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Earnings Risk and Demand for Higher Education: A Cross-Section Test for Spain

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ABSTRACT

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We develop a simple human capital model for optimum schooling length when earnings are stochastic, and highlight the pivotal role of risk attitudes and the schooling gradient of earnings risk. We use Spanish data to document the gradient and to estimate individual response to earnings risk in deciding on attending university education, by measuring risk as the residual variance in regional earnings functions. We find that the basic response is negative but that in households with lower risk aversion, the response may be reversed to positive.

JEL Classification: I21

Keywords: earnings risk, schooling decisions

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1. INTRODUCTION

There can be no doubt that schooling is a risky investment. An individual deciding on schooling is at best imperfectly aware of her abilities, the demands of the school curriculum, the probability to succeed, the nature of the job that may be obtained after completing an education and the position within the post-school earnings distribution that may be attained. Neither can there be any doubt that the relation of these uncertainties with schooling decisions and outcomes is under-researched, although recently this literature seems to be taking off.

The literature starts with Levhari and Weiss (1974), with Eaton and Rosen (1980) and Kodde (1985), Jacobs (2002) building on their model. Levhari and Weiss introduce a two-period model, with work in period 2 and a choice between time devoted to school and to work in period 1. The pay-off to school time is uncertain, but revealed at the beginning of period 2. Increasing risk (increasing variance in the pay-off to school time) reduces investment in education if good states of the world generate higher marginal returns to education.[1]

Williams (1979) is the first to apply a stochastic dynamic programming model to education decisions, and to link up with the finance literature on marketable investment. The production of human capital, the depreciation of human capital and future wages are all stochastic. Again, higher risk, as larger variance in the production of human capital, reduces investment in schooling, unless risk aversion is very strong and the covariance between depreciation and production of human capital is highly negative.

Belzil and Hansen (2002) estimate a stochastic dynamic programming model on data from the NLSY 1979-1990, assuming a model with constant relative risk aversion (estimated at 0.928). They conclude from their estimates that an increase in risk (variance of labour earnings) increases schooling length. This happens because increased risk in the labour market makes schooling more attractive as this comes with receiving more riskless parental income support. The elasticity, at 0.07, is quite small though.

Hogan and Walker (2001) construct a stochastic dynamic programming model where being in school has utility value, and the shadow wage, to be realised when leaving school, follows a Brownian motion. Once the student leaves school, this shadow wage becomes the fixed wage for the entire working life. The model predicts longer schooling when risk increases. The upside risk, the probability to obtain a high wage, increases, while the increase in downside risk remains ineffective, because at low wage students stay in school anyway.

The different models differ somewhat in the concept of risk, but essentially they all consider the effect of changes in the variance of the post-school wage. The predictions are different though: increased risk may increase or decrease the length of schooling. The differences can be explained from differences in model structure, each highlighting different channels through which risk appears. Obviously, risk has many faces, and individuals can react in many ways. In this paper, we develop probably the simplest model possible to analyse the effect of stochastic post-school earnings on the desired length of schooling, showing the key role of essential risk parameters and risk attitudes in a simple elegant formula. We will then estimate the sensitivity of schooling decisions to variance in post-school earnings, by including regional observations on residual

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[1] Kodde (1985) identifies an additional, implicit, requirement for this result.

earnings variance in a probit for the decision to attend university education in Spain. The results show a negative effect of risk on investment, dampened by increasing taste for risk.

