CHAPTER 2

Human Capital and Earnings in Austria

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1   Introduction

In this paper we review the empirical literature on returns to human capital variables available in Austria. In Austria, only a couple of papers studying wage functions exist. Although the first paper on this topic was published in 1984, the topic disappeared from research for about 10 years.

The studies address several problems discussed in labour economics. So they differ in the population sample considered and the regression equations applied. Consequently, we are mainly interested in the robustness of the results according to various specifications. But we are also looking for differences in the regression estimates between the sub-samples examined.

The paper is organised as follows: Section 2 contains a brief description of the data sets used in various studies. We discuss estimation methods and variables entered in the regression equations in Section 3 and we compare the results in Section 4. Section 5 concludes.

2   Data sets

Most empirical studies concerning Austria's wage structure are based on micro-data from the *Mikrozensus* of the Central Statistical Office. This is a quarterly 1% household survey, which is representative for the Austrian economy. It contains detailed information on personal characteristics like sex, age, nationality, human capital, labour market status, working hours and industry affiliation. For most years no direct information on work experience and job tenure is available. The Mikrozensus has been established in 1981 and information about earnings of the dependent working population is available only every second year.

Apart from this survey information, information from administrative social security records is available *(Hauptverband der Sozialversicherungsträger)*. Here, earnings data and complete working careers for all workers in Austria are recorded − starting from 1972. As these data are kept for purposes of the social security administration only − primarily for the calculation of old age retirement

pensions – many important socio-economic characteristics of workers are missing. Earnings are only recorded up to the social security contribution ceiling (censored data), education can only be constructed by the year of entry in the labour force and no family affiliation is recorded; but there is good information on vocational training (apprenticeship) which is important in Austria for blue-collar workers. So far, a 2% sample of these data has been used for the years 1972 – 1991.

3 Methods and variables

Christl (1984), Hofer and Pichelmann (1997), and Boss et al. (1997) estimate Mincerian wage equations using ordinary least squares methods. Whereas Christl (1984) investigates differences in returns to schooling across occupational groups in 1981[1], Hofer and Pichelmann (1997) are interested in whether the wage differentials between low and high skilled workers have gradually disappeared between 1981 and 1993. Returns to education for different occupational groups, especially public and private sector workers, are presented by Boss et al. (1997). Because information about female work interruptions is hardly available, Christl (1984) and Hofer and Pichelmann (1997) concentrate on male workers only. Moreover, since the proportion of men who do not participate in the labour force is negligible, they do not control for selection bias.

   The dependent variable is the logarithm of (real) monthly net wages. Because monthly wages are heavily determined by hours worked, working-time adjusted earnings based on a 40 hours week were constructed in the studies mentioned above. Christl (1984) has a very parsimonious specification using only years of education, experience and experience squared as exogenous variables (see Appendix Table A1). Experience means potential experience, i.e. age – years of schooling – 6 (school starting age).

   In order to get a more flexible specification, Hofer and Pichelmann (1997) as well as Boss et al. (1997) differentiate between 6

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[1] Christl (1984) runs regressions for all male workers, blue-collar workers, white-collar workers, and civil servants separately.

educational categories, namely compulsory school without any higher education or vocational degree, apprenticeship, intermediate vocational school (BMS), upper vocational school (BHS), academic secondary school (AHS – upper cycle), and university (UNI). But Hofer and Pichelmann (1997) also run regressions with years of schooling instead of dummy variables to facilitate international comparisons.

Besides the human capital proxies used by Christl (1984), Hofer and Pichelmann (1997) include a dummy variable and interaction terms between this dummy variable and experience and its square to differentiate between blue-collar and white-collar workers. A vector of 8 industry dummies and a foreigner dummy complete the list of independent variables used. Information about family background, region, nationality and hours worked are used by Boss et al. (1997).

Civil servants are subject to strict salary scales, not directly related to market wages. Therefore Hofer and Pichelmann (1997), Winter-Ebmer (1995) as well as Zweimüller and Winter-Ebmer (1994) exclude civil servants from the population analysed; otherwise the estimates of returns to schooling and experience are possibly downward biased (see Table 1).

