending. Redistribution can act as a form of income insurance, reducing the downside potential of risky investments in physical and human capital. At the same time, the welfare state distorts decisions and has well-known efficiency costs; it may displace various forms of private insurance and self-insurance, so that the net effect of redistribution on risk taking, savings, and growth is theoretically ambiguous. Recent empirical evidence in fact suggests that there is no general empirical correlation between economic growth and the size of the welfare state (Lindert 1996; Persson and Tabellini 1994). The deadweight losses of redistribution seem to be offset in practice by real benefits. The idea that the welfare state has real economic benefits is not new, of course, but it is beginning to receive more practical research attention (e.g., Atkinson 1995, ch. 6; Barr 1993, p. 3; Sinn 1996; Haveman 1988, ch. 6; Ringen 1987). This paper reports new evidence about the welfare state's potential effect on growth through its encouragement of risk taking, an effect that has been discussed before but never measured.

The paper presents estimates of the correlation between individual income risk and measures of redistribution policies in countries where the individual lives. It uses data

from the Panel Comparability Project (PACO) to estimate income risk, pre- and post-transfer, in the seven countries of the project (France, Germany, Hungary, Luxembourg, Poland, Great Britain, and the United States), and then regresses these risk estimates against individual and country characteristics.

The results have a very clear pattern: all else equal, income risk seems to be higher in countries with larger shares of social spending in gross domestic product (GDP). This pattern persists despite significant variation in the empirical model. It holds up regardless of the definition of income risk, the exclusion of different countries in the sample (eastern Europe, Germany), the set of macroeconomic controls, whether the equation system is considered separately or simultaneously, and other changes as well. Such a finding is not inconsistent with evidence found by other researchers, for example, that income mobility seems to be no lower in countries with large welfare states, such as Germany, compared to those with small ones, like the United States (Burkhauser and Poupore 1997).

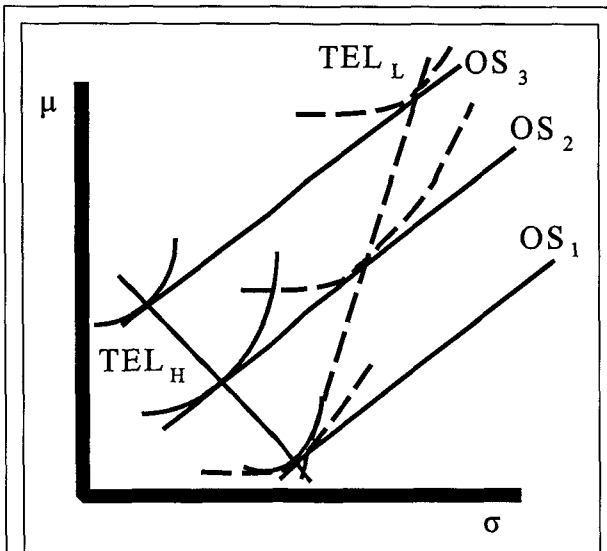
2. Conceptual Background

An empirical study of the relationship between redistribution and risk is relevant because economic theory makes no clear predictions about it. This can be seen most clearly in Sinn's (1996) model of individual choice under risk with state redistribution. (See Figure 1 for a simplistic interpretation of Sinn's argument.) Individuals may choose mean risk bundles (μ, σ) along the opportunity sets labeled $OS_i, i = 1, 2, 3$. Opportunity sets located in the upper left part of the figure represent the bundles available when redistribution is greater: because of the income-insuring effect of redistribution, agents can obtain the same mean incomes with lower risks. The diagram shows, however, that a sensible risk-averse preference ordering exists such that an expansion of transfers will lead to an increase in the amount of risk agents face. As transfers expand, agents with a relatively lower risk aversion will choose bundles along the expansion path TEL_L (for "transfer expansion line, low aversion") while those with higher risk aversion will

* The data used in this study are from the public use version of the PACO datafiles, including data from the German Socio-Economic Panel, the British Household Panel Study, the Lorraine Panel Study, the Panel Study of Income Dynamics, the Luxembourg Household Panel Study, the Hungarian Household Panel Study, and the Polish Household Panel. The comparable variables in this datafile were created by the PACO project, coordinated through CEPS/INSTEAD in Luxembourg. I thank Thomas Schelling, Hans-Werner Sinn, Andrew Dick, Martin Werding, and participants in the 1998 Econometric Society winter meetings, the 1998 Conference of Users of the German Socio-Economic Panel, and seminars at the Center for Economic Studies/University of Munich and the University of Passau for helpful comments and suggestions.

