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Evolution of Private Returns to Tertiary Education during Transition: Evidence from Slovenia

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Abstract

This paper analyzes the evolution of private returns to tertiary education during the period of transition from a socialist to a market economy using the personal income tax data of all Slovenian workers employed between 1994 and 2008. We document a rich interplay between supply and demand in the labor markets of high school and university graduates. We show that, in spite of significant increases in the labor supply, the demand for university graduates dominated and increased the rates of return in the early period of transition (1994-2001), while in the later period (2001-2008) the opposite was the case. We also provide evidence on considerable heterogeneity in the rates of return between genders, levels, and fields of study, with particularly large (low) returns to the fields that were suppressed (favored) during socialism. These initial differences in returns have, however, gradually declined.

Keywords: Returns to Education, Tertiary Education, Fields of Study, Mincerian Regressions

JEL Classification Code: J24

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1 Introduction

The functioning of labor markets during socialism was heavily affected by various government interventions. One of the key measures that governments used was direct wage-setting with the aim of maintaining low income inequality, which resulted in low private returns to tertiary education and, in turn, a low proportion of university graduates in the labor force. The governments also affected educational choices by determining the entry quotas of different educational programs, and demand for graduates of different fields of study through direct allocation of capital to specific industries. The preference for technical fields of study and manufacturing led to a relatively high supply of graduates in these fields and a relatively low supply of graduates in social sciences, law and business studies.

The end of the socialist era[1] was marked by a set of reforms, amongst which was a liberalization of wage determination. Anticipating rich wage dynamics, several studies analyzed the labor market outcomes in transition countries. Authors have, for instance, analyzed labor markets in Slovenia (Orazem & Vodopivec, 1995, 1997; Stanovnik, 1997; Bevc, 1993), Czech Republic and Slovakia (Chase, 1998; Münich, Svejnar, & Terrell, 2005), Poland (Strawinski, 2008), Belarus (Pastore & Verashchagina, 2006), Russia (Brainerd, 1998), Vietnam (Moock, Patrinos, & Venkataraman, 2003), China (Li, 2003; Fey & Zimmerman, 2005) and a set of transition countries (Flabbi, Paternostro, & Tiongson, 2008). These papers have two conclusions in common – the socialist era was followed by a period of increasing returns to education and increased wage inequality, although Flabbi et al. (2008) suggest that the evidence of a rising trend in returns to education in transition countries is rather weak, with significant differences across countries.

These studies typically focus on the dynamics of private returns to education in the early transition period and do not explore the differences across levels and fields of tertiary education.[2] The aim of this paper is to fill the gap in the literature and show the evolution

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[1]See De Arriba Bueno (2010) for a description and an analysis of the objectives of transition.

[2]The literature on returns to different fields of study is also relatively scarce for established market economies. Authors find large and consistent differences in the rates of return for 4-year college graduates (Arcidiacono, 2004), M.A. programs (Yoram, 1973), and for Canadian graduates (Finnie & Frenette, 2003; Stark, 2007). Non-American studies of rates of return to education by fields of study are similarly

of private rates of return to different levels of tertiary education and fields of study using Slovenian data on all economically active workers during the period of fifteen years between 1994 and 2008. While the Münich et al. (2005) study also examines returns to different fields of education in 1996, their analysis is limited to 2,284 men from a stratified random sample of households in the Czech Republic. In order to reduce the cognitive ability bias, we augment the Mincerian earnings equation with our measure of general cognitive ability based on points achieved at high school matura examination.[3] In addition, due to the differences in the determination of wages in the public and private sector, we also check the robustness of our results by estimating the returns to education separately for workers employed in the private sector. Moreover, we do not study only returns to education as reflected in the wages of employees, but also total reported labor income.

We find that the private annual (monetary) rates of return, calculated with the Mincerian earnings function, follow an inverse U-shaped trend. During the 1994-2001 period, the returns to all levels, except for PhD, rose in spite of the increasing shares of workers with a 4-year undergraduate degree or higher. This finding suggests that the demand for university graduates grew at faster rate than their supply. A drop in the rates of return followed in the 2001-2008 period. In addition to variations of returns in time, we observe considerable heterogeneity in rates of return between genders, educational levels, and fields of study, with especially large returns in the beginning of the period analyzed to the fields that were neglected during socialism, such as social studies, law and business studies; and relatively low returns to the technical fields that were favored by socialist leaders. Over time, these differences decreased with relative increases in the labor supply of graduates in the fields of social studies, law and business. The differences in the returns

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limited. The exceptions are Livanos and Pouliakas (2008) studying the Greek labor market, Blundell, Dearden, Goodman, and Reed (2000), O'Leary and Sloane (2005), and Walker and Zhu (2011) studying returns to higher education in Britain, Kelly, O'Connell, and Smyth (2010) studying returns in Ireland, and Buonanno and Pozzoli (2009) studying the Italian labor market.

[3]To avoid the ability bias if using ordinary least squares estimator without some measure of ability, researchers have for example used (i) some proxy of ability (Griliches, 1977; Nordin, 2008), (ii) instrumental variables estimator (Angrist & Kruger, 1991 and 1992; Card, 1995; Denny & Harmon, 2000; Harmon & Walker, 1995 and 2000), or (iv) data on siblings or twins (Ashenfelter & Krueger, 1994). For a more comprehensive review see Harmon, Oosterbeek, and Walker (2000); Meghir and Rivkin (2011).

between levels of tertiary education provide evidence that contrasts Card's (1999) result of constant return to all levels of education. On the basis of results from a subsample of workers with a measure of ability, we confirm the existence of a positive ability bias. We are able to proxy ability with a score achieved in a high school external examination for a subsample of workers and gain information on the ability bias in the analyzed context. Moreover, we find that, in more homogeneous groups, males usually have higher rates of return than females. Lastly, the returns based on total reported labor income show that alternative income sources represent a non-negligible part of private rates of return. Differences between returns based on net wage and those based on net labor income increase with the level of education and are unequal between fields of study.

In the next section, the determination of wages in Slovenia is described, including the data sources and descriptive statistics in the third section. In the fourth section, the estimated returns and the robustness checks are presented. The paper finishes with the conclusion.

2 Determination of Wages in Slovenia

The wages in Slovenia are affected by collective bargaining and the minimum wage, promoted by law since 1990 and 1995, respectively. The collective bargaining process takes place at a national, industry, and firm level. At the national level, it is a process of negotiations between four main trade union associations and the employers' association over the key components of two national collective contracts, separate for private and public sector. The wage floors for different types of jobs, depending on difficulty of the job and educational requirements, apply to all employees of the covered employers and are determined in the industry-level collective contracts. The firm-level wages are set in firm-level bargaining between the union representatives and the firm management. Although these wages typically exceed the industry-level wage floors, they can be lower if a firm exhibits poor economic performance, reflected in operating losses and declining sales.

