

# Evolution of Returns to Tertiary Education during Transition

Evidence from Slovenia

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(Preliminary - do not quote!)

Motivation

Theoretical  
background

Data description and  
sample statistics

Estimation of private  
returns

Conclusions

# Heritage of socialist countries

- ▶ The socialist governments affected returns to tertiary education by:
  - ▶ directly setting wages and
  - ▶ allocating production factors between firms (and state).
- ▶ The labor markets in socialist countries featured:
  - ▶ low wage income inequality and low private returns to tertiary education,
  - ▶ low share of employees with completed tertiary education and
  - ▶ high share of graduates from technical fields of study.

# Dynamics in labor markets during early transition

- ▶ Economic reforms liberalized firm-level decision making. Wage-setting liberalization resulted in
  - ▶ an increase in wage inequality (see Milanovic, 1998; Newell, 2001; Mitra and Yemtsov, 2006),
  - ▶ an increase in private returns to all levels of education (see Bevc, 1993; Orazem and Vodopivec, 1995; Newell and Reilly, 1999; Munich et al. 1999) and
  - ▶ relatively high returns to previously neglected fields of study (e.g. business and commerce, legal studies, etc.).
- ▶ In response to these shifts in the structure of financial rewards
  - ▶ the governments of transition countries relaxed entry barriers to tertiary education and as a consequence
  - ▶ the share of students in tertiary education increased and
  - ▶ the relative share of students of technical studies decreased (see TransMonee, 2000).

# The aim of the paper

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To document the evolution of returns to tertiary education for Slovenia for the period 1994-2004 by:

- ▶ levels of education (2 year undergraduate, 4 year UG, MA or MSc and PhD) and
- ▶ fields of study (8 broad fields of study by ISCED 1997).

# What does economic theory predict about dynamics of private returns?

- ▶ The measured private returns to different levels of education depend on relative demand and supply of different types of workers:
  - ▶ higher returns to tertiary education in the early transition, especially in non-technical degrees, that induced higher enrolment rates should lead in lower returns to tertiary education
- ▶ However, the shift in relative supply could be off-set by the shift in relative demand for graduates of higher education programs:
  - ▶ Acemoglu et al. (2002) show that in U.S. (and some other developed countries) wage inequality increased despite an increase in supply of skilled workers.
- ▶ What is the net effect on the private rates of return to tertiary education is thus an empirical question!

# What are the private returns to different fields of study for other countries?

- ▶ Yoram (1973) studied the returns to different fields of education for university graduates with master and doctoral degrees in the U.S.. He finds substantial differences between different fields of master programs.
- ▶ More recent studies for Canada:
  - ▶ Finnie and Frenette (2003) use three cohorts of graduates (1982,1986,1990) and find large and consistent differences in earnings by fields of study. High returns are found in the fields of Health, Engineering and Computer Science, Commerce and Mathematics/Physics, while the low earnings fields include Arts and Humanities, Agricultural/Biological Sciences and Sciences and Other Social Sciences.
  - ▶ Stark (2007) uses data for 1996 and estimates returns for undergraduate, master and doctoral degrees. Results suggest decreasing marginal returns to education: BA is a good investment, whereas MA is not and substantial heterogeneity between different fields.

# Description of data

- ▶ Country: Slovenia.
- ▶ Sources: Slovenian Tax Office and Slovenian Statistical Office (SORS).
- ▶ Access to data: Secure room at SORS.
- ▶ Time frame of data: 1994-2004.
- ▶ Coverage: All workers with available information on labor income, employment status, educational attainment, gender, age.

Note. Not all unemployed included as there is no information on educational attainment for these workers!

# Summary statistics and basic features of data

- ▶ The average years of schooling increased significantly for both men and women with improvements in attainments at all levels of education.
- ▶ The major shifts in structure of labor force by level of education is for lower levels, although 4-year UG programs increased significantly for women as well.
- ▶ The share of graduates in non-technical fields (social sciences, business and law) increased, while the share of graduates in technical fields decreased.
- ▶ The skill premia have an inverse U-shape: increasing between 1994 and 1999 and decreasing between 1999 and 2004.
- ▶ The average age of persons (and hence calculated experience) for different levels of education has increased for all levels of education: this is a consequence of increased retirement age. Increases are larger for less educated workers - shift in compositional structure of workers.