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Figure
Ambiguous Response of Risk Taking to Redistribution^{a)}



a) The figure indicates that risk levels (σ) may increase as the welfare state expands. The budget lines labeled 'OS' are bundles of risk and expected income (μ) available at a given level of welfare state redistribution. When redistribution expands, the OS set shifts to the left, as from OS₁ to OS₂ to OS₃. Individuals may then choose lower levels of risk at the same expected income level, or higher expected incomes at the same risk. Choices are determined by the individual's preference function, whose indifference contours are indicated by the curved lines on the figure. The light contours represent an individual with high risk aversion; as transfers expand this individual chooses a path of (σ , μ) bundles labeled 'TEL_H' for 'Transfer Expansion Line, High Risk Aversion'. The darker contours represent low risk aversion, with a path of bundles labeled 'TEL_L'. The point of the figure is that low-risk-aversion individuals, choosing along TEL_L, will actually increase the variance of their incomes in response to an expansion of transfers. Thus, whether or not risk falls in response to the Welfare State is an open question.

Source: Author's calculation of Sinn's (1996) model of individual choice under risk with state distribution.

choose along TEL_H. Thus, some agents decrease risk in response to greater redistribution while others increase risk; the overall effect of the welfare state on society's risk taking is therefore theoretically ambiguous.

3. Methods and Data

Measuring Risk

Here *risk* will be defined as the standard deviation of shocks to yearly individual log income. Assume we have data from a single country on N individuals indexed $i = 1, \dots, N$, over T years, indexed $t = 1, \dots, T$. For each individual we have information on annual income Y_{it} , and a vector of characteristics X_{it} . Log income is y_{it} and is assumed to be determined by the equation

$$(1) \quad y_{it} = \alpha + \beta X_{it} + \nu_i + \epsilon_{it}$$

with parameters α and β , and error terms ν and ϵ independently normally distributed, uncorrelated with X , with zero means and variances σ_ν^2 and σ_ϵ^2 respectively. In addition $E(\epsilon_{it}, \epsilon_{is}) = 0$ if $t \neq s$. We define $\alpha + \beta X_{it} + \nu_i$ as the individual's permanent income and ϵ_{it} as the deviation from permanent income in the current period; note that ϵ_{it} contains both permanent and transitory income shocks, but since the distinction between them is not particularly informative for the main question here (the relation of all risks, however structured, to redistribution), they will not be estimated separately. The error term ν_i is the fixed portion of individual i 's permanent income; it varies across the population but not across time periods. For purposes of estimation and interpretation one should assume that the individual knows the value of ν but the researcher does not, whereas ϵ is considered a random variable by both parties. The relevant concept of risk here involves the income deviations unanticipated by the individual (as opposed to the researcher); it depends only on the error term ϵ_{it} . Denoting the variance of that term σ_i emphasizes that the risks faced by different individuals will be different; it also implies heteroskedasticity (which will require modifications to standard error calculations: see below).

A random effects regression estimates the parameters α and β as well as the individual-specific income effects ν_i . The residuals from the regression, $e_{it} = y_{it} - \alpha - \beta X_{it} - \nu_i$, can be squared and then averaged over the T periods to obtain an estimate of the income variance faced by the individual: $\sigma_i^2 = \sum_T e_{it}^2 / T$. The square root of the estimate yields σ_i , the standard deviation of the unanticipated income shocks facing this individual, and will be the operational definition of income risk in what follows.

The end result of this step is a cross-section of income risk estimates from a single country. Let period s be a single year in that country's panel (ideally in the middle of the time series). Then the variables $\{X_{is}, \sigma_i\}$ form a cross-sectioned sample of individual characteristics matched with the individual estimates of income risk.

Relating Risk to Country Characteristics

Repeating the process described above for several countries yields several cross-sections of risk estimates that are comparable across countries because, as shocks to log income, they measure relative percent changes.¹ Pooled, the estimates form a multinational cross-sectional dataset, in which risk estimates can be regressed on an individual's own characteristics as well as the characteristics of the country in which he/she resides:

¹ For example: A typical log income shock estimate might indicate a standard error of 0.15, meaning that in 95 percent of the years income does not change by more than 30 percent in either direction.

$$(2) \quad \sigma_{ic} = \alpha + \beta X_{ic} + \gamma Z_c + \epsilon_{ic}$$

where the 's' subscript on individual characteristics has now been suppressed, and 'c' subscripts indicate country of residence. The equation will be estimated using weighted OLS with robust Huber-White ('sandwich') standard errors.