Zweimüller and Winter-Ebmer (1994) investigate gender wage differentials in private and public sector jobs in Austria in 1983,

Table 1.   Data sets, observation periods and population groups considered

	Data set used	Year(s) covered	Sample
Christl (1984)	Mikrozensus	1981	all males
Zweimüller and Winter-Ebmer (1994)	Mikrozensus	1983	males and female white-collar workers
Winter-Ebmer (1995)	Mikrozensus	1983	males and females, civil servants excluded
Winter-Ebmer and Zweimüller (1996)	Social Security Records	1991	male native blue-collar workers below age 31
Boss et al. (1997)	Mikrozensus	1985-1993 pooled	males and females
Hofer and Pichelmann (1997)	Mikrozensus	1981-1993	males (15 – 54 yrs), civil servants excluded

applying Heckman's two-stage method to control both for participation decisions and sectoral choice. Their regression equation is more comprehensive compared to that of Hofer and Pichelmann (1997). Additionally, they include years of work interruption, city size, marital status, number of children, weekly working hours, regional and occupational dummies, and 6 professional position dummies in their regression equation. As professional positions are highly determined by education, on the one hand, and work experience, on the other, results with and without these dummies are presented. Work interruption is proxied by age – minimal years of schooling for a certain degree – 6 – actual experience. Regressions are run separately for four sub-populations: males in the private sector, females in the private sector, males in the public sector, and females in the public sector. Net hourly wages in logarithmic terms are used as the dependent variable constructed as: monthly net earnings divided by usual hours worked per week. Because of potentially biased estimates due to selective participation in the labour market and sectoral choice, they include two Heckman selectivity terms, which do not seem to influence the results very much, though. Boss et al. (1997) use a selectivity correction term to control for selective response rates for the income question, which does not seem to matter in the empirical results.

In estimating gender discrimination, Winter-Ebmer (1995) employs more or less the same specification as Zweimüller and Winter-Ebmer (1994). He includes concentration ratios in the labour and the product market but drops professional position dummies. Again, least squares estimates are presented using log net hourly wages as the dependent variable. As he is interested in job-lock and mobility of women, separate results for single and married persons are available.

Ichino and Winter-Ebmer (1998) focus on endogeneity of the schooling decision within an Instrumental Variables framework. As cohorts in Central Europe, who were at school age during World War II, had significantly lower educational attainment than cohorts who went to school either before or after the war, cohort information can be used as an instrument for educational attainment. As age 10 is the crucial age for high-school enrolment and further university enrolment, which depends on high-school graduation, this cohort information – being 10 to 14 years of age during the war – is used as an instrument for education. Moreover,

it can be assumed that not all individuals react similarly to this instrument: only those with high liquidity constraints reduce their schooling attainment because of the war.

In accordance with the Local Average Treatment Effects (LATE) interpretation of Instrumental Variables estimates (see e.g. Angrist and Imbens, 1995), they refrain from interpreting their IV results as *average* returns to education in the population. If the instrument "being 10 to 14 during World War II" shifts the educational attainment of specific individuals only, i.e. those with liquidity constraints, the resulting returns to education should be interpreted as the average returns to education for those individuals who changed educational attainment just because of the liquidity constraints caused by the war. Because mainly individuals with potentially high returns and high liquidity constraints are likely to react, this can be considered to be an upper bound for average returns to education.[2] The authors use a very parsimonious specification: besides education, only age terms, because all other variables might be considered as endogenous themselves.

An example of the use of data from social security records is Winter-Ebmer and Zweimüller (1996). The authors regress monthly gross earnings on (constructed) years of education, apprenticeship training and detailed work experience and job tenure. As years of education are only approximated, measurement error will lead to downward biased estimates for returns to education. Moreover, due to top-coding in monthly earnings, they use a Tobit framework.

4 Results

The empirical specification of the earnings equation differs considerably across various studies, obviously depending on the specific aim of the paper. Therefore we concentrate ourselves to report only estimates for human capital proxies.

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[2] See Ichino and Winter-Ebmer (1999) for an argument on how upper and lower bounds for returns to education can be approximated by using different Instrumental Variables estimators.

4.1   Returns to education

In all studies, the estimates of the educational wage premium give the expected results and are rather similar. The results are summarised in Tables 2 to 5.

Christl (1984) reports returns to education of about 9% for all males, white-collar workers, and civil servants but only 6% for blue-collar workers. The chosen human capital function explains the variance in earnings very well (adj. R^2 of about 25% for all males and white-collar workers and of 44% for civil servants). However, for blue collar workers the human capital earnings function explains only 5% of the variance around the mean. This indicates that for blue-collar workers schooling and work experience are of minor importance for their earned income. Zweimüller