While trade union labor coverage is around 50 percent at the national level, a law on union representation stipulates that a trade union is representative at the national level and in sectors and occupations if membership exceeds the thresholds 10 and 15 percent of all employees, respectively. Hence, the coverage of collective contracts is significantly higher than the union density and may be up to 90 percent. It is also important to note that trade union representation is obligatory only in firms with at least 50 employees, which implies that gross wages in smaller firms may exhibit different wage premiums for job difficulty and educational attainment than the industry-level contracts.

Furthermore, according to the Employment Relationships Act, employees are eligible for a bonus for working the night shifts, on Sundays, on holidays, and for overtime work. Employers have to cover employees' costs for food during work time and travel costs to work. Employees also receive a seniority bonus: a relation between wage and overall tenure (in all firms) in addition to the holiday period, which also increases with overall tenure (from 20 days at the start of career and 30 days after 20 years of tenure). This affects also re-hiring prospects of older workers and could explain the rather high unemployment rates among them.

3 Data Description and Summary Statistics

3.1 Data description

The analysis is based on the data on all employees that were economically active in Slovenia between 1994 and 2008, and have completed at least 4-year high school. The sample was created in a secure room at the Statistical Office of the Republic of Slovenia (SORS) by merging four distinct data sets. The first source of data is the Slovenian Employment Registry (SER) maintained by SORS, which contains information on age, gender, educational attainment, field of study, employment status, periods of employment, and working hours. The second source of data is the personal income tax returns from the Tax Administration of the Republic of Slovenia (TARS) with information on annual gross wages and related social contributions, wages earned by workers on short-term contracts,

other types of work related compensation (e.g. taxable bonuses, perks), copyrights, and patent rights income. Finally, the data on the score achieved on the Matura examination and the sector of employment (public, private) are from the National Examination Center and Agency of the Republic of Slovenia for Public Legal Records and Related Services, respectively.

We exclude sole proprietors from the sample, as their income reflects contributions of both human and physical capital. We also exclude employees with incomplete information on all relevant characteristics. The data set does, however, include information on many unemployed persons. Unfortunately, the data for these persons are incomplete due to lack of information on educational attainment. Since the probability of unemployment is higher among less educated persons, the estimates of returns are likely to be downward biased.[4] Nevertheless, this bias should be small as we restrict the sample to only those persons that finished at least four years of high school. All in all, we have 5,194,050 observations.

We use two measures of net labor earnings. The first is net annual wage, which is equal to the gross wage without social contributions (22.1 percent of the gross wage) and the labor income tax. The special tax treatments (e.g. special child deductions) are disregarded. The second measure is net labor income. It is calculated in the same way as net wage, but also includes taxable bonuses, perks, wages earned on the basis of short-term labor contracts, copy and patent rights income. Both measures of net labor earnings are expressed in 2007 constant prices (EUR)[5] with no adjustment for part-time employment.

Since we are not able to measure the actual experience of workers, we use the potential experience. We calculate potential experience according to the following formula: *experience = age – years of education – school entry age*, where the school entry age is typically seven in Slovenia.

For a subsample of employees, who finished high school in 1995 or later, we are

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[4]A person is unemployed if she or he is registered at the local employment office. This definition is less strict than the standard ILO definition. Hence Slovenian unemployment rates based on registry exceeded survey unemployment rates by as much as 6 percentage points.

[5]The exchange rate in 2007 was 1 EUR = 1.37 USD.

able to measure ability with the score achieved in the Matura examination. This is an equivalent of the Scholastic Aptitude Test (SAT), common also in some other European countries (e.g. Austria, Italy, Switzerland). The Matura examination in Slovenia consists of three mandatory subjects (the Slovene language, Mathematics and one foreign language - usually English, with grading from 1 to 8) and two elective subjects, such as Biology, History, or Physics with a grading from 1 to 5. In order to pass, student must obtain at least 10 out of 34 points.[6] We use a normalized score, thus the ability ranges between 0 and 1.[7]

3.2   Descriptive Statistics

As a transition country, Slovenia underwent significant dynamics in the labor markets. In the early transition period, after wage liberalization took place, the returns to education increased considerably. However, in comparison with the returns in Western economies, they were still rather low (Stanovnik, 1997; Orazem & Vodopivec, 1995). Nevertheless, increases in returns to education increased the demand for education and improved the level of education attained. Figure 1 shows the dynamics of the number of employees by level of education in the entire period of analysis, while Table 1 shows the employment structure in percentages in 1994, 2001 and 2008. Over the entire period of analysis, 1994-2008, the number of male (female) employees who completed high school increased from 78,319 (96,961) to 121,859 (122,729).[8] The largest change occurred in the number of female workers with a 4-year undergraduate (UG) degree, which increased from 20,924 in 1994 to 75,046 in 2008. While there was also a significant increase in the number of male workers with a four year undergraduate degree (from 23,479 to 50,707), the corresponding relative change was significantly smaller than for females. Similarly, the number of workers with graduate diplomas also increased significantly. The number of male and female workers with a Master's degree increased from 2,470 to 5,147 and from

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[6]Note that the grading scale is changed every year so that the achieved points in each cohort are Gaussian distributed.

[7]We used also the non-normalized points, but the results are qualitatively similar.

[8]The total population in Slovenia is around 2 million; we exclude employees with less than completed 4-year high school and sole proprietors from analysis.

1,387 to 5,140, respectively. Following a similar trend, the number of PhDs increased from 301 to 1,837 for females and from 1,395 to 3,131 for males.

The preference of socialist governments for technical fields of study, such as Engineering and Manufacturing, and Sciences and Mathematics, has caused an imbalance between the relative supply and demand of different groups of graduates. After wage liberalization, these imbalances led to divergence of wage premia and consequently of returns to different fields of study. This led to an increase in the number of employees with a four year UG degree in the fields of Social Sciences, Business and Law and Arts and Humanities (see Figure 2). The percentage of workers with a four year UG degree in Social Sciences, Business and Law among all workers within this category increased from 26.7 to 33.8 percent for males and from 34.6 to 43.3 percent for females. At the same time the share of male workers with a degree in Engineering and Manufacturing among all male workers with four year UG degree fell from 41.5 to 37.8 percent.

As expected, the average net wage increased during the analyzed period for all levels of educational attainment (see Figure 3). In addition, the gender wage gap increased with the level of education, the highest being for the PhDs. Specifically, the mean net wage for males and females who had completed high school rose from 7,321 to 10,337 and from 6,447 to 8,585, respectively, while the net wage for PhDs grew from 22,050 to 28,782 for males, and from 18,786 to 23,337 for females. The discrepancy between male and female earnings is evident also in Figure 4, which presents the net wages by four year UG fields of study and gender. In 2008, the top-earning fields for males with a four year UG degree were Health and Welfare (24,456), Social Sciences, Business and Law (19,589), and Engineering and Manufacturing (19,059). The ranking of highest-earning fields for females was slightly different - Health and Welfare (16,366), Sciences and Mathematics (14,821), and Social Sciences, Business and Law (14,369).

