

ISSN 0709-9231

CAHIER 8646

A Survey Measure of Risk Aversion

by

*Claude Montmarquette*¹

and

*André Blais*²

¹ Department of Economics, Université de Montréal.

² Department of Politics, Université de Montréal.

October 1986

Cette étude a été publiée grâce à une subvention du fonds F.C.A.R. pour l'aide et le soutien à la recherche. Ce cahier a également été publié par le Centre de recherche et développement en économique (Publication #2986).

RESUME

Nous utilisons des données d'enquête sur le bien-être des individus pour mesurer leur attitude vis-à-vis le risque. La neutralité vis-à-vis le risque ne peut pas être rejetée par les données.

Mots-clés : *Enquête, aversion pour le risque, multinomial logit.*

* * * *

ABSTRACT

We use survey data on the well-being of individuals to measure attitude toward risk. Risk neutrality cannot be rejected by the data.

Keywords : *Survey, Risk Aversion, Multinomial Logit.*

1. Introduction

Over the years, numerous empirical studies measuring attitudes toward risk of individuals or groups have appeared in the economic literature. Szpiro (1986a,b) reviewed some of the findings and suggested a measurement of relative risk aversion in various countries. Contrary to earlier results, the degree of relative risk aversion was generally found to be greater than one. Recently Harrison (1986) used an experimental method and rejected risk neutrality in favor of risk aversion for his 46 experimental subjects.

In this paper we use survey data on the well-being of individuals to measure attitudes toward risk. Direct measurements of individual utility are frequent in surveys done by psychologists and sociologists (Campbell, 1981). Since the pioneering work of Van Praag (1968), economists have referred to direct questions about satisfaction to study preference formation (Kapteyn and Wansbeek, 1982), utility interdependence (Kapteyn, Van Praag and Van Herwaarden, 1978), and the relativity of utility (Van de Stadt, Kapteyn, Van Praag and Van de Geer, 1985). In section 2 of the paper, we suggest that attitudes towards risk can be explicitly inferred from these studies. In section 3, we use a multinomial logit regression and, allowing for various functional forms, we report the degree of risk aversion implied by these utility functions. In section 4, we conclude.

* We are indebted to Reuven Brenner, George Dionne and Jean-Marie Dufour for helpful comments, and to Marc Gaudry and Tran Cong Liem for the use of their BC-logit computer program. Remaining errors are the sole responsibility of the authors.

2. A survey test

In a 1985 telephone survey across the Province of Quebec, more than 1000 individuals answered the following question: " Are you totally unhappy, not very happy, happy, or very happy, with your actual standard of living ? ". The survey also contained information about the household annual income, the number of working parents, the number of persons in the household, and the age and the sector of employment (working in the private or the public sector) of the respondent.

Let us define an underlying latent variable U^* to denote the level of indirect utility of individual i associated with the income of individual i . Following McFadden (1973), let us assume that utility is a random function. We can derive the degree of relative risk aversion of the individual i with the following equation :

$$U_i^* = \beta_0 + \beta_1 \frac{\lambda}{(Y_i - 1)} + \beta_2 NPW_i + \beta_3 NPH_i + \beta_4 A_i + \beta_5 PS_i + \epsilon_i . \quad (1)$$

$i = 1, \dots, I$, where I is the total number of individuals, and the variables are defined as follows :

U^* : utility of the survey respondent;

Y : household annual income as a proxy for the wealth of the respondent.

NPW : number of working parents in the household;

NPH : number of persons in the household;

A : age of the respondent;

PS : respondent working in the public sector ($PS=1$), or the private sector ($PS=0$);

ϵ : a random error term.

Equation (1), and the Box-Cox transformation on the income variable defines the Arrow-Pratt relative risk aversion measure (RRA) :

$$RRA = - \frac{U_1^{*''} Y_1}{U_1^{*'}} = 1 - \lambda \quad (2)$$

For $\lambda = 1$, we have risk neutrality, risk aversion for $\lambda < 1$, and risk loving for $\lambda > 1$.

Let us consider the answer to the " standard of living " survey question, the observed variable U_1 of survey respondent's utility level. The variable U_1 is defined :

$$\begin{aligned} U_1 &= 1 \quad \text{if } U_{11}^* = \text{Max}(U_{11}^*, U_{12}^*, U_{13}^*, U_{14}^*) \\ U_1 &= 0 \quad \text{otherwise.} \end{aligned} \quad (3)$$

Let us assume that the error terms ϵ_{1j} are independently and identically distributed with the type I extreme-value distribution. Then we obtain the multinomial logit specification for our model:

$$P_{1j} = \text{Prob}(U_{1j} = 1) = \frac{e^{a \cdot x_{1j}^{(\lambda)}}}{\sum_k e^{a \cdot x_{1k}^{(\lambda)}}} \quad (4)$$

X_{1j} is the vector of explanatory variables, and the Box-Cox transformation applies to the income variable.