# Dynamics of structure of labor force

Table 1: Dynamics of structure of labor force by level of education, 1994-2004

Level of Education	Male			Female		
	1994	1999	2004	1994	1999	2004
Less than HS	55.99	48.06	41.33	48.78	40.81	33.32
HS	30.70	37.68	43.02	34.57	39.82	43.31
UG 2-years	5.26	5.20	4.88	9.07	9.10	8.88
UG 4-years	7.07	7.94	9.44	7.15	9.67	13.60
Master's	0.61	0.69	0.78	0.34	0.46	0.61
PhD	0.37	0.42	0.55	0.09	0.15	0.28
Average years of schooling	10.49	10.78	11.06	10.73	11.12	11.56
Number of persons	410,028	437,516	431,737	371,591	392,759	375,369

Source: SORS and own calculations.

Notes: Employment shares are given in percent.

# Dynamics of structure of labor force

Table 2: Dynamics of structure of labor force by level of education, 1994-2004

Level of Education	Male			Female		
	1994	1999	2004	1994	1999	2004
Structure of workers by educational attainment (in percent)						
HS 4-year	60.51	62.04	62.64	62.22	61.00	58.44
UG 2-years	15.62	13.85	11.64	20.60	18.31	15.80
UG 4-years	20.98	21.15	22.54	16.22	19.46	24.19
Master's	1.80	1.84	1.87	0.77	0.92	1.08
PhD	1.09	1.12	1.31	0.20	0.30	0.50
Number of persons	138,147	164,280	180,852	163,707	195,086	211,059

# Dynamics of structure of labor force (cont.)

Table 3: Dynamics of structure of labor force with 4 year UG by fields of study, 1994-2004

Level of Education	Male			Female		
	1994	1999	2004	1994	1999	2004
4-year UG Education	2.47	2.31	2.26	2.08	2.08	1.87
Arts and Humanities	8.14	8.19	7.88	24.14	24.78	25.13
Social Sciences, Business and Law	26.17	28.42	30.31	34.81	37.64	38.78
Sciences and Mathematics	4.59	4.01	3.49	4.58	4.05	3.21
Engineering and Manufacturing	41.16	40.42	38.96	14.62	12.47	10.56
Agriculture and Veterinary	7.27	6.37	5.44	4.47	3.80	3.19
Health and Welfare	6.90	6.50	6.20	13.59	11.71	11.37
Services	0.39	0.86	1.63	0.11	0.30	0.58
Other	2.90	2.93	3.82	1.62	3.17	5.31
Total number of workers	28891	34702	40738	26488	37932	51049

# Dynamics of structure of labor force (cont.)

Table 4: Dynamics of structure of labor force with MSc (or MA) by fields of education, 1994-2004

Level of Education	Male			Female		
	1994	1999	2004	1994	1999	2004
Master's Education	1.05	1.13	0.98	0.56	0.73	0.57
Arts and Humanities	9.68	8.80	7.91	15.67	16.18	16.78
Social Sciences, Business and Law	19.48	21.75	24.87	17.18	19.81	25.57
Sciences and Mathematics	5.41	6.18	5.84	7.24	7.48	5.80
Engineering and Manufacturing	37.88	37.76	37.97	19.17	19.36	17.00
Agriculture and Veterinary	7.02	6.74	5.99	6.44	6.25	6.02
Health and Welfare	18.39	16.41	14.52	31.82	28.13	24.87
Services	0.20	0.20	0.44	0.00	0.06	0.13
Other	0.89	1.03	1.48	1.91	2.01	3.25
Total number of workers	2479	3011	3374	1257	1792	2276

# Dynamics of skill premia

Table 5: Dynamics of skill premia by levels of education, 1994-2004

Level of Education	Male			Female		
	1994	1999	2004	1994	1999	2004
Net annual labor income						
2-year UG	51.78	58.88	53.14	36.68	53.57	53.94
4-year UG	93.25	98.06	91.96	70.23	73.18	70.87
Master's	162.21	196.80	177.45	139.83	182.73	164.89
PhD's	242.49	282.21	252.15	202.23	223.88	218.68
Benchmark 4-year HS	650479	723354	852307	593694	643755	755608

Source: SORS and own calculations.