Table 2.   **Returns to education (%) – years of schooling**

	Year	Years of education	
		Female	Male
Christl (1984)			
all males	1981		9.37
blue-collar	1981		6.83
white-collar	1981		8.90
civil servants	1981		9.12
Zweimüller and Winter-Ebmer (1994)			
professional position excluded			
private white-collar	1983	6.10	4.80
public white-collar	1983	5.30	5.10
professional position included			
private white-collar	1983	2.50	1.00
public white-collar	1983	3.00	2.10
Winter-Ebmer (1995)			
unmarried	1983	5.60	6.10
married	1983	6.80	6.40
Hofer and Pichelmann (1997)	1981		8.69
	1983		7.87
	1985		7.63
	1987		7.44
	1989		7.60
	1991		7.37
	1993		7.22

and Winter-Ebmer (1994) estimate returns to schooling (between 4.8% and 6.1% for male and female white-collar worker in the private sector, respectively) which are somewhat smaller. These results relate to their specification, where professional position dummies are not included in the regression equation. If included, then the estimated returns to education are dramatically lower (between 1% and 3%) indicating a high correlation between years of schooling and professional position.[3]

Hofer and Pichelmann (1997) have comparable data for both the 1980s and early 1990s. They found no increase in the education premium in this period. On the contrary, they report a decline in the returns to one additional year of education from 8.7% in 1981 to 7.2% in 1993. This is also true if schooling levels are entered as dummy variables. In particular, individuals with higher education levels lost ground as compared to persons with compulsory schooling. For example, the wage premium for a university degree has fallen from 96% in 1981 to 84% in 1993 (see Table 3a). The figures for an upper vocational school degree (BHS) are 54% in 1981 and 41% in 1993, respectively.

Table 3b reports returns to different types of schools for occupational groups (Boss et al., 1997). It has to be noted that – owing to very low enrolment rates – calculating returns to higher education for the case of blue-collar workers does not make big sense. Comparing returns for white-collars and public servants, we see that for males, returns are always higher in the private sector, whereas for females, returns are higher in the public sector for the lower schooling types, but higher in the private sector for university educated workers.

Estimated returns to education of about 5 – 6% for male as well as female private and public white-collar workers are reported by Zweimüller and Winter-Ebmer (1994).[4] Winter-Ebmer (1995) presents estimates of returns to education for married and unmarried private employees. As expected, the estimates do not differ with marital status.

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[3] The professional positions are: unskilled, low skilled, medium skilled, high skilled, leading, leading manager.

[4] Differences in returns to education between males and females and across sectors are not statistically significant except for the difference between male and female private white-collar workers (significant at 10%).

Table 3a. **Returns to education for males for different school types (%)[a]**

	1981	1983	1985	1987	1989	1991	1993
Hofer and Pichelmann (1997)							
Compulsory (base)	-	-	-	-	-	-	-
Apprenticeship	10.20	09.25	11.20	11.20	11.22	11.69	11.28
BMS [b]	20.67	17.32	20.33	21.26	23.86	18.71	21.81
AHS [c]	39.08	33.94	35.70	37.89	39.21	33.71	29.74
BHS [d]	54.20	44.40	47.65	45.30	48.16	48.25	41.03
UNI [e]	95.93	88.97	83.40	84.02	83.53	82.18	84.34

Notes: [a] all estimates are transformed by $(\exp(\beta)-1) \times 100$
[b] intermediate vocational school (2 to 4 year courses)
[c] academic secondary school (upper cycle – 4 year courses)
[d] upper vocational school (5 year courses)
[e] university

Table 3b. **Returns to education for different school types (%)[a]**

	Male			Female		
	Blue-collar	White-collar	Civil servants	Blue-collar	White-collar	Civil servants
Boss et al. (1997)						
Compulsory (base)	-	-	-	-	-	-
Apprenticeship	13.66	13.43	6.40	5.65	6.61	14.11
BMS [b]	17.59	28.53	20.80	5.55	23.86	31.26
AHS [c]	10.63	45.35	41.76	12.19	34.04	44.20
BHS [d]	28.40	56.67	45.50	10.96	40.21	52.81
UNI [e]	7.14*	86.64	82.40	-4.02*	80.04	67.20

Notes: Observations pooled over the years 1985, 1987, 1989, 1991 and 1993, annual dummies included.
[a] all estimates are transformed by $(\exp(\beta)-1) \times 100$
[b] intermediate vocational school (2 to 4 year courses)
[c] academic secondary school (upper cycle – 4 year courses)
[d] upper vocational school (5 year courses)
[e] university
* not significant

The results by Ichino and Winter-Ebmer (1998) use a very crude measure for educational attainment: having completed high school or not. Using this measure, they find that those with lower education command 40% lower wages according to the OLS regression. In the IV-LATE framework wages are 61.2% lower for workers who did not finish high school because of the war. As this is the only IV result for Austria, which is relatively difficult to compare with the other estimates, it can be assumed that returns to education estimated by Instrumental Variables are approximately 50% higher than those measured by OLS.