Data

The data are drawn from the Panel Comparability (PACO) database maintained by CEPS/Institute in Luxembourg. The PACO countries and years in the release used in this paper include France 1985-1990, Germany (the western states) 1984-1990, Hungary 1992-1994, Luxembourg 1985-1992, Poland 1987-1990, Great Britain 1991-1993, and the United States 1983-1987.² To ensure sure that risk estimates are always based on the same number of years ($T = 3$), the longer panels are broken into two consecutive three-year segments. The full set of three-year samples is: France A 1985-1987, France B 1988-1990, Germany A 1985-1987, Germany B 1988-1990, Hungary 1992-1994, Luxembourg A 1987-1989, Luxembourg B 1990-1992, Poland 1988-1990, Great Britain 1991-1993, and United States 1985-1987. The observations are weighted so that each country's data receives the same weight.

The samples consist of all individuals over age 17 in all households present throughout all three years of the given sample. Income is assigned to each individual in a household by pooling the household's total annual income from all sources and then dividing by an equivalence scale. Within PACO it is possible to identify pre- and post-transfer income, but there is no tax information. The pre- and post-

transfer risk measures are used to construct a new variable, the *insurance effect* of transfers, as the difference between pre-transfer income risk and post-transfer income risk. The independent variables include measures of the individual's age, sex, work status and hours, industry of occupation (if any), household structure, number and age of children, and marital status. The income values in each country's sample were first updated to real 1992 currency using that country's consumer price index; these were then translated into United States dollars using International Monetary Fund (IMF) purchasing power parity rates. Data on country characteristics were taken from various sources, principally World Bank publications.

4. Results

Median Risk Levels

Table 1 presents median income risks by country. In general, risks are highest in the "duress" economies of Poland and Hungary, somewhat lower in the more stable but more free market economies of the United Kingdom and the United States, and lowest in western Europe's more advanced welfare states. There is a startling exception: German pre-transfer incomes exhibit about as much risk as United States pre-transfer incomes. The same result was found in a previous study of risk in the two countries, using quite different methods (Bird 1995). The third row indicates that the insurance effects are everywhere positive. Every country's social welfare system provides income insurance in some amount.

² Future releases will include Belgium, The Netherlands, Italy, Portugal, and Spain.

Table 1

Median Levels of Income Risk by Country^{a)}

National Medians	Pre-Transfer Income Risk	Post-Transfer Income Risk	Insurance Effect ^{b)}
France	0.133	0.112	0.021
Germany	0.190	0.180	0.010
Hungary	0.225	0.146	0.079
Luxembourg	0.091	0.080	0.011
Poland	0.189	0.174	0.015
United Kingdom	0.174	0.142	0.032
United States	0.188	0.150	0.038

a) Table reports medians of individual-level income risk measures within large national samples of individuals. Sample sizes vary by country and income definition and are weighted, see text. *Income risk* here is the equivalent income per person in the household, in thousands of 1992 United States dollars. *Income risk* is the standard deviation of annual shocks to log income, obtained as the residual from a random-effects income model. — b) The *insurance effect* is the difference between the median standard deviation of pre-transfer income and the median standard deviation of post-transfer income.

Source: PACO.

Table 2

OLS Regression of Post-Transfer Income Risk on Individual Characteristics and Sample Identifiers^{a),b)}

Variable	Sample Mean	Sample Standard Deviation	Coefficient	Standard Error
Log pre-transfer income	1.804	1.181	-0.1277	0.0052*
(Income ²)/1000	0.005	0.004	14.5768	1.0073*
Log transfer income	0.251	0.422	-0.1477	0.0052*
Age	42.707	16.527	0.0004	0.0001*
Sex = female	0.517	0.500	-0.0004	0.0026
Did the respondent change household in past year = yes	0.153	0.360	0.1107	0.0128*
Household structure				
Lone parent	0.049	0.217	0.0217	0.0056*
Three generations	0.058	0.235	-0.0157	0.0040*
Two adults, children	0.494	0.500	-0.0080	0.0031*
Two adults, no children	0.204	0.403	0.0137	0.0038*
Sample Dummies				
France, 1986	0.07	0.258	-0.0718	0.0053*
France, 1989	0.07	0.258	-0.0755	0.0057*
Germany, 1985	0.07	0.258	0.0874	0.0056*
Germany, 1989	0.07	0.258	0.0277	0.0052*
Hungary, 1992	0.14	0.350	-0.2619	0.0148*
Luxembourg, 1986	0.07	0.258	-0.0938	0.0039*
Luxembourg, 1991	0.07	0.258	-0.0859	0.0035*
Poland, 1989	0.14	0.350	-0.1376	0.0063*
United Kingdom, 1992	0.14	0.350	-0.0189	0.0035*