Notes: Skill premia are calculated relative to the benchmark average income of 4-year high-school graduates. Benchmark incomes are given in Slovenian tolar in constant 1994 prices. Skill premia are given in percent.

# Dynamics of skill premia

Table 6: Dynamics of skill premia for 4-year UG by fields of education, 1994-2004

Level of Education	Male			Female		
	1994	1999	2004	1994	1999	2004
4-year UG Education	45.12	51.54	47.45	19.58	30.16	37.51
Arts and Humanities	73.83	78.19	68.80	39.04	38.92	40.75
Social Sciences, Business and Law	126.44	111.62	101.34	68.51	63.74	58.47
Sciences and Mathematics	82.96	94.16	92.89	37.42	48.76	56.91
Engineering and Manufacturing	78.62	92.28	93.50	39.51	46.27	49.43
Agriculture and Veterinary	83.53	90.46	77.29	30.29	36.70	40.32
Health and Welfare	135.59	156.15	134.19	96.31	95.86	80.45

Source: SORS and own calculations.

Notes: Skill premia are calculated using real net annual labor income. They are calculated relative to average income of 4-year HS graduates and given in percent.

# Dynamics of age - experience

Table 7: Dynamics of average age by level of education, 1994-2004

Level of Education	Male			Female		
	1994	1999	2004	1994	1999	2004
Average age						
HS 4-year	34.07	35.46	37.38	32.41	34.39	36.97
UG 2-years	40.06	41.94	44.52	36.40	38.97	42.40
UG 4-years	39.98	40.06	41.00	35.87	35.65	36.94
Master's	43.40	44.30	45.34	41.06	41.49	42.43
PhD	49.89	48.85	49.09	45.70	43.24	44.37

# Estimation framework

- ▶ We follow Mincer (1974) in estimating private returns by regressing the log of net wages and net labor income ( $\ln y$ ) on variables that measure educational attainment and experience:

$$\ln y = \sum_{j=1}^J \beta_{1j} D_{1j} + \beta_2 x + \beta_3 x^2 + \varepsilon,$$

where  $D_{1j}$  is a dummy variable assuming value 1 if a worker holds a degree of type  $j$  and 0 otherwise.  $x$  and  $x^2$  are years of experience and its square.

- ▶ The implied annual rate of return for each level of education can be calculated from estimated regression coefficients using the following formula:

$$r_{j,k} = (1 + \beta_{1j} - \beta_{1k})^{\frac{1}{T_j - T_k}} - 1,$$

where  $T_j - T_k$  denotes the difference in two educational levels and  $\beta_{1j} - \beta_{1k}$  denotes the difference in regression coefficients for two educational programs.

# Summary of estimated returns by levels of education

Using two measures of labor income (net wage, net labor income) and two distinct samples (FTE, all workers), we find that:

- ▶ higher levels of tertiary education exhibit lower marginal returns for both genders when net wage is a measure of income
- ▶ the marginal returns are not monotonically decreasing when we use net labor income
- ▶ the marginal returns for labor income are significantly higher than the returns calculated for net wage
- ▶ the marginal returns of experience are decreasing with years of experience - steeper for net labor income
- ▶ over time marginal returns to education increase for both genders using both measures of income for all levels of education

# Results

Table 8: Private returns by level of education (in percent) using annual net wage and sample of FTE, 1994-2004