2. LENGTH OF EDUCATION WITH STOCHASTIC EARNINGS

2.1 *A simple formula*

Suppose, an individual faces potential earnings, depending on realized schooling s, in a simple multiplicative stochastic specification.

$$Y_{st} = \theta_{st} Y_s \tag{1}$$

where Y_{st} is earnings at age t for given schooling length s, Y_s is a non-stochastic shift parameter and θ_{st} is a stochastic variable.[2] Simplify to $\theta_{st} = \theta_s$ and

$$\begin{aligned} &E(\theta_s) = 1 \\ &E\{\theta_s - E(\theta_s)\}^2 = \sigma_s^2 \end{aligned} \tag{2}$$

θ_s is a stochastic shock around Y_s, with a single lifetime realisation[3], but with variance dependent on schooling length s. Write the individual's objective as maximum lifetime utility

$$\begin{aligned} W &= E \int_s^\infty U\{\theta_s Y_s\} e^{-\rho t}\, dt \\ &= \frac{1}{\rho} e^{-\rho s} E[U(\theta_s Y_s)] \end{aligned} \tag{3}$$

Apply a second-order Taylor series expansion around Y_s and write

$$\begin{aligned} E[U(\theta_s Y_s)] &= E[U(Y_s)] + Y_s U'(Y_s) E(\theta_s - 1) + \frac{1}{2} Y_s^2 U''(Y_s) E(\theta_s - 1)^2 \\ &= U(Y_s) + \frac{1}{2} Y_s^2 U''(Y_s) \sigma_s^2 \end{aligned} \tag{4}$$

Then, rewrite the objective function as

$$\max_s!\ \mathrm{W(s)} = \frac{1}{2} e^{-\rho s} \left[U(Y_s) + \frac{1}{2} Y_s^2 U''(Y_s) \sigma_s^2 \right] \tag{5}$$

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[2] We might specify earnings at age t for schooling s as $Y_{t-s}, t \geq s$, reflecting dependence on experience rather than age. However, since we assume $Y_{st} = Y_s$, i.e. constant wages over experience, this is immaterial.

[3] This simple specification is similar in spirit to Levhari and Weiss's two period model, with a wage unknown when deciding on schooling, but with a single lifetime realisation (one wage rate for the entire post-school period).

Setting the derivative to s equal to zero, ignoring a term with $U'''(Y_s)$ and rewriting a little yields as optimum condition

$$\varepsilon_s \left\{ \mu_s - \alpha_s \sigma_s^2 \left(\mu_s + \gamma_s - \frac{1}{2}\rho \right) \right\} - \rho = 0 \qquad (6)$$

with

$$\mu_s = \frac{\partial Y_s}{\partial s} \frac{1}{Y_s} \geq 0 \qquad (7)$$

$$\gamma_s = \frac{\partial \sigma_s}{\partial s} \frac{1}{\sigma_s} \qquad (8)$$

$$\alpha_s = \frac{U''(Y_s)}{-U'(Y_s)} Y_s \qquad (9)$$

$$\varepsilon_s = \frac{\partial U}{\partial Y_s} \frac{Y_s}{U(Y_s)} > 0 \qquad (10)$$

Hence, μ_s is the marginal rate of return to schooling, γ_s is the relative gradient of risk to schooling, α_s is relative risk aversion and ε_s is the income elasticity of utility. To understand this expression, note

- if $\sigma_s^2 = \frac{\partial \sigma_s}{\partial s} = 0$ and $\varepsilon_s = 1$, we have the standard condition of the core Becker-Mincer model, with investment until discount rate and marginal rate of return are equal. These conditions specify a riskless world and lifetime earnings maximization.
- if $\sigma_s^2 = \frac{\partial \sigma_s}{\partial s} = 0$ and $\varepsilon_s \neq 1$, we have the modification of utility maximization rather than earnings maximization.
- if individuals are risk neutral $(\alpha_s = 0)$ we have the same result as when there is no risk $(\sigma_s^2 = 0, \, all \; s)$.[4]

The second-order condition for an optimum requires the left-hand side of equation (6) to be a downward sloping function of s. By consequence, anything that shifts the curve upwards has a

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[4] Note that $\alpha_s = 0$ implies $\varepsilon_{ys}^u = 1 : \varepsilon_s = U' Y_s / U, U'' = 0$ implies U' constant or $U(Y_s) = cY_s$ which implies $\varepsilon_s = 1$.

positive effect on optimum schooling (intersection with zero-axis to the right), and anything that shifts the curve down reduces optimum schooling.