a) OLS regression with robust Huber-White standard errors; * indicates statistical significance at the .05 confidence level, two-tail test. The regression includes variables for work status and conditions, and family status. For marital status, the omitted category is single or widowed. For sample dummies, the omitted category is United States 1986. — b) Dependent variable is the standard deviation of the residual from random effects income model; Sample mean is 0.193; sample standard deviation is 0.195; N = 51,810, weighted to 70,000; and R² = 0.1562.
Source: PACO.

Risk Regressions with Sample Dummies

Table 2 presents selected coefficients from a base-case regression of post-transfer income risk. The income coefficients indicate that risks fall with income but at a decreasing rate. The negative transfer income coefficient suggests comfortably that the transfer system is itself no more capricious in providing income than the market. Most of the other variables follow intuitive patterns, although risks seem not to differ significantly by sex, once other variables are taken into account. The sample dummies reveal that the United States (the omitted category) has among the highest risks. Only in Germany are risks higher than the United States, in one sample three points higher and in the other nine points higher. In substantive terms these effects are very large relative to individual characteristics; for example, a 20-year-old faces risks only about 1.2 percent

age points lower than a 50-year-old, and increasing income from the mean by an entire standard deviation only lowers risk by 6.8 percentage points. The implication is that individual income risks are more powerfully shaped by socioeconomic institutions than by measurable individual characteristics.

Table 3 repeats the results from Table 2 in the third column, but also reports regressions of pre-transfer risk, and the insurance effect, on the same regressors. There is a simple message: most of the variation in post-transfer risk is caused by variation in pre-transfer risk, as opposed to the insurance effect. Looking at the sample dummies, for example, it is fairly clear that the cross-country pattern of post-transfer risk is virtually identical to, albeit lower than, the pattern of pre-transfer risk. Thus, it seems that the welfare states in the sample, which differ greatly in terms of size and structure, have similar impacts on risk.

Table 3

Regressions of Risk and Insurance, with Sample Dummies^{a)}

Variable	Pre-Transfer Income Risk		Income Insurance		Post-Transfer Income Risk	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Pre-transfer income	-0.1017	0.0058*	0.0260	0.0044*	-0.1277	0.0052*
(Income ²)/1000	11.2957	1.1656*	-3.2811	0.8972*	14.5768	1.0073*
Transfer income	0.0614	0.0080*	0.2092	0.0063*	-0.1477	0.0052*
Age	0.0002	0.0001*	-0.0003	8.72E-5*	0.0004	-0.0001*
Sex = female	0.0022	0.0032	0.0026	0.0022	-0.0004	0.0026
Did the respondent change households in past year = yes	0.1352	0.0141*	0.0246	0.0094*	0.1107	0.0128*
Household structure						
Lone parent	0.0214	0.0068*	-0.0003	0.0047	0.0217	0.0056*
Three generations	-0.0070	0.0057	0.0087	0.0043*	-0.0157	0.0040
Two adults, children	0.0022	0.0040	0.0102	0.0028*	-0.0080	0.0031*
Two adults, no children	0.0146	0.0049*	0.0010	0.0032	0.0137	0.0038*
Sample Dummies						
France, 1986	-0.0959	0.0061*	-0.0241	0.0036*	-0.0718	0.0053*
France, 1989	-0.0931	0.0071*	-0.0176	0.0049*	-0.0755	0.0057*
Germany, 1985	0.0706	0.0063*	-0.0167	0.0029*	0.0874	0.0056*
Germany, 1989	0.0135	0.0059*	-0.0142	0.0027*	0.0277	0.0052*
Hungary, 1992	-0.2795	0.0165*	-0.0176	0.0109	-0.2619	0.0148*
Luxembourg, 1986	-0.1359	0.0054*	-0.0421	0.0033*	-0.0938	0.0039*
Luxembourg, 1991	-0.1225	0.0054*	-0.0366	0.0041*	-0.0859	0.0035*
Poland, 1989	-0.1605	0.0072*	-0.0229	0.0042*	-0.1376	0.0063*
United Kingdom, 1992	-0.0341	0.0047*	-0.0152	0.0028*	-0.0189	0.0035*
R ²	0.1854		0.2971		0.1562	
Mean	0.241		0.048		0.193	
Standard deviation	0.239		0.145		0.195	

^{a)} N = 51,810. See notes in Table 2.