Level of Education	Male			Female		
	1994	1999	2004	1994	1999	2004
	Net wage					
2-year UG	10.20	11.66	12.16	8.21	10.84	12.56
4-year UG	8.92	10.08	10.15	8.84	10.12	10.23
Master's	6.27	8.94	9.27	6.91	10.61	10.29
PhD	5.92	4.28	4.54	4.29	1.83	4.42
x=0	2.08	2.10	2.60	3.25	3.65	3.80
x=10	1.63	1.53	1.68	2.21	2.60	2.65
x=20	1.21	1.01	0.85	1.27	1.64	1.62
x=30	0.79	0.49	0.02	0.32	0.69	0.58

# Results (cont.)

Table 9: Private returns by level of education (in percent) using annual net wage and sample of all workers, 1994-2004

Level of Education	Male			Female		
	1994	1999	2004	1994	1999	2004
	Net labor income					
2-year UG	11.46	13.69	14.95	10.44	14.46	15.94
4-year UG	10.79	11.96	12.17	10.31	12.01	12.55
Master's	13.69	15.28	15.52	12.15	15.41	15.86
PhD	10.48	11.34	11.72	8.90	7.43	8.91
x=0	7.74	7.74	7.12	9.47	8.82	8.26
x=10	4.76	4.48	4.14	5.29	5.13	5.04
x=20	2.05	1.51	1.43	1.49	1.78	2.11
x=30	-0.66	-1.46	-1.28	-2.31	-1.58	-0.82

# Summary of estimated returns by fields of study

Using net labor income and two educational levels (4-year UG, master) we find that:

- ▶ the highest marginal returns for 4-year UG and master degree are found in the fields of Health and Welfare and Social Sciences, Business and Law; the lowest returns are found in education and Agriculture and Veterinary
- ▶ the returns in the fields of Sciences and Mathematics and Engineering and Manufacturing increased significantly of 4-year UG degrees, but not for master

# Results (cont.)

Table 10: Private returns by level of education (in percent) using annual net wage and all workers, 1994-2004

Level of Education	Male			Female		
	1994	1999	2004	1994	1999	2004
	4-year UG					
Education	6.00	7.31	8.16	6.29	9.41	11.14
Arts and Humanities	9.46	10.33	10.30	8.19	10.14	11.84
Social Sciences, Business and Law	12.63	12.73	12.73	11.94	13.45	13.32
Sciences and Mathematics	10.07	12.42	12.37	8.81	11.25	12.34
Engineering and Manufacturing	9.79	11.50	12.47	8.96	10.58	11.30
Agriculture and Veterinary	10.49	11.34	10.95	7.72	10.23	10.43
Health and Welfare	14.28	16.97	15.41	13.51	15.19	15.11

# Results (cont.)

Table 11: Private returns by fields of study for graduates of master programs (in percent), 1994-2004

Level of Education	Male			Female		
	1994	1999	2004	1994	1999	2004
	Master's					
Education	19.72	16.16	12.34	20.72	9.59	21.60
Arts and Humanities	12.09	14.99	14.50	9.04	14.81	10.00
Social Sciences, Business and Law	14.41	16.38	17.62	14.27	13.60	16.58
Sciences and Mathematics	11.63	9.87	10.60	15.12	10.64	9.16
Engineering and Manufacturing	12.17	11.86	11.35	11.77	17.03	14.67
Agriculture and Veterinary	11.87	14.98	11.34	18.07	13.11	15.54
Health and Welfare	12.72	15.23	19.24	7.67	14.37	18.00

# Conclusions

- ▶ Labor income premia for tertiary education degrees have decreased after 1999.
- ▶ This is a result of a change in changed structure of labor force in terms of work experience. The share of younger graduates with less work experience is higher among higher education graduates.
- ▶ The marginal returns to higher levels of education are either stable or even increasing over time.
- ▶ The marginal returns to less-technical fields (Social Sciences, Business and Law) are still among the highest and not decreasing.
- ▶ The marginal returns to Sciences and Mathematics and Engineering and Manufacturing increased significantly.