4.2   Returns to apprenticeship training

Table 4 summarises the estimates of returns to apprenticeship training. The estimates of the various studies are quite different and they range between 1.6% (female white-collar workers in the private sector) and 13.7% (male blue-collar workers).

Table 4.   Returns to apprenticeship training (%)[a]

	Year	Female	Male
Zweimüller and Winter-Ebmer (1994)			
professional dummies excluded			
private white-collar	1983	1.61[*]	2.12[*]
public white-collar	1983	-1.58[*]	2.94[*]
Winter-Ebmer (1995)			
unmarried	1983	3.25[*]	12.18
married	1983	4.92[*]	7.47
Winter-Ebmer and Zweimüller (1996)			
blue-collar below age 31	1991		13.31
Hofer and Pichelmann (1997): see Table 3a			
Boss et al. (1997): see 3b			

Notes: [a] all estimates are transformed by $(\exp(\beta)-1) \times 100$
        [*] insignificant estimate

According to Hofer and Pichelmann (1997), who investigate returns to education for private sector male workers, apprenticeship training leads to a 9.3 – 11.1% wage premium relative to individuals who hold only compulsory education (see Table 3a). This figure is in accordance with estimates presented by Winter-Ebmer (1995) for married and unmarried male workers (private sector), Winter-Ebmer and Zweimüller (1996) for blue-collar workers below age 31, and Boss et al. (1997) for blue- and white-collar male workers employed in the private sector (see Table 3b). However, estimates of returns to apprenticeship training for females working in private enterprises are quite low compared to their male counterparts (6% vs. 13% in Boss et al., 1997). This may be a consequence of segregation in apprentice recruitment. Whereas men enter an apprentice position with good chances of a craftsman career, more women enter dead-end education, where they have to change occupation after the completion of the apprenticeship.

Boss et al. (1997) also publish estimates of returns to apprenticeship training for male and female civil servants. In the public sector, females holding an apprenticeship degree can command 14.1% higher wages compared to those who hold only compulsory education. The corresponding figure for males is only 6.4%, which is unusually low. Moreover, Zweimüller and Winter-Ebmer (1994) report estimates for white-collar workers (males and females) which are dramatically lower (about 2%). Indeed, these estimates are not significant. These large differences in estimates of returns to apprenticeship training are quite unsatisfactory, since no explanations could be proposed. Therefore more research effort should be devoted to this area.

4.3   Returns to experience

In all studies, the estimated earnings-experience profiles are concave as human capital theory predicts. Table 5 reports estimates for returns to experience and experience squared. Note that the results for Christl (1984), Hofer and Pichelmann (1997), and Boss et al. (1997) relate to potential experience, whereas the studies by Zweimüller and Winter-Ebmer (1994), Winter-Ebmer (1995), and Winter-Ebmer and Zweimüller (1996) relate to actual years of work experience.

Christl (1984) and Hofer and Pichelmann (1997) estimate returns to experience for male blue-collar and male white-collar workers in 1981. As expected, both studies report an earnings-experience profile which is flatter for blue-collar workers than for white-collars. According to their results, blue-collar workers (white-collar workers) can expect the highest returns to experience after 26 – 31 (27 – 30) years.

Various studies report quite a different shape of earnings-experience profiles. The profiles estimated by Christl (1984) and Zweimüller and Winter-Ebmer (1994) are flatter and less concave than those presented by Hofer and Pichelmann (1997). Whether these differences are attributable to the more flexible specification applied by Hofer and Pichelmann (1997) requires further research (see Card (1998) for a discussion for using credentials vs. schooling years).

Considering the development of returns to experience between 1981 and 1993, Hofer and Pichelmann (1997) observe a small tendency to a flatter profile for both groups.

Gender differences in rewards for experience can be seen from Zweimüller and Winter-Ebmer (1994) and Winter-Ebmer (1995). In the private sector, years of experience are more honoured for males (3.2%) than for females (2.1%) in the early stages of their working lives. In the public sector, no differences in the returns for experience are detected. Again, estimates for returns to experience are generally lower if professional position dummies are included, but the same picture concerning discrimination by gender appears.

4.4   Returns to tenure

Information about job tenure is hardly available in Austria. Only Winter-Ebmer and Zweimüller (1996), who use information from administrative social security records, investigate tenure induced wage effects by including years of tenure and its square in their regressions. They report returns to tenure only for male blue-collar workers below age 31. For this group a convex earnings-tenure profile is found, with falling returns to tenure at the beginning of the career with a firm. This result seems to be at odds with human capital theory, but can be explained by the prevalent job-hopping and job-matching behaviour of this group of very young workers.