Table 1: Employment structure by educational attainment and gender in Slovenia, 1994-2008

	Males			Females		
	1994	2001	2008	1994	2001	2008
High school	63.20	63.02	60.92	64.93	60.25	52.95
2-year UG	15.02	12.87	9.60	20.12	17.46	11.67
4-year UG	18.95	20.67	25.35	14.01	20.50	32.38
MSc/MA	1.71	2.09	2.57	0.73	1.34	2.22
PhD	1.12	1.35	1.56	0.21	0.45	0.78

Sources: TARS, SER and own calculations.
Notes: The employment shares are given in percentages.

Figure 1: Dynamics of employment by educational attainment and gender
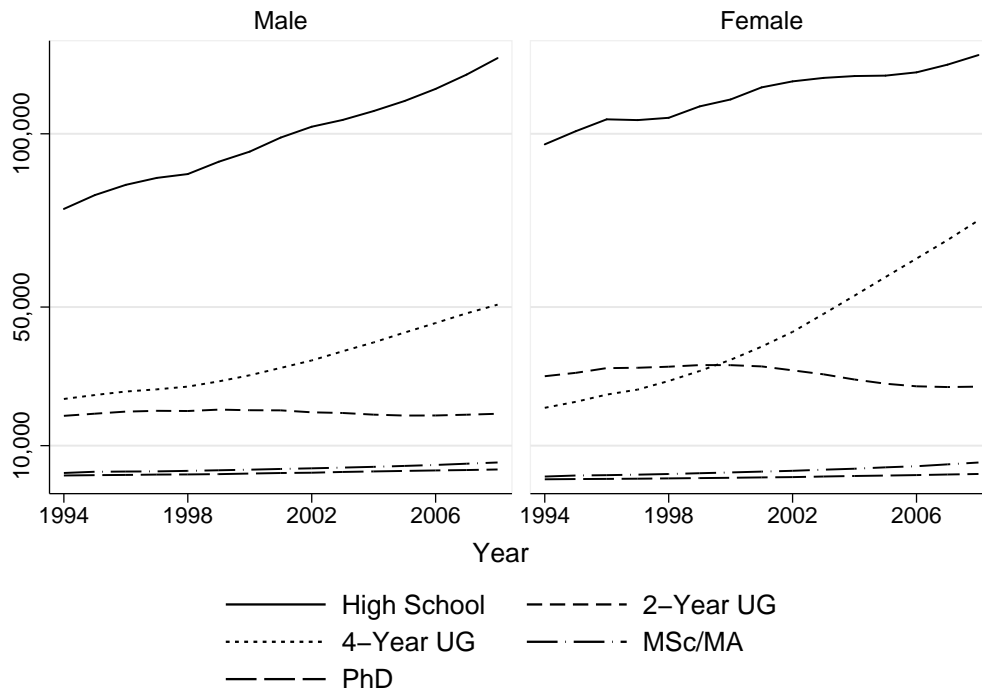
The returns to tertiary education are estimated for three distinct samples: i) all employees, ii) subsample of employees with information on ability, and iii) subsample of employees in the private sector. The summary statistics for all three samples on key variables (female dummy, age, experience, net wage, net labor income, and measure of ability) are given in Table 2. The subsample of persons with ability is significantly smaller as this information is only available for younger employees who graduated from 1995 onwards, which is also reflected in lower mean age and experience than in the full

Figure 2: Dynamics of employment by fields of study and gender, 4-Year UG

——— Education	– – – Arts and Humanities
·········· Social Sciences, Business and Law	— · — Sciences and Mathematics
— — — Engineering and Manufacturing	– · – · · Agriculture and Veterinary
············ Health and Welfare	
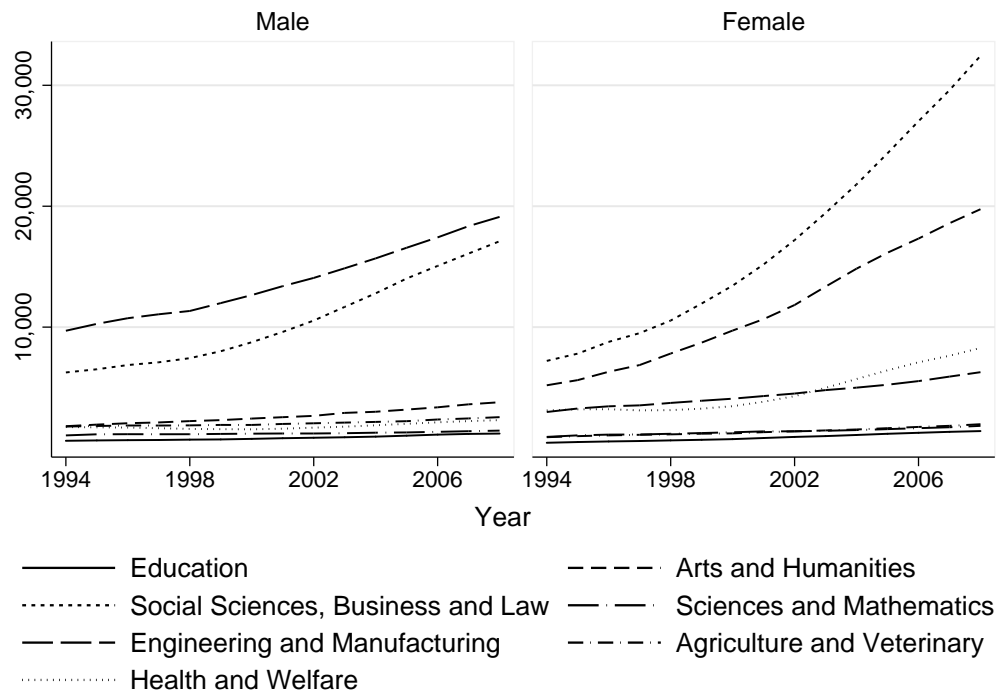
Figure 3: Dynamics of average net wages by educational attainment and gender