The use of discrete data differs from Van Praag's measurement of utility levels. In the Van Praag and his followers' studies, based on the information maximization argument, it is assumed that an individual is able to evaluate income levels in term of satisfaction on a [0-1] scale. The resulting evaluation of the welfare function $U(Y)$, making some additional assumptions, follows approximately a lognormal distribution. However, Van Herwaarden and Kapteyn (1981), comparing different functional forms of welfare function, found the logarithm of income specification to yield better results than the lognormal. Both functional forms imply a risk averse individual. Because we do not scale the utility, and we refer to a Box-Cox transformation on the income variable, our specification directly integrates the question of functional forms and attitudes toward risk; the data are being used to decide simultaneously on both issues.

3. Empirical Illustration.

Using a weighted sample to correct for under representation of different groups, multinomial logit regressions were used for the 546 observations retained¹. Table 1 reports the main results. Under column (1), the model included all the variables of equation (1); under column (2), the regressions included only the income variable and the constant terms. Results are also reported by sectors of employment of the survey respondent.

For all cases, the likelihood ratio tests reject the null hypothesis that all the β -coefficients (not considering the alternative specific constants) are truly zero.

¹ Since we used the annual household income as a proxy for the respondent's wealth, we used the observations only if one parent was clearly identified as the survey respondent.

Table 1
Survey Test for Risk Aversion

	Total Population		Public Sector		Private Sector	
	(1)	(2)	(1)	(2)	(1)	(2)
Box-Cox : λ	0.4723	0.3859	0.9903	0.5225	1.74	1.74
$t(\lambda = 0)^a$	1.75	0.90	0.97	0.56	2.32	2.42
$t(\lambda = 1)^a$	-1.40	-1.44	-0.01	-0.51	0.98	1.03
Arrow-Pratt RRA = $1 - \lambda$	0.5277	0.6141	0.0097	0.4775	-0.74	-0.74
Model:						
χ^2 : Likeli. ratio test	56.84	42.45	34.60	19.60	35.11	28.92
d. of f.	16	4	13	4	13	4
Sample Size	546	546	181	181	375	375

a : t-test for the null hypothesis that $\lambda = 0$, and $\lambda = 1$.

The RRA measures of table 1 suggest that individuals are marginally risk averters in the total population sample, and for the survey respondents working in the public sector of the economy. For the respondents working in the private sector, they appear to be risk lovers. However, from the t-tests, risk neutrality cannot be ruled out for all cases². It is worth pointing out that the estimates of λ for the total sample lie outside the sub-sample estimates. Statistically this is not impossible as shown by Leamer (1978) for the linear case, but the results seem to question the validity of measuring risk aversion at an aggregate level. Finally the logarithm of income specification proposed by Herwaarden and Kapteyn (1981) is to be rejected except for the private sector case.

²T-statistics and variances of the "risk aversion parameters" λ are scale invariant with an intercept included in the regressions. The conditional variances are downward biased for the linear coefficients of a Box-Cox transformation as shown by Spitzer (1984).

4. Conclusion

Economists are reluctant to use direct survey data on the basis that what counts is what you do, rather than what you say. However this paper supports the idea that direct survey data can be useful to economists like any others forms of statistical data. Surveys enable social scientists to examine individual level data, in contrast with aggregate data which are usually resorted to in studies of risk aversion. Surveys permit large representative samples of individuals from an homogeneous population, in contrast with the small number of subjects used in experiments. Some of our findings suggest that the question of an homogeneous population is important to measure risk aversion.

References

- Campbell, A., 1981. The Sense of Well-Being in America: Recent Pattern and Trends. McGraw Hill, New-York.
- Harrison, Glenn W., 1986. An Experimental Test for Risk Aversion. Economics Letters 21. 7-11.
- Kapteyn, A., Van Praag, B.M.S., Van Herwaarden, F.G., 1978. Individual Welfare Functions and Social Reference Spaces. Economics Letters 1. 173-178.
- Kapteyn, A., Wansbeek T.J., 1982. Empirical evidence on Preference Formation. Journal of Economic Psychology 2. 137-154.
- Leamer, Edward E., 1978. Specification Searches. John Wiley & Sons, New York.
- McFadden, D., 1973. Conditional Logit Analysis of Qualitative Choice Behavior. In P. Zarembka (ed.), Frontiers in Econometrics. Academic, New York.
- Spitzer, J.J., 1984. Variances Estimates in Models with the Box-Cox Transformation : Implications for Estimation and Hypothesis Testing. Review of Economics and Statistics 4. November., 645-652.
- Szpiro, George G., 1986a. Relative Risk Aversion Around the World. Economics Letters 20. 19-21.
- Szpiro, George G., 1986b. Measuring Risk Aversion : An Alternative Approach. Review of Economics and Statistics 1. February., 156-158.
- Van Herwaarden, F.G., Kapteyn, A., 1981. Empirical Comparison of the Shape of Welfare Function. European Economic Review 15. 261-286.
- Van Praag, B.M.S., 1968. Individual Welfare Functions and Consumer Behaviour. North-Holland, Amsterdam.
- Van de Stadt, H., Kapteyn, A., Van de Geer, S., 1985. The Relativity of Utility : Evidence from Panel Data. Review of Economics and Statistics 2. May., 179-187.