Effects of risk on demand for education length depend crucially on risk attitude α_s and on the term in the inner brackets. If this term is positive $\left(\mu_s + \gamma_s > \frac{1}{2}\rho\right)$, an increase in risk, at constant risk gradient, will reduce optimum schooling for risk averters $(\alpha_s > 0)$ and increase it for risk lovers. However, if risk strongly falls with education $\left(\gamma_s < \frac{1}{2}\rho - \mu_s\right)$ the conclusion is reversed. An increase in the risk gradient reduces optimum schooling length for risk averters and increases it for risk lovers. Note that even the effect of increased returns to education μ_s interact with risk attitude. An increase in returns will only increase optimum schooling length if $\alpha_s < 1/\sigma_s^2$. Strongly risk averse individuals may use the increased returns to shy away from risky investments. The schooling gradient of risk plays an important role in predicted outcomes, but is seldom analysed, in spite of the fact that at least crude non-standardised data are widely available. It calls for a search for empirical regularities.

2.2 G*eneralisation*

We will now develop a very general result, subject to only one substantial restriction. We will assume that stochastic shocks to earnings at different ages are uncorrelated. Correlated shocks will probably not affect the key result that with risk aversion, investment will be lower when risk increases, while the reverse holds for risk lovers.

Assume a general earnings profile $\theta_{st} Y_{st}$ where Y_{st} is non-stochastic and θ_{st} is the stochastic shock at age t, for given education s, with

$$E(\theta_{st}) = 1 \quad , \quad all\ s, t \tag{11}$$

$$E\{\theta_{st} - E(\theta_{st})\}^2 = \sigma_{st}^2 \tag{12}$$

$$E\{\theta_{st} - E(\theta_{st})\}\{\theta_{sv} - E(\theta_{sv})\} = 0 \quad , t \neq v \tag{13}$$

As before, the individual is assumed to maximized to maximize lifetime utility

$$\begin{aligned} \mathrm{W} &= \mathrm{E}\int_s^\infty E\{\theta_{st} Y_{st}\} e^{-\rho t}\, dt \\ &= \int_s^\infty e^{-\rho t} E\{U(\theta_{st} Y_{st})\} dt \end{aligned} \tag{14}$$

because of independent errors. Applying, as before, a second-order Taylor series expansion, we get

$$\mathrm{W} = \int_s^\infty e^{-\rho t}\left[U(Y_{st}) + \frac{1}{2}U''(Y_{st}) Y_{st}^2\, \sigma_{st}^2\right] dt \tag{15}$$

Setting the first derivative of W to s equal to zero, in a similar development as the derivation of (6), including ignoring a term with U''' yields the condition

$$\frac{\partial \mathrm{W}_s}{\partial s} = -\left[\varepsilon_{ss}^{-1} - \frac{1}{2}\alpha_{ss}\sigma_{ss}^2\right]U'_{ss}Y_{ss}e^{-\rho s} + + \int_s^\infty \left[\mu_{st} - \alpha_{st}\sigma_{st}^2\left(\mu_{st} + \gamma_{st}\right)\right]U'_{st}Y_{st}e^{-\rho t}\,dt = 0 \tag{16}$$

$$\mu_{st} = \frac{\partial Y_{st}}{\partial s}\frac{1}{Y_{st}} \geq 1 \tag{17}$$

$$\gamma_{st} = \frac{\partial \sigma_{st}}{\partial s}\frac{1}{\sigma_{st}} \tag{18}$$

$$\alpha_{st} = \frac{U''\left(Y_{st}\right)}{-U'\left(Y_{st}\right)}Y_{st} \tag{19}$$

$$\varepsilon_{st} = \frac{\partial U\left(Y_{st}\right)}{\partial Y_{st}}\frac{Y_{st}}{U\left(Y_{st}\right)} > 0 \tag{20}$$