——— High School	– – – – 2–Year UG
·········· 4–Year UG	— · — · MSc/MA
— — — PhD	
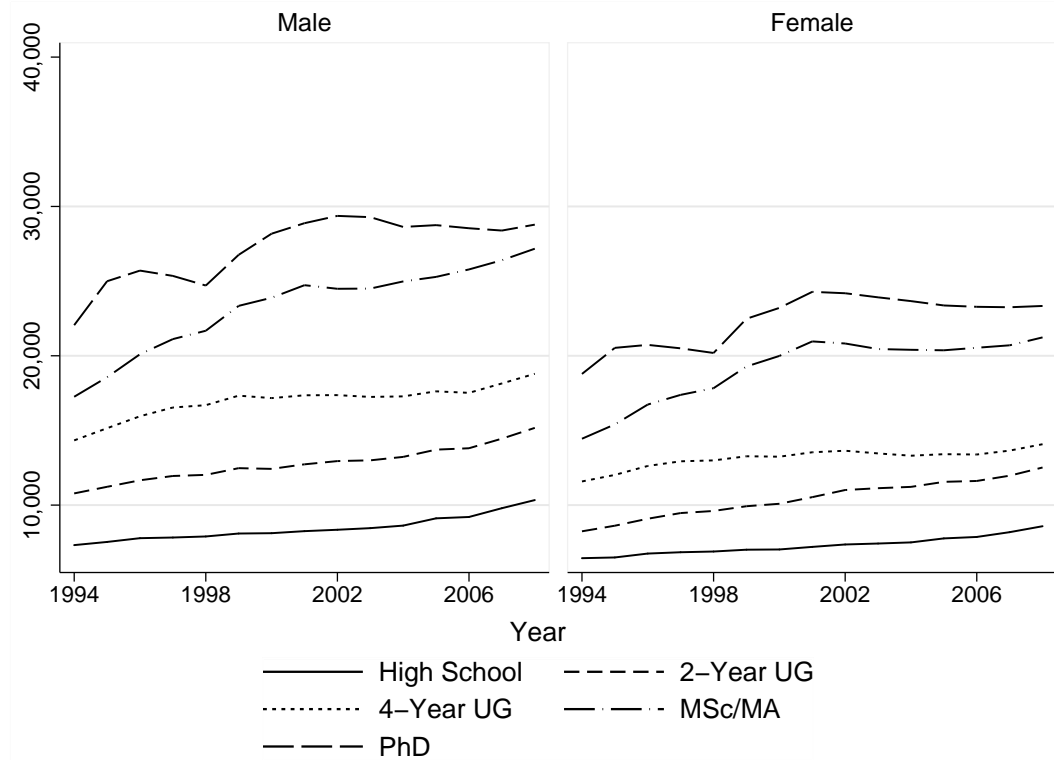
sample and sample of private sector employees.

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Figure 4: Dynamics of average net wages by fields of study and gender, 4-Year UG
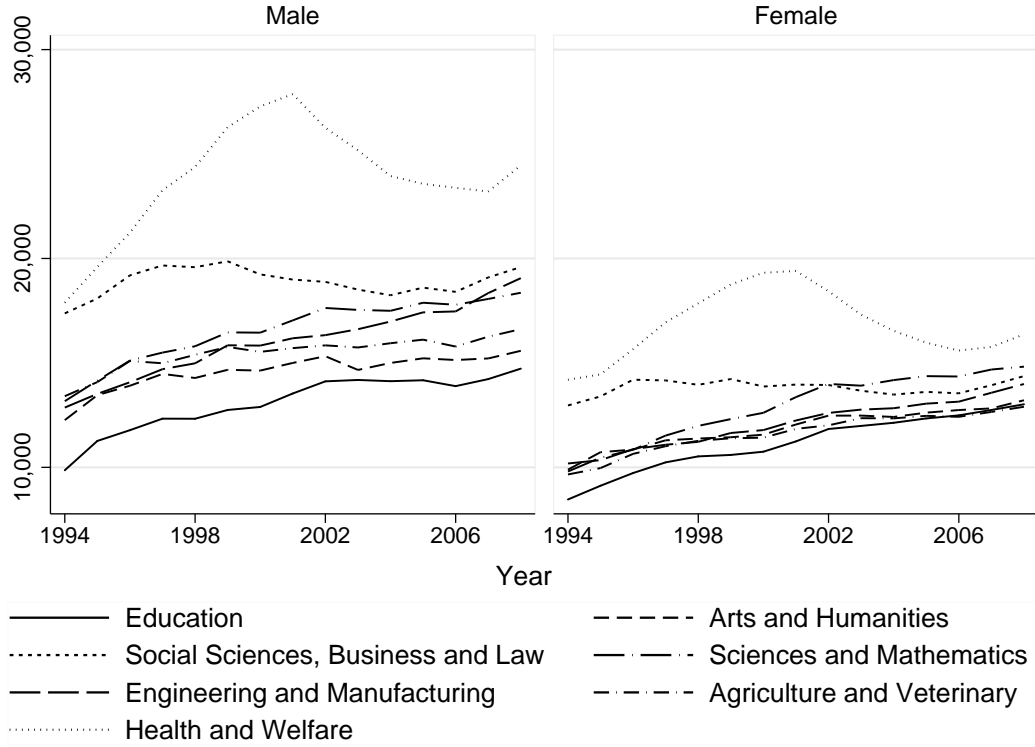
4 Empirical Analysis

4.1 Methodology

Returns to education can be computed using many different estimation techniques and approaches (see Heckman, Lochner, & Todd, 2006, for a review). We follow the most frequently used approach, originally proposed by Mincer (1974). This approach relies on estimation of earnings equation using OLS and extraction of returns from regression coefficients on measures of schooling. Thus, in contrast to the methods based on calculation of internal rate of return (IRR), it neglects pecuniary and non-pecuniary costs of education as well as non-pecuniary benefits. This is, however, a small limitation for our data set as Slovenian students bear a small portion of costs of their studies. Most importantly, full time undergraduate students at public and government-dependent institutions, which enrolled 93 percent of all students in the first and second stage of tertiary education in 2008, do not have to pay tuition fees (http (1)). Moreover, according to a Eurostudent (http (2)) survey, 49.4 percent of all students in tertiary education in the

Table 2: Basic characteristics of workers in the sample

	Full Sample	Ability subsample[a]	Private sector subsample[b]
Person-year observations	5,194,050	174,751	2,724,483
Females [percent]			
High School	52.95	51.22	45.23
2-Year UG	61.08	59.88	42.84
4-Year UG	55.29	65.69	40.98
Msc/MA	44.44	56.36	32.68
PhD	30.15	35.99	26.69
Mean age	38.43	27.56	38.34
Sd age	9.45	2.43	9.44
Mean experience	18.08	6.28	18.30
Sd experience	9.40	2.57	9.45
Mean net wage	10,406	9,289	10,066
Sd net wage	7,815	4,946	8,293
Mean net labor income	10,887	9,653	10,443
Sd net labor income	8,942	5,423	9,236
Mean ability		0.31	
Sd ability		0.20	

[a] Subsample of individuals for which ability is measured.
[b] Subsample of individuals working in private sector.

2005-2008 period lived with their parents or relatives. Therefore, the Mincerian regression is an appropriate method for estimation of returns to education in Slovenia.