Table 5. **Returns to experience (%)**

	Year	Experience		Experience Sq.	
		Female	Male	Female	Male
Christl (1984)					
all males	1981		3.02		-0.05
blue-collar	1981		1.89		-0.03
white-collar	1981		4.26		-0.07
civil servants	1981		2.26		-0.02
Zweimüller and Winter-Ebmer (1994)					
professional position excluded					
private white-collar	1983	2.10	3.20	-0.02	-0.05
public white-collar	1983	1.90	2.10	-0.02	-0.02
professional position included					
private white-collar	1983	1.80	2.80	-0.02	-0.04
public white-collar	1983	1.90	2.10	-0.02	-0.02
Winter-Ebmer (1995)					
unmarried	1983	3.10	2.80	-0.07	-0.05
married	1983	0.20	1.60	-0.00	-0.03
Winter-Ebmer and Zweimüller (1996)					
blue collar below age 31	1991		7.60		-0.50
Boss et al (1997)					
all workers		2.30	2.40	-0.04	-0.04
blue-collar workers	1985-	0.90	1.90	-0.02	-0.03
white-collar workers	1993	3.20	3.70	-0.06	-0.05
civil servants	pooled	2.30	2.00	-0.03	-0.02
Hofer and Pichelmann (1997)					
blue-collar	1981		4.68		-0.09
	1983		4.69		-0.09
	1985		5.07		-0.10
	1987		4.48		-0.08
	1989		4.26		-0.08
	1991		3.90		-0.07
	1993		4.02		-0.07
white-collar	1981		6.53		-0.12
	1983		6.35		-0.11
	1985		6.57		-0.12
	1987		6.76		-0.10
	1989		6.83		-0.10
	1991		6.30		-0.09
	1993		5.40		-0.09

In an earnings change equation (over a period of 3 years), positive returns to tenure between 0.6 and 1% are found, if the change of employer and the change of industry in this 3-year period is controlled for.

5   Conclusion

In this paper we reviewed various Austrian studies with regard to their estimates of standard human capital proxies. All estimates (except the estimate for tenure) are in accordance with theory and show the expected sign. Returns to schooling lie in a range from 5% to 9%. They are higher for instrumental variables estimates. However, if occupational dummies are included the estimates are dramatically lower.

With respect to returns to experience, all studies found concave earnings-experience profiles. The estimates are difficult to compare, since different data sets might observe workers at a different point in their work career, and thus the concave wage pattern might be differently approximated by a quadratic profile. But at a first glance, earnings-experience profiles of employees in the public sector as well as those of married people are flatter and less concave.

Estimates of returns to apprenticeship training are more diverse. Whereas non-governmental male workers holding an apprenticeship degree can command a wage increase of up to 13%, the premium for female workers is only 6%. However, this picture is reversed for civil servants, honouring apprentice training with a 14% wage premium for females but only with a 6% wage increase for males. Tenure induced wage effects have hardly been investigated in Austria.

Generally, in Austria no comprehensive study concerning human capital variables and private returns exists. The various studies described above differ substantially in the questions addressed and the samples used to estimate the parameters of different wage equations, so that the results are sometimes hard to compare. Moreover, most studies use data for only one year. So there is a need for a lot of further research in this field, which comprises all aspects concerning human capital and earnings.

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Appendix

Table A1.   **Applied research on returns to education in Austria: variables included**

	Christl (1984)	Hofer/ Pichelmann (1997)	Boss et al. (1997)	Zweimüller/ Winter- Ebmer (1994)	Winter- Ebmer (1995)	Winter- Ebmer/ Zweimüller (1996)
Years of Education	x			x	x	x
Levels of Education		x	x			
Experience	potential	potential	potential	actual	actual	actual
Experience Squared	x	x	x	x	x	x
Blue collar/ White collar	x	x	x			
Professional Status			x	x/-*		
Working Hours			x	x	x	
Sector Public/ Private				x		
Region			x	x	x	x
City Size				x	x	x
Sector of Industry		x		x		x
Marital Status/ Children			x	x	x	
Work Interruption				x		
Apprentice Training				x	x	x
Seasonal Occupation				x	x	
Foreigner		x		x	x	x
Tenure/ Tenure Squared						x
Unemployment rate						x
Select. Bias Correction			x	x	x	x

Note: * Regressions are run with and without professional status.