Now, we have essentially the same result as before.[5] As the second order condition requires $\partial^2 \mathrm{W}_s / \partial s^2 < 0$, we know that $\partial \mathrm{W}_s / \partial s$ is declining in s. Then, a positive effect of some variable on the derivative increases optimal equation (the intersection of the curve with the zero axis), a negative effect decreases optimal education. The conclusions are slightly different from those of the simpler case, but important results remain. And now of course conclusions pertain to age-specific variables and parameters, rather than single lifetime values. A sign reversal of α_{st}, from risk aversion to risk loving, switches the sign of the effect of changes in variance σ_{st}^2 and in risk gradient γ_{st}. A change in σ_{ss}^2, variance at the start of working life, has a different effect than a change in a later year: it adds a positive term for risk averters, a negative term for risk lovers. An increase in later variance (t > s), reduces optimum schooling lengths for risk averters, unless the slope gradient annihilates the effect of the rate of return $\left(\mu_{st} + \gamma_{st} < 0\right)$. An increase in the schooling gradient of risk will have a negative effect on schooling length for risk averters. Note that indeed risk averters may be induced to longer schooling if the schooling gradient of risk is sufficiently negative. Our key general conclusion remains: the sensitivity to risk depends essentially on risk attitudes and there is an important role for the schooling gradient of risk. The first conclusion is no surprise, although existing models do not all allow for a full range of risk attitudes. The second conclusion indicates that empirical work is needed to establish the nature and determinants of the schooling gradient of earnings risk.

Needless to say our model is simpler and more restrictive than the dynamic programming models that are being developed. In particular, our assumption that individuals commit once and for all

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[5] Note, as before, that earnings maximisation implies unitary elasticity, $\alpha_{st} = 0$, $U'_{st} = 1$. With income independent of age, the standard Mincer condition returns.

to an optimum schooling length ignores that individuals may adjust plans as they advance through education, and indeed, with growing information will see their risk from ignorance reduced. But our model has the virtue of highlighting the role of key parameters, and thus provide a useful frame for empirical analyses. Generalising the model to a correlated variance structure over time has no priority, as we do not anticipate surprises from it.

3. CROSS-SECTION ESTIMATES FOR SPAIN

Both the survey of the literature and the model developed above indicate that the effect of post-schooling earnings variance on demand for schooling length is not unambiguous and will depend on the schooling gradient of risk and on risk attitudes. Hence, empirical work is needed to establish this sensitivity. We will explain the decision to continue education at the university level or not after completing secondary education. Among the explanatory variables we include the ratio of lifetime earnings with university and with secondary education and the risk ratio, the ratio of residual earnings variance, at the level of an individual's region of residence.

We use the Spanish Family Budget Survey EPF 1990/91, a nationally representative survey among 21 155 households, collecting information on all 72 123 individual household members. We use the database to estimate earnings functions separately for university and secondary education in an individual's region of residence, a simple quadratic function of potential experience (age minus education) and dummies for region and gender (see below)[6]. From the earnings functions, we approximate the rate of return to university education, by dividing the difference in intercepts for university and secondary education, by the length of university education (5 years). We also divide the relative difference between the residual standard deviations by 5. The resulting estimates of mu and gamma**,** as used in equation 6), are presented in Table 1. Negative signs for gamma dominate, pointing to a lower earnings risk for university than for secondary education. Generally, the sum of mu and gamma is positive, and in most cases it would be larger than 0.05; at a discount rate of 0.10, the term in brackets in (6) would still be positive. But these are just first estimates of a parameter that has not been documented very often. They are subject to selectivity effects from individuals' schooling choices, and correcting for such effects should be the first step in further research. However, it is not inconceivable that individuals deciding on extending their education use uncorrected, biased estimates, simply because they have not much more information than the researcher has.

We use the regional earnings functions also to calculate lifetime earnings, at a discount rate of 3.5 percent**,** by education and then calculate the ratio of lifetime earnings for the two educations. This is a measure of the average return to education in the region of residence of the individual's parental household. We also calculate, from the same earnings functions, the ratio of the residual variances in the region; hence, a measure of average relative risk of the investment in schooling.

