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Earnings Functions under Test: Evidence from Five Countries

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EARNINGS FUNCTIONS UNDER TEST: EVIDENCE FROM FIVE COUNTRIES

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1. Introduction

Human capital earnings functions with the log of earnings as endogenous variable and years of schooling, years of experience, and years of experience squared as exogenous variables are a standard tool in econometric studies of labor markets. Usually, these earnings functions, at least for men, are estimated by ordinary least squares (OLS). In an earlier study (cf. Wagner and Lorenz 1988) based on five large samples of German male full-time workers it was tested whether the assumptions of the classical linear regression model are fulfilled for the wage equations estimated, i.e., whether the errors of the model are normally distributed and homoscedastic, and the functional form is specified correctly. The nullhypotheses of normal distribution, homoscedasticity, and correct specification were nearly allways rejected. The aim of this paper is to check whether these results are due to particularities of the German labor market (e.g. regulations or segmentation) or whether they can be found in other countries, too.

2. Data

To answer this question identically specified human capital earnings functions are estimated and tested for male full-time workers from five countries (Australia, Canada, Germany, Israel, Netherlands).

The samples are part of the Luxembourg Income Study (LIS) data bank (cf. Rainwater and Smeeding 1988) which contained microdata sets from ten countries in July 1988. Here all countries are included where the schooling variable is given in an appropriate form.[1)]

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1) Details as regards the data sets are given in Smeeding/Rainwater/Buhmann/Schmaus 1987; it should be noted that the German data set used here was not included in our earlier study (Wagner and Lorenz 1988).

Earnings are (log of) gross annual wage and salary income. The schooling variable is coded as follows: a dummy variable for medium education (i.e. 10 years of schooling and not academic), and a dummy variable for academic education, using low education (i.e. one to nine years of schooling) as the reference group. The experience variable is computed as potential experience, i.e. age minus schooling minus six, using nine years of schooling for low education, ten for medium education, and fifteen for academic.

3. Results of the Econometric Study

The results of the OLS estimations for the earnings functions are given in table 1.

All estimated coefficients show the theoretically expected signs which are statistically highly significant if tests are based on the reported t-values. (The focus of this paper being on econometric aspects, we will not consider differences and similarities as regards the rates of return in the countries included.)

In checking these models we first tested the hypothesis of normality of errors using a test statistic derived by Jarque and Bera (1980).[2] The results reported in table 2 show that the null-hypothesis is rejected for all countries but Israel.

A closer inspection of the residuals reveals that large standardized residuals are nearly exclusively found for cases belonging to either the highest one percent or the lowest two percent of the wage distribution. It was not possible to apply a robust estimation method (e.g. least absolute deviations) at LIS, but adding dummies for 'highest 1 %' and 'lowest 2 %' did not change the results drastically, though the nullhypothesis is rejected for the augmented models, too.

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2) For details as regards the tests used see the original papers cited and the textbook by Krämer and Sonnberger (1986).

Table 1: Earnings Functions for Male Full-time Black and White Collar Workers in five countries

Endogenous Variable: log of annual gross wage and salary income

Exogenous Variable \ Country (Year of Data)		Australia (1981/82)	Canada (1981)	Federal Republic of Germany (1981)	Israel (1979)	Nether-lands (1983)
Medium Education (Dummy)	$\hat{\beta}$	.152	.164	.324	.370	.311
	|t|	11.79**	11.09**	15.08**	11.87**	19.55**
	ATV	11.90**	10.72**	15.44**	11.79**	19.53**
Academic Education (Dummy)	$\hat{\beta}$	.471	.472	.426	.721	.687
	|t|	22.32**	21.93**	4.11**	18.68**	24.18**
	ATV	19.84**	20.00**	5.76**	19.46**	21.84**
Potential Experience	$\hat{\beta}$	.0446	.0402	.0440	.0367	.0453
	|t|	21.92**	17.92**	8.83**	6.92**	13.14**
	ATV	16.77**	16.05**	7.48**	5.60**	12.63**
(Potential Experience)^2	$\hat{\beta}$	-.000767	-.000705	-.000792	-.000584	-.000692
	|t|	19.04**	16.89**	8.48**	6.07**	10.43**
	ATV	14.10**	14.33**	6.98**	4.81**	9.74**
Constant	$\hat{\beta}$	9.015	9.354	9.881	9.339	9.898
	|t|	377.78**	317.77**	159.42**	132.84**	236.65**
	ATV	306.89**	301.51**	140.58**	113.99**	236.88**
R^2		.113	.115	.173	.243	.324
N of cases		7577	5588	1464	1143	1892