The returns are calculated by ordinary least squares estimation of Mincerian earnings function:

$$\ln y = \alpha + \sum_{j=1}^{J} \beta_j D_j + \gamma_1 z + \gamma_2 z^2 + \varepsilon, \tag{1}$$

where y are the individual earnings; D_j is a dummy variable indicating that a worker holds a degree of type j;[9] z represents the number of years an individual has worked

[9]We separately estimate returns to levels of education and returns to fields of education. In the first case j is equal to a level of education (2-year UG, 4-year UG, MSc/MA, or Phd). In the second case j is

since completed schooling, and ε is an error term. Equations for males and females are estimated separately. For a subsample of individuals with available information on score achieved at Matura examination, we estimate Equation (1) with this additional regressor measuring general cognitive ability (A):

$$\ln y = \alpha + \sum_{j=1}^{J} \beta_j D_j + \gamma_1 z + \gamma_2 z^2 + \delta A + \varepsilon. \tag{2}$$

The annual rate of return for each level of education, r_j, is then calculated as:

$$r_j = (1 + \beta_j - \beta_k)^{\frac{1}{T_j - T_k}} - 1, \tag{3}$$

where $T_j - T_k$ is the time needed to complete educational level j after level k was obtained (see Table 3) and $\beta_j - \beta_k$ is the difference in regression coefficients for the two levels of education. For example, the annual rate of return to PhD is calculated as:

$$r_{PhD} = (1 + \beta_{PhD} - \beta_{MSc})^{\frac{1}{2}} - 1.$$

Similarly, we calculate the return to four year UG degree in Education as

$$r_{4-yearUG,Educ.} = (1 + \beta_{4-yearUG,Educ.})^{\frac{1}{5}} - 1.$$

This gives us a rate of return for each additional year of a specific level of study. Note that we compare regression coefficient for a four year UG program with high school (omitted category) instead of a two year UG program, since the latter may not necessarily lead to four year UG programs due to mobility restrictions and direct enrollment of high school graduates in four year UG programs.

equal to a degree in specific field (e.g. 4-year UG degree in Education). The omitted category is always high school.

Table 3: Time needed to complete educational level j after level k was obtained

j	k	$T_j - T_k$
2-year UG	High school	3^a
4-year UG	High school	$5^{a,b}$
MSc/MA	4-year UG	2
PhD	MSc/MA	2

[a] Since students typically have to write a theses it takes 3 years to complete 2-year UG program and 5 years to complete 4-year UG program.
[b] The exceptions are Engineering and Manufacturing and Health and Welfare, that last 5.3 and 6 years, respectively.

4.2 Results and Discussion

4.2.1 Mincerian Earnings Function

The top panel of Table 4 presents annual returns to different levels of education for the full sample of persons in 1994, 2001, and 2008. The returns feature an inverse U-shaped dynamic for both males and females (see also Figure 5). This pattern suggests that labor demand for university graduates grew at a faster rate than their supply until 2001, which led to increases in the rates of return. However, after 2001, the continued increase in labor supply of graduates dominated increase in demand, which is reflected in declining rates of return for all levels of education with the exception of PhD level. Specifically, in the 1994-2001 period, the rate of return for males (females) with a four year UG degree increased from 9.78 (9.43) to 11.07 (11.25) percent, whereas in the 2001-2008 period, this rate decreased to 9.63 (9.94) percent.[10] At the same time, the percentage of males (females) with four year UG degrees among all male (female) workers who at least completed high school increased from 18.95 (14.01) to 20.67 (20.50) in the 1994-2001 period and then from 20.67 (20.50) to 25.35 (32.38) percent in the 2001-2008 period (see Table 1). This pattern of returns is consistent with a cobweb model of wage dynamics in labor markets with gestation lags and seems to have been observed also in other transition countries

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[10]Other studies find the returns to schooling in range between 2 and 13 percent (e.g. Harmon et al., 2000, Boarini & Strauss, 2007, 2010). For example, Harmon et al. (2000) estimate the returns for males in 1995 to be 8.9 percent, 7.8 percent, and 13.0 percent for Slovenia, U.S., and Great Britain. However, direct comparison of these returns with our results may be problematic due to the differences in assumptions and estimation techniques

(see Carnoy, Loyalka, & Andoushchak, 2012 who depict a similar trend for Russia).

According to Card (1999), the results for the U.S. imply that each additional year of education has the same proportional effect on earnings, ceteris paribus. In our case, this would imply equal rates of return for all levels of education. However, our results do not confirm that. For instance, while the rates of return for two year and four year UG degrees are similar – 9.68 and 9.63 percent in 2008 for males, respectively – we find large differences between rates of return among four year UG, MSc and PhD degrees. In particular, in 2008, the returns to these degrees for females were 9.94 percent for a four year UG, 16.11 percent for MSc and only 6.28 percent for PhD degree.

In the lower panel of Table 4 and in Figure 6, we show the rates of return to different fields of study for four year UG programs.[11] We observe significant heterogeneity of returns across fields of study, particularly in 1994, which is in line with Farčnik and Domadenik (2012) who find considerable differences in the employment probabilities of Slovenian graduates by fields of study in the 2007-2009 period. While large differences in returns were also observed in developed countries (e.g. Stark, 2007), the differences observed in Slovenia were driven primarily by the distortions in the relative labor supply due to socialist government interventions. The highest returns were observed in the fields that were neglected during socialism (Social Sciences, Business and Law), while the returns were relatively low in the favored technical fields of study (Engineering and Manufacturing; Science and Mathematics). Again, the gestation lags in changing the structure of labor supply that would be consistent with labor demand took twenty years to reduce the extra returns in the fields of Social Sciences, Business and Law and bring them in line with returns in technical fields of study. Since choices of field of study are often driven by non-monetary factors such as preferences or ability, it is not surprising that differences in returns across fields continue to exist even in 2008.

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[11]The results for other levels of tertiary education are omitted for the sake of brevity. They are, however, consistent with presented results.

Table 4: Private rates of return to tertiary education in Slovenia based on net wage, 1994-2008

	Males			Females		
	1994	2001	2008	1994	2001	2008
Levels						
2-year UG	9.31	11.07	9.68	7.65	10.96	9.99
4-year UG	9.78	11.07	9.63	9.43	11.25	9.94
MSc/MA	10.82	17.40	14.82	11.26	18.20	16.11
PhD	11.92	8.94	6.62	9.29	8.33	6.28
Average[a]	9.70	11.35	9.87	8.45	11.32	10.18
Fields (4-year UG)						
Education	5.88	8.70	6.70	6.45	9.49	9.26
Arts & Human.	8.27	9.85	7.56	7.60	10.25	9.49
Social Sci., Bus. & Law	11.61	11.68	9.79	10.82	11.77	10.18
Sci. & Math.	9.30	11.35	9.61	7.98	11.15	10.19
Eng. & Manufact.	8.06	9.89	9.46	7.25	8.92	8.67
Agricult. & Vet.	9.61	10.12	8.03	7.72	9.48	7.93
Health & Welfare	10.84	13.84	11.04	9.87	12.34	9.64

Notes: Estimated coefficients are presented in Table A1. For the sake of brevity we present only results for levels of education. The returns are given in percentages.
[a] Average return is calculated as a weighted average with employment shares as weights.