Source: PACO.

Risk Regressions with Country Characteristics

Table 4 repeats these regressions, replacing the sample dummies with a vector of country characteristics.³ The critical variable is the *social quota*, defined by the World Bank as the share of social spending in GDR. The results indicate that risks are higher in countries with larger social quotas. Specifically, the social quota coefficient in the pre-transfer risk regression is 0.0341, positive, and statistically significant. The sign and magnitude of this coefficient is robust to a large number of alterations in the empirical approach (see the longer version of the paper, available at <<http://troi.cc.rochester.edu/~ejbd/vita/vita.html>>).

Note, too that the social quota coefficient in the income insurance regression ($b = 0.0023$) is substantively small, indicating that the insuring effect of transfers does not

seem to depend strongly on the size of the welfare state. Of course, at some level there has to be an effect: going from having no welfare state to having one at the smallest level (here, the United States at 14 percent of GDP) must create some insurance effect, since the insurance effect is present and positive throughout the sample of countries. It seems, however, that once a welfare state is established—a basic system of safety nets, means-tested benefits, and social insurance programs—further increases in the scale of the programs have very little effect on the programs' aggregate income insuring effect.

³ The number of country characteristics is limited by the fact that only seven countries, and ten samples, are available for aggregate-level variation. This does not matter for the basic results, however, see the longer version of the paper, available at <<http://troi.cc.rochester.edu/~ejbd/vita/vita.html>>.

Table 4

Regressions of Risk and Insurance, with Country Characteristics^{a)}

Variable	Pre-Transfer Income Risk		Income Insurance		Post-Transfer Income Risk	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Pre-transfer income	-0.0900	0.0057*	0.0264	0.0043*	-0.1164	0.0050*
(Income ²)/1000	11.0550	1.1485*	-3.2232	0.8839*	14.2779	0.9907*
Transfer income	0.0713	0.0078*	0.2101	0.0062*	-0.1388	0.0051*
Age	0.0003	0.0001*	-0.0003	8.69E-5*	0.0006	0.0001*
Sex = female	0.0033	0.0032	0.0025	0.0022	0.0007	0.0026
Did the respondent change households in past year = yes	0.1049	0.0080*	0.0293	0.0049*	0.0755	0.0070*
Household structure						
Lone parent	0.0194	0.0069*	-0.0003	0.0047	0.0197	0.0056*
Three generations	-0.0115	0.0057*	0.0084	0.0043	-0.0199	0.0040*
Two adults, children	-0.0027	0.0040	0.0101	0.0028*	-0.0128	0.0031*
Two adults, no children	0.0134	0.0049*	0.0009	0.0032	0.0125	0.0039*
Macro Variables						
Social quota (percent) ^{b)}	0.0341	0.0010*	0.0023	0.0005*	0.0318	0.0009*
Unemployment (percent)	-0.0222	0.0010*	-0.0009	0.0005	-0.0214	0.0009*
Real GDP per capita (1992 US dollars in thousands)	-0.0151	0.0006*	-0.0020	0.0003*	-0.0131	0.0005*
Real GDP (1992 US dollars in trillions)	0.1165	0.0032*	0.0126	0.0017*	0.1038	0.0028*
R ²		0.1736		0.2968		0.1390
Mean		0.241		0.048		0.193
Standard deviation		0.239		0.145		0.195
^{a)} N = 51,810. See notes in Table 2. — ^{b)} Social quota identified by the World Bank as the share of social spending on gross domestic product. Source: PACO.						

5. Conclusion

Overall, the study's results provide strong evidence that income risk and redistribution are positively correlated. This is consistent with the idea that the welfare state encourages risk taking and economic growth. An alternative explanation would be that voters in countries in which risks are higher demand greater redistribution from

their governments. Such an interpretation is less convincing, however, given the finding that the insurance effect seems to be only weakly related to the social quota. Voters demanding more redistribution would perceive that the gap between pre- and post-transfer risk is largely unaffected by the more generous policies which result. Thus, the pattern of pre-transfer risk seems more likely to be caused by the pattern of welfare states than vice versa.

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