

# **Do personal characteristics affect the Rasch measures of perceived physical risk? A quantile regression approach.**

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**Abstract** This paper focuses on the measurement of the perception of healthy risk according to personal characteristics. The Physical Risk Assessment Inventory was adopted as measurement tool and it was administered to 551 students enrolled in the first and in the fifth classes of some high schools of Palermo. The analysis of the determinants of the perceived risk is based on its quantitative measures. Therefore the analysis has been developed into two tracks. First track is devoted to obtain a quantitative measure of the perceived risk: an Extended Logistic Rasch Model was used considering separately males and females. Results highlight the different perception of risk between males and females, although the order of risky activities is the same for the two of them. Second track investigates the determinants of the Rasch person measures: a Quantile Regression was adopted to overcome the non-normality of the measures distribution. Results show that males pay less attention to their own health than females do, and that difference increases when the quantiles of the person measures increase. Same remarks hold for fifth year students with respect to first year ones.

**Key words:** Risk perception, PRAI, Rasch Model, Quantile Regression

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## 1 Introduction

Risk is sometimes defined as the probability of an unwanted occurring event, but in this paper risk is understood as the probability of an unwanted event occurring together with the severity of potential loss. However it is not clear how the probability and severity of risk can be combined in an objective fashion. One first difficulty is the estimation of the values associated with things thought to be at risk, and the reasonably convincing argument can be made that these should represent social choices, rather than technical issues. Although the perception and assessment of risk are essentially phenomenologically based, the nature of risk is fundamentally interactive. Risk exists because things considered having value are placed at risk, and as such the nature of risk concerns the interaction of people in their environment. Some risks are derived from our own behaviors and the risk variability depends on the ability of controlling actions [1]. The aim of this paper is the measurement of the perceived risk according to the personal characteristics. The measurement issue is faced following two tracks: the first one is oriented to obtain a quantitative measure; the second one is oriented to investigate its determinants. The novelty is the use of Quantile Regression to investigate the determinants of the perceived risk measures. In literature the PRAI (Physical Risk Assessment Inventory) questionnaire [1] is known as a good tool to measure the perceived risk. In this paper the questionnaire is considered in its Italian version. It is composed of 26 7-points Likert scale items divided into two dimensions: health (11 items) and sport (15 items). The PRAI questionnaire was administered to 551 students enrolled in some secondary level schools of Palermo. Each student was classified according to their *class* (first year or fifth year class), *school type* (classical Liceo, scientific Liceo, and technical school), and the *gender*. Health and sport items follow the same 7-point Likert scale (from 0: no physical risk to 6: extreme physical risk), so higher the ordinal response selected by the students, higher the perceived risk associated with each activity. Students were about 16 years old on average and the 40.5% of them were female. 60.4% attended first year classes and three school types: classical (23.4%), scientific (33.7%), and technical (42.9%). For reason of space, just health dimension results are showed in this paper.

## 2 The quantitative measure of the perceived risk

A first measurement of perceived risk obtained with the PRAI questionnaire showed that for the health risk scale subjects are mostly concentrated on the higher categories, with the 91% of cases. The quantitative measure of the perceived risk was obtained through a Rasch analysis. Rasch Models (RM) allow to estimate both the perceived risk (on the student perspective) and the connected risk to activities (on the items) [2]. The estimates are the

person location parameter (PLP) and the item location parameters (ILP) respectively. Bigger PLP, higher the perceived risk; instead, smaller the ILP, higher the connected risk. Due to the ordinal nature of the data, the RM involved is the Extended Logistic Model [3] for polytomous items. The analysis was performed separately for the two sub-datasets of males and females. In fact, literature [4] reports that “men’s and women’s ranking of risks differs very little.” But “men and women thus seem to worry about the same risks, but women constantly worry a bit more”. Therefore, the group was splitted into two sub-groups, the first for males and the second for female, and two Rasch analyses were performed. To check the unidimensionality of each scale, item-trait interaction test was considered. It started an iterative procedure of deletion of those items that at each iteration shows more misfit (through the individual item fit test). That was performed until the RM converged to the criteria of unidimensionality. Furthermore, given the unidimensionality, the person separation index ( $\psi$ ) was used to test the reliability of each RM. At the end of the item elimination iterative procedure, all the RMs deleted few items and the unidimensionality was always significative ( $p \in [0.06, 0.60]$ ), maintaining a good level of reliability ( $\psi > 0.77$ ). The overall PLP estimate for males shows they have always a lower perception of the risk than the females ( $-51\%$  for the indoor activities and  $-97\%$  for the outdoor activities); ; furthermore, the highest risk is connected with the behaviors in the health scale, for both males and females. The male and female measures differ for the number of items and the scale composition, i.e. for males there is a 6-items scale while for females a 8-items scale, sharing 5 items. Both perceived the use of heroin as the most risky behavior. With respect to the males, they have perceived the alcohol abuse ( $ILP = 0.081$ ) as healthy hazard; whereas, females have perceived risky the abuse of hallucinogenic drugs ( $ILP = -0.22$ ), driving after drinking ( $ILP = -0.2$ ), and finally having unsafe sex ( $ILP = 0.085$ ). However, they ordered the behaviors in a quite similar way, with respect to the connected risk, even if with different degree.

### 3 The determinants of risk perception

Considering the Rasch measures, it is possible to investigate the causal relationship between a set of covariates and the PLP measures. The covariates involved in the analysis regards those students’ information collected via PRAI (see paragraph 1). Now we put together males and females and consider the gender as a covariate.

The distribution of PLP measures shows the non-Normality and the presence of outliers. Consequently, to quantify the influence of the covariates on perceived risk PLP too, it seems adequate to perform a Quantile Regression (QR) analysis [5]. The baseline is female student, attending at the first year of the classical Liceo. The use of QR allows to investigate how much certain

individual characteristics may affect some percentiles. We perform five QRs for each risk dimension, considering 0.05, 0.25, 0.50, 0.75, and 0.95 percentiles respectively, and we compare these results with Ordinary Least Square (OLS) ones.

For reason of space, just health dimension results are showed in this paper. The OLS estimates suggest a significant effect of the class variable, whereas QR estimates highlight that the effect of the class is not significant and it varies in intensity with respect to the percentile distribution. In fact, for the students belonging from 0.05 to 0.45 percentile, the class effect is not statistically relevant. Moreover, for the other students, the difference between the fifth year student and the first year student statistically increases, showing that the fifth year students seem to pay less attention to their health than first year students. Finally, results show that fifth year students who are at the 0.75 percentile have a PLP measure significantly lower of about 0.5 logit than the students attending the first year class. Quite similar remarks can be made for the other categories of the remaining variables. The school type variable do not seem to be significant, while gender does. Moreover, with respect to the gender, results show that higher the male's perception of risk, higher the difference with the corresponding female percentile: males seem to be less careful. It can imply the different approach to the risk behavior for male and female. It is consistent with literature findings [4]. With regard to the baseline, the perceived risk for the female students, attending the first year class of the classical Liceo increases with the considered percentiles and it is always higher the mean level of risk underlined by the items.

**Acknowledgements** The article is the result of the productive collaboration among the authors. In particular, paragraph 1 can be ascribed to Monica Mandalà, paragraph 2 can be ascribed to Fabio Aiello, and paragraph 3 can be ascribed to Giovanni Boscaino.

This paper has been supported from Italian Ministerial grant PRIN 2008 "Measures, statistical models and indicators for the assessment of the University System", n. 2008BWXSLH

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