4.2.2 Ability Augmented Earnings Function

Since individuals with higher ability are more likely to enroll in tertiary education programs and choose more demanding fields that may yield higher returns, the estimates of regression coefficients for schooling (β's in Equation 1) might be biased. To reduce such biases, we augmented the Mincerian regression with our measure of general cognitive ability based on points achieved in the high school Matura examination. This measure is not without limitations; namely, the results achieved in the Matura examination may also reflect the effects of education, and thus may be picking up the productivity enhancing effect of education (e.g. Harmon et al., 2000). Also, it is not a perfect measure of the ability to earn money rather than a measure of ability in the IQ sense. In spite of these limitations, we believe that augmenting the Mincerian earnings function with this

Figure 5: Private annual rates of return to tertiary education in Slovenia by educational attainment and gender [in percent]
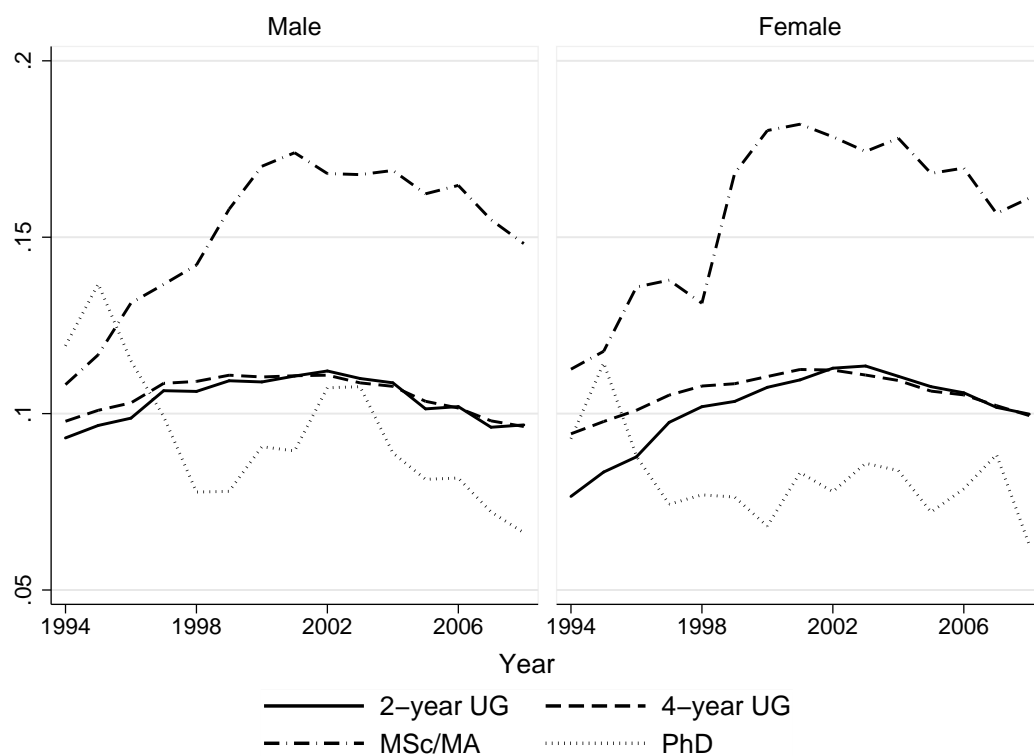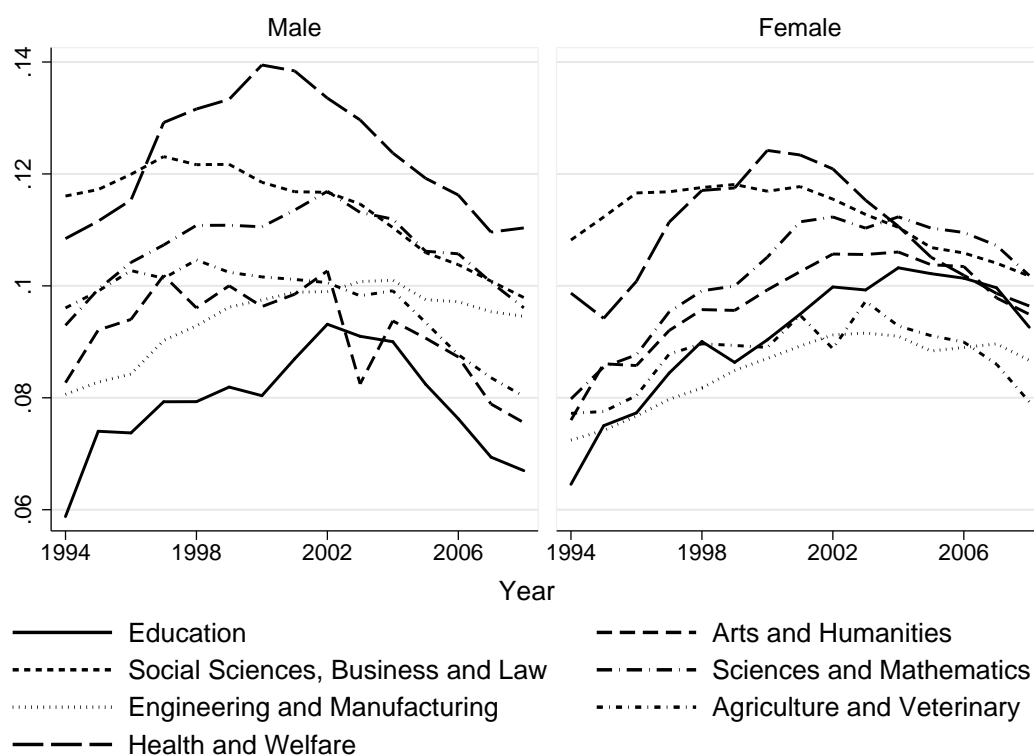

Figure 6: Private annual rates of return to tertiary education in Slovenia by fields of 4-year UG study and gender [in percent]

measure reduces the potential biases of estimated returns to education.

As already noted, the scores of the Matura examination are available only from 1995 onwards and since it takes eight years more for the first individuals with a PhD degree to enter the labor market, we can provide estimates of returns only for a sub-period between 2003 and 2008. The sample of individuals is further reduced as Matura is taken only by students of general secondary schools (excluding students of vocational secondary schools).

Table 5 presents the rates of return with and without (in parentheses) control of ability for individuals with results in the Matura examination. Comparison of these rates of return allows us to estimate the size of ability bias. We find a positive ability bias for all fields and levels of education, except for the two year UG degree.[12] However, its size is relatively small - usually less than one percentage point for different levels and fields of education. For example, the estimated return for males with a four year UG degree in 2008 was 8.84 percent when the ability measure was not included, and 8.47 percent after the inclusion of control variable, which suggests that ability bias concerns are less important in our data set.

Another interesting result comes from comparison of the returns based on full sample and the returns from the subsample of individuals for which ability is measured, but not controlled for. In the full sample, the results for neither of the genders are strictly higher than the other one; males in the ability subsample generally outperform females, no matter if the ability control is included or not. Note that persons in the ability subsample completed general secondary schools which usually have higher entry requirements (based on the national exams at the end of primary school) than vocational schools, and are intended for those who wish to continue with the tertiary education. Thus, workers included in the ability subsample constitute a more homogeneous group in terms of discount rates, preferences, and ability than the workers in the full sample. This finding might therefore imply that estimated rates of return for females are lower than for males if we are able to control for the unobservables. Although we do not have empirical

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[12]The difference in regression coefficients for 2-year UG is not statistically significant. See Table A3.

verification, we think that the described phenomenon might be attributed to employees with vocational secondary education in specific types of jobs who have high wages due to the adverse work conditions (e.g. miners, soldiers, and workers working at heights). Their premium reduces the returns to tertiary education for males to a greater extent than for females, since these are mainly male jobs. As the sample of employees who took Matura is less likely to include such workers, the returns for males exceed those of females.

Table 5: Private rates of return from augmented and original (in parentheses) regressions for the same subsample

	Males			Females		
	2004	2006	2008	2004	2006	2008
Levels						
2-year UG	10.53	10.30	5.94	4.52	5.74	4.52
	(10.07)	(10.04)	(6.08)	(4.97)	(5.87)	(4.32)
4-year UG	8.88	8.79	8.47	7.40	6.50	6.39
	(9.43)	(9.31)	(8.84)	(8.33)	(7.43)	(6.83)
MSc/MA	19.98	15.10	15.13	21.83	9.99	10.38
	(21.97)	(16.01)	(15.77)	(23.00)	(11.77)	(11.59)
PhD	8.55	3.63	3.24	-1.48[a]	11.97	3.07
	(9.32)	(4.65)	(4.57)	(-2.77)[a]	(12.39)	(3.87)
Fields (4-year UG)						
Education	8.12	6.48	4.05	7.14	6.91	5.33
	(8.02)	(6.60)	(4.17)	(7.79)	(7.52)	(5.51)
Arts & Human.	7.71	7.26	6.03	7.92	6.24	5.60
	(8.30)	(7.78)	(6.43)	(8.71)	(7.07)	(5.93)
Social Sci., Bus. & Law	8.53	8.62	8.58	7.09	6.53	6.99
	(9.02)	(9.07)	(8.80)	(7.97)	(7.37)	(7.30)
Sci. & Math.	9.48	8.75	7.81	8.85	6.47	6.22
	(10.79)	(9.68)	(8.53)	(10.15)	(7.79)	(6.85)
Eng. & Manufact.	9.31	9.11	9.05	6.15	6.30	6.35
	(9.66)	(9.42)	(9.30)	(7.14)	(6.96)	(6.55)
Agricult. & Vet.	7.11	7.78	6.85	4.99	7.12	6.48
	(7.29)	(7.81)	(6.47)	(5.94)	(7.31)	(6.62)
Health & Welfare	9.53	9.79	10.02	7.92	6.96	7.02
	(10.35)	(10.56)	(10.62)	(9.01)	(8.26)	(7.79)

[a] Coefficient in Mincerian regression is not statistically significant (see Table A2).

4.3 Robustness checks

4.3.1 Private versus public sector

As mentioned in Section 2, Slovenian wages are mainly determined by collective bargaining. This process affects the wages of all employees in the public sector, while the private sector is unionized to a lesser extent, since representation of workers is not obligatory for firms with fewer than 50 employees. Unfortunately, the share of wages that are subject to collective contracts is not known. Furthermore, all employees in the Slovenian public sector (even the President, ministers, lower ranked public employees, etc.) have their wages set according to the fixed salary scheme. Their wage must reflect the difficulty of the job, an amount related to performance, and specific additional payments for overtime, night shifts, and work experience, but not necessarily their actual productivity. Due to the described differences in the determination of wages in the public and private sector, we conducted a robustness check by estimating the rates of return to education separately for the private sector.

Characteristics of the subsample of employees in private sector are presented in the last column of Table 2. Age and experience are approximately the same in both samples, while the share of females in private sector is smaller. The average earnings are lower in the private sector in terms of both the net wages and the net labor income, which is partly due to lower share of university graduates in this sector. At the same time the dispersion of incomes in the private sector is higher.

The estimates of rates of return for the private sector subsample are presented in Table 6. Overall, these are comparable to the rates observed in the full sample (Table 4), which is also reflected in comparable inverse U-shaped dynamics. There are, however, some important differences between the private and public sector returns to male MSc degrees, PhD degrees for both genders, and some specific fields of study, such as Education, and Arts and Humanities. These degrees and fields of study seem to be less productive in the private sector as the observed returns are much lower in the private sector than the returns of the full sample.

Table 6: Private rates of return to tertiary education in Slovenia, private sector

	Males			Females		
	1994	2001	2008	1994	2001	2008
Levels						
2-year UG	10.32	10.83	10.00	8.67	10.17	8.91
4-year UG	9.85	10.52	9.53	9.62	10.95	9.73
MSc/MA	10.59	15.51	14.44	14.84	21.06	18.29
PhD	0.61	3.44	7.46	16.22	6.74	5.72
Fields (4-year UG)						
Education	3.23	2.33	1.28[a]	1.65[a]	1.67[a]	0.10[a]
Arts & Human.	9.14	7.09	4.55	8.61	8.66	7.04
Social Sci., Bus. & Law	11.95	11.13	9.49	10.64	11.69	10.20
Sci. & Math.	8.98	11.54	9.90	6.94	11.40	10.22
Eng. & Manufact.	8.32	9.80	9.48	7.70	9.06	8.92
Agricult. & Vet.	9.79	10.49	8.29	8.09	9.63	7.48
Health & Welfare	11.75	10.98	9.50	11.70	12.72	10.60

[a] Coefficient in Mincerian regression is not statistically significant
(see Table A4).

4.3.2 Net wage versus net labor income

The net wage does not capture all monetary rewards of education and thus the rates of
return do not necessarily capture the full effects of educational attainment. While the
net wage is the largest component of the total net labor income, it omits bonuses, perks,
wages earned on the basis of short-term labor contracts, copyrights, and patent rights
income. If the percent in the total labor income varies with educational attainment, the
rates of return based on net wage may be biased.

The rates of return based on the full sample of observations and net labor income
as a measure of income are presented in Table 7 and thus directly comparable to the
rates of return reported in Table 4. A comparison reveals that the rates of return for
net labor income exceed those based on the net wage for all levels of education and both
genders. Moreover, these differences increase with the level of education, which may
be a consequence of (i) the incentives created by the labor income taxation – the more
educated individuals pay high marginal tax rates including high social contributions, thus

they often resort to copyright contracts which allow workers to avoid the burden of social insurance, and/or (ii) better opportunities for higher educated workers to earn money. The differences are the highest in the field of Arts and Humanities for both genders, and the smallest in Agriculture and Veterinary Science for males and Social Sciences, Business and Law for females (except in the year 1994, when the lowest differences in returns for females where in Health and Welfare). However, the order of the fields with highest and the lowest returns remains the same. Furthermore, the returns for both genders again follow an inverse U-shaped pattern for all levels, except the PhD.

Table 7: Private annual rates of return to tertiary education in Slovenia based on net labor income, 1994-2008

	Males			Females		
	1994	2001	2008	1994	2001	2008
Levels						
2-year UG	9.66	11.41	9.90	7.71	11.07	10.01
4-year UG	10.53	11.63	10.05	10.00	11.70	10.24
MSc/MA	14.36	19.78	16.91	13.16	20.30	17.72
PhD	16.37	12.98	11.32	14.24	10.53	9.87
Fields (4-year UG)						
Educ.	5.98	9.03	7.39	6.94	9.73	9.55
Arts & Human.	10.52	11.36	8.95	8.85	11.08	9.97
Social Sci., Bus. & Law	12.09	12.05	10.12	11.15	12.00	10.37
Sci. & Math.	10.29	12.06	10.11	8.51	11.63	10.54
Eng. & Manufact.	8.87	10.40	9.77	7.87	9.44	9.01
Agricult. & Vet.	9.69	10.34	8.20	8.00	9.74	8.17
Health & Welfare	11.37	14.50	11.61	9.99	12.57	9.85

Note: Estimates coefficients are presented in Table A5.

5 Conclusions

The analysis of dynamics of rates of returns during transition revealed many interesting features. The most important finding is the pattern of an inverse U-shaped trend of rates of return to all levels of education due to gestation lags in adjustment of labor supply to labor demand. In spite of the growing supply of university graduates over the

entire period of analysis, the strong demand led to increases in the rates of return during the period 1994-2001. However, the continued growth of labor supply in the subsequent period (2001-2008) was not matched by comparable increases in the labor demand, which resulted in the decline of rates of return.

We also document large differences in the rates of return between different levels of education, which is inconsistent with evidence of constant rates of returns to schooling for all levels of education in the U.S. (Card, 1999). Moreover, we observe considerable heterogeneity in the rates of return to different fields of study. In the early transition, the consequences of socialist government interventions were reflected in the higher (lower) relative supply of favored (neglected) fields of studies and consequently in lower (higher) rates of return. However, over the course of transition, the supply of neglected fields of study increased relative to the favored fields, which led to lower heterogeneity of returns across fields of study.

In order to deal with potential biases in the estimates of rates of return, we extended our empirical estimations with a measure of general cognitive ability. The rates of return calculated with and without the ability measure confirmed the existence of an upward bias of less than one percentage point.

Finally, we also provided two robustness tests. On one hand, we compared the rates of return in the private sector with those of all employees and found little difference. On the other hand, we estimated the returns using the wider measure of labor income – net labor income that includes net wage and other sources of income – and found that an important part of private rates of return to university graduates arises from alternative income sources, especially for workers with MSc and PhD degrees, or degrees in Arts and Humanities.

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A   Appendix

Table A1: Estimation results: Mincerian wage regression, annual net wages

	Males			Females		
	1994	2001	2008	1994	2001	2008
$\beta_{2-yearUG}$	0.306***	0.370***	0.319***	0.248***	0.366***	0.330***
	(0.005)	(0.005)	(0.005)	(0.003)	(0.004)	(0.004)
$\beta_{4-yearUG}$	0.595***	0.691***	0.584***	0.569***	0.704***	0.606***
	(0.005)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)
$\beta_{MSc/MA}$	0.823***	1.069***	0.902***	0.807***	1.101***	0.955***
	(0.014)	(0.011)	(0.009)	(0.016)	(0.012)	(0.009)
β_{PhD}	1.076***	1.256***	1.039***	1.001***	1.275***	1.084***
	(0.017)	(0.014)	(0.011)	(0.030)	(0.021)	(0.014)
z	0.037***	0.038***	0.041***	0.047***	0.055***	0.052***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
z^2	0.000***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$cons$	8.276***	8.421***	8.645***	8.152***	8.051***	8.192***
	(0.007)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A2: Estimation results: Mincerian wage regression with and without ability, annual net wages

	Males			Females		
	2004	2006	2008	2004	2006	2008
			With Ability			
$\beta_{2-yearUG}$	0.350***	0.342***	0.189***	0.142**	0.182***	0.142***
	(0.066)	(0.046)	(0.034)	(0.061)	(0.045)	(0.036)
$\beta_{4-yearUG}$	0.530***	0.524***	0.502***	0.429***	0.370***	0.363***
	(0.024)	(0.015)	(0.011)	(0.022)	(0.016)	(0.013)
$\beta_{MSc/MA}$	0.970***	0.849***	0.827***	0.913***	0.580***	0.582***
	(0.092)	(0.047)	(0.031)	(0.095)	(0.051)	(0.033)
β_{PhD}	1.148***	0.923***	0.893***	0.884	0.833***	0.644***
	(0.286)	(0.086)	(0.044)	(0.682)	(0.137)	(0.068)
z	0.082***	0.081***	0.085***	0.043***	0.011	0.004
	(0.015)	(0.010)	(0.007)	(0.012)	(0.008)	(0.007)
z^2	−0.003**	−0.003***	−0.003***	−0.002**	0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
$ability$	0.287***	0.259***	0.211***	0.251***	0.314***	0.270***
	(0.047)	(0.031)	(0.024)	(0.039)	(0.029)	(0.024)
$cons$	8.263***	8.325***	8.433***	8.333***	8.501***	8.603***
	(0.056)	(0.040)	(0.030)	(0.048)	(0.036)	(0.029)
			Without Ability			
$\beta_{2-yearUG}$	0.334***	0.333***	0.194***	0.157***	0.187***	0.135***
	(0.058)	(0.042)	(0.032)	(0.056)	(0.042)	(0.033)
$\beta_{4-yearUG}$	0.