To explain educational decisions, we use the subset of individuals aged 17 to 23 who have completed secondary education. We distinguish between attending university or not, i.e. at work or unemployed. The youth sample has 2501 observations, 1277 men and 1224 women; 1521 attend university, 980 don't. We only include individuals in the youth sample if they are registered as member of the parental household. This, however, is quite common in Spain. Among those 17-23 years old and not attending higher education, 1521 are offspring of the

[6] We applied OLS, since variables to correct for selectivity and endogeneity bias are not available. However, in related work including a Heckman correction had little effect. See Diaz Serrano (2001).

household head (and hence included in our youth sample) and 85 are living alone or have a different relation to the household head. Among those attending higher education, 980 are included as child of the household head, 128 are excluded as not being a child living with the parents (such observations are excluded because we need observations on the family to explain schooling decisions).

Relating educational decisions to earnings variables at the level of the residential region only makes sense if information at this level is the prime input in the decision. This is probably a fairly acceptable decision. It seems quite unlikely that educational decisions are dominated by expectations relating to the region where one might possibly work after graduation, e.g. a youth growing up in Extramadura anticipating earnings consequences in Madrid as the dream destination for a career. While such effects cannot be ruled out, we assume the regional environment of the parental household to be the main source for expected earnings consequences of schooling.

Our baseline probit is given in Table 2. Family characteristics have a conventional, and mostly highly significant effect on the probability to attend university after having completed secondary education. Family income, home ownership, parental education and occupation level have a positive effect, family size a negative effect. Urbanisation has a positive effect, while city size has a (surprising) negative effect. Unemployment is the duration of unemployment so far for unemployed with a secondary education. It has a positive effect, understandable from lower opportunity cost.[7]

The key variables are the earnings ratio and the earnings variance. They are based on earnings functions from the 18 Spanish autonomous regions, including a dummy for gender in each earnings function. The earnings ratio has the expected positive effect, and significantly so. The earnings variance ratio has a negative effect, significant at 10%. Using the framework of equation (6) and (7), this indicates that risk aversion dominates among youth with completed secondary education, as risk averse students respond negatively to the schooling gradient of risk, i.e. the risk ratio between university and secondary education.

In Table 3 we present estimates based on alternative specifications of the earnings functions. The top line repeats the estimate for the baseline equation from Table 2. The letter codes for intercept, experience and gender indicate whether the coefficients have been allowed to vary by autonomous region R or province P, education K and gender G (i.e. the letters refer to subscripts for the coefficients estimated on the variables). The top panel uses earnings function by autonomous regions, the lower panel by province. With 52 provinces rather than 18 regions we have more variation in our earnings and risk variables, but also less observations per province to estimate the variables. If there is an entry below gender, the earnings equations contain a gender dummy, in the other cases we use intercept differentiated by gender (which amounts to the same thing). Clearly, the basic results are unaffected: a positive effect of returns to education and a negative effect of relative variance on the probability to attend university. But with provincial earnings functions, significance levels drop substantially. This may be assigned to the poorer estimates of the underlying earnings functions, on account of the sometimes very small number of observations for an education-province combination.

Finally, in Table 4, we present a test on heterogeneous risk attitudes. The survey, as an expenditure survey, has observations on expenditures on lottery tickets. Presumably, this points

[7] The results are essentially the same if we use the ratio of unemployment duration by education.

to lower risk aversion, and in a strict sense even to risk loving. We created a dummy to pick out households who spend more than 3% of the family budget annually on lottery tickets, and interacted this with the variance ratio. The results are precisely in the expected direction, with a strong dampening of the negative effect of the risk gradient, and in fact, a sign reversal for those who spend relatively much on lotteries. Compared to the results in Table 3, the negative response to relative risk becomes stronger but for lottery adepts, the positive effect is so strong that it even surpasses the primary effect and generates a positive balance: those who spend much on lotteries even react positively to increases in the risk ratio. This is strong support for one of our key predictions, i.e. a pivotal role for risk attitudes.