Note: $\hat{\beta}$ = estimated regression coefficient

|t| = absolute t-value [*(**) = sign.for α = 0.05 (0.01)]

ATV = Heteroscedasticity-consistent t-value (White 1980)

Source: Own calculations using the LIS data bank; for a desription of variables and data see text.

Table 2: Results of Tests for Earnings Functions for Male Full-time Black and White Collar Workers in five Countries

TEST \ Country (Year of Data)	Australia (1981/82)	Canada (1981)	Federal Republic of Germany (1981)	Israel (1979)	Nether-lands (1983)
NORMALITY OF ERRORS					
Jarque-Bera Test	R	R	R		R
HOMOSCEDASTICITY OF ERRORS					
Breusch-Pagan-Test (studentized version)					
Test Variables:					
Medium Education		[R]			
Academic Education	[R]				
Years of potential Experience		R	[R]		R
(Years of potential Experience)^2		R	R		[R]
All four exogenous variables	R	R			
RESET					
Test Variables:					
Powers 3 and 4 of years of potential experience	R	R	R	R	R
Powers 2 and 3 of fittet y-values	[R]				R

Note: R [R] indicates that the test rejects the null-hypothesis for $\alpha = 0.01$ [0.05]

Source: Own calculations using the LIS data base; for a description of the models see table 1, for tests see text.

As the next step the hypothesis of homoscedasticity of errors was tested with the Breusch-Pagan-test (Breusch and Pagan 1979) using as test variables each exogenous variable and all of them, and applying a 'studentized' version of the test developed by Koenker (1981) because of the rejection of the hypothesis of normally distributed errors reported above. As can be seen from the results given in table 2 only for Israel the null hypothesis of homoscedastic erros cannot be rejected on a five percent level of significance. Instead of estimating the unknown variances of erros and applying estimated generalized least squares we computed heteroscedasticity-consistent t-values (ATV) using the method of White (1980) to correct for the bias in the estimation of variances of the coefficients in the models estimated by OLS. A comparison of the t-values and the ATV reported in table 1 does not reveal any difference large enough to come to a different conclusion as regards the statistical significance of the estimated coefficients. Therefore, heteroscedasticity of erros seems to be no sound reason to abandon the conclusions based on human capital earnings functions estimated by OLS.

The final step of diagnostic checking consists of testing the hypothesis of a correctly specified functional form.

Here the regression specification error test (RESET) by Ramsey (1969) is applied in a form suggested by Thursby and Schmidt (1977) using as test variables either powers three and four of years of potential experience or the second and third powers of the fitted endogenous variable. As can be seen from table 2 all models are rejected by at least one version of RESET even at the one percent level of significance. Therefore, the specification used seems not to be a correct one. RESET, however, is not a constructive test in the sense that hints towards a correctly specified model are given.

4. Conclusions

The numerous rejections of the null hypotheses of the models based on data from Australia, Canada, Germany, and the Netherlands, raise the question whether earnings functions of the type used here (and, slightly modified in one way or another, in hundreds of studies all over the world) are based on solid econometric grounds. To repeat two of the caveats mentioned in our earlier study, each of the tests applied, however, may not be insensitive to the failure of assumptions different from the one it is designed for to test against. Furthermore, many questions regarding multiple testing of a model are still open today from a theoretical point of view, and, therefore, a prob value for the joint test conducted in applying different tests to each of the models cannot be given (cf. Krämer and Sonnberger (1986, p. 147 ff.)).

To sum up, the rejections of the null-hypotheses stated when applying OLS to estimate an earnings function are not due to particularities of the German labor market. It is strongly suggested, therefore, to draw conclusions based on wage equations only after testing the hypotheses mentioned, and checking the sensitivity of results by applying 'robust' estimation methods, computing heteroscedasticity-consistent t-values, and using different functional forms.

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