We have tested the robustness of the effect by varying the budget share of lotteries form 1 to 6 %, as shown in Table 5. A 1% budget share in lotteries, realised by a third of the sample, is too small to reproduce the result of differential response to earnings risk, but for all thresholds from 2 to 6%, the basic results reappear, in about the same magnitude and significance levels.

4. CONCLUDING REMARKS

The literature on the effect of uncertain returns to education on the decision to invest generates no unequivocal results. The simple investment model presented here indicates that risk attitudes and the schooling gradient of earnings risk are pivotal in determining the sign of the relationship. Our estimates for Spain support our conclusion on the importance of risk attitudes.

The model we use, while generating essential insights, can certainly be improved by building on less restrictive assumptions. The most urgent candidate for change is the assumption that individuals must make a single binding decision on their length of education. In that sense, dynamic optimisation models, where individuals adjust their decisions along the way, are more attractive. Yet, while no doubt providing interesting and relevant refinements, it is doubtful whether such modelling will substantially modify the conclusion on the key role of risk attitudes and the schooling gradient of earnings risk. Further empirical work seems more urgent, in particular seeking replication of the results reported here, and extending the set of observations on earnings risk. And, of course, test for the effects of selectivity.

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Table 1. Annual returns to university education and the schooling gradient of earnings risk, by region

	μ_s		γ_s	
Region	**Men**	**Women**	**Men**	**Women**
1	0.1674	0.2016	-0.0882	-0.0721
2	0.1192	0.2027	0.0115	-0.0062
3	0.0339	-0.4798	-0.0364	-0.0617
4	0.0424	0.0684	0.0370	-0.0392
5	0.2596	0.1097	-0.0583	-0.0376
6	0.1580	0.3341	-0.0394	0.0304
7	-0.0036	0.1494	-0.0252	-0.0482
8	0.0809	0.1886	-0.0356	-0.0669
9	0.0957	0.0822	-0.0179	-0.0917
10	0.1249	0.1276	-0.0492	0.0065
11	0.2723	0.1273	0.0324	-0.0248
12	0.1442	0.0733	-0.0897	-0.0489
13	0.1373	0.3910	-0.1408	0.0033
14	0.0195	-0.1708	-0.0578	0.2307
15	0.0354	-0.0240	0.1087	-0.0600
16	0.0980	0.1127	-0.0220	-0.0346
17	-0.1328	0.0324	0.0560	0.0489
18	-0.0650	0.0019	-0.0842	-0.0962

With:

$$\mu_s = \frac{(\beta_{he} - \beta_{se})}{5} \qquad \gamma_s = \frac{(\sigma_{he} - \sigma_{se})}{5\sigma_{se}}$$

where:

β = Constant term in the earnings function - including a dummy for urbanization
σ^2 = Variance of the exponential(residuals) – including a dummy for urbanization in the earnings function.
he = higher education
se = secondary education

Table 2 Continued education and risk: basic regression

	coef.	t
earnings ratio	.478	2.87
earnings variance	-.107	-1.90
log family income	.207	3.70
House ownership	.114	1.82
family size	-.523	-5.04
education household head		
primary	.331	4.09
Secondary	.699	6.19
3 years college	1.036	7.11
5 years college	1.344	8.38
occupation household head		
managerial/directive, farming	.421	3.16
Blue collar, farming	-.124	-0.77
independent manager/ professionals, industry and services	.192	2.47
salaried directive/professionals, industry and services	.467	4.06
salaried white collar, industry and services	.319	4.23
not classified elsewhere	.463	2.10
Urban area	.401	2.53
city size		
10.000-50.000	-.152	-1.72
50.000-100.000	-.341	-1.82
100.000-500.000	-.393	-2.23
more than 500.000	-.439	-2.32
Unemployment	.195	2.51
Intercept	-3.820	-4.59

N = 2501; earnings ratio and earnings variance ratio based on 18 autonomous regions; Pseudo R^2 = 0.1168

Table 3 Continued education and risk: alternative earnings functions

Intercept	exp	gender	earnings ratio	variance ratio	average observations/profile	minimum observations/profile	Maximum Observation/prfile
18 regions RK	RK	RK	0.478 (2.87)	-0.107 (1.90)	sec: 250 univ: 162	sec: 46 (84) univ: 16 (44)	sec: 618 univ: 463
RKG	RKG	-	0.295 (2.63)	-0.077 (1.74)	Sec. men: 163 Sec. Women: 87 Univ. Men: 95 Univ. Women: 68	Sec. men: 37 (56) Sec. Women: 9 (28) Univ. Men: 9 (20) Univ. Women: 7 (17)	Sec. men: 409 Sec. Women: 209 Univ. Men: 266 Univ. Women: 210
52 provinces PKG	PKG	-	0.061 (1.05)	-0.043 (1.38)	Sec. men: 57 Sec. Women: 30 Univ. Men: 33 Univ. Women: 24	Sec. men: 15 (21) Sec. Women: 3 (6) Univ. Men: 4 (10) Univ. Women: 1 (7)	Sec. men: 152 Sec. Women: 81 Univ. Men: 98 Univ. Women: 64
PKG	KG	-	0.325 (3.37)	-0.017 (0.045)	Sec. men: 2926 Sec. Women: 1559 Univ. Men: 1698 Univ. Women: 1216	Sec. men: 2926 Sec. Women: 1559 Univ. Men: 1698 Univ. Women: 1216	Sec. men: 2926 Sec. Women: 1559 Univ. Men: 1698 Univ. Women: 1216
PK	K	K	0.162 (1.44)	-0.058 (1.26)	sec: 4485 univ: 2914	sec: 4485 univ: 2914	sec: 4485 univ: 2914
PK	PK	PK	0.272 (2.98)	-0.038 (0.99)	sec: 87 univ: 57	sec: 18 (27) univ: 5 (19)	sec: 233 univ: 162

R = region (18)
P = province (52)
K = education (secondary, higher)
G = gender
t values in parentheses

Note:
The minimum values in column (minimum observations) always correspond to region18 (Ceuta and Melilla), and provinces 51 and 52 wich are also Ceuta and Melilla. These region/provinces are a special case, as Spanish colonies in Morocco. The values in parenthesis in column (minimum observations) are the minimum observations without taking into account region18 or provinces 51 and 52.

Table 4 Continued education and risk: heterogeneous risk attitudes

Intercept	exp	Gender	earnings ratio	variance ratio	Variance ratio* lottery exp.
18 regions					
RK	RK	RK	0.295	-0.143	0.157
			(2.64)	(2.51)	(1.70)
RKG	RKG	-	0.297	-0.098	0.150
			(2.64)	(2.13)	(1.84)
52 provinces					
PKG	PKG	-	0.064	-0.058	0.138
			(1.09)	(1.78)	(2.00)
PKG	KG	-	0.333	-0.029	0.169
			(3.45)	(0.063)	(1.95)
PK	K	K	0.158	-0.065	0.149
			(1.41)	(1.40)	(1.55)
PK	PK	PK	0.277	-0.053	0.152
			(3.03)	(1.33)	(1.96)

R = region (18)
P = province (52)
K = education (secondary, higher)
G = gender

t-values in parentheses

Table 5 Risk heterogeneity, with varying threshold

Butgetshare lotteries	1%	2%	3%	4%	5%	6%
N above threshold	810	517	337	239	180	138
earnings ratio	0.478 (2.97)	0.483 (2.89)	0.476 (2.85)	0.472 (2.83)	0.474 (2.84)	0.479 (2.87)
variance ratio	-0.105 (1.67)	-0.140 (2.39)	-0.143 (2.40)	-0.135 (2.31)	-0.120 (2.08)	-0.114 (2.00)
Variance *lottery dummy	-0.006 (0.10)	0.122 (1.64)	0.171 (2.32)	0.178 (1.91)	0.166 (1.43)	0.149 (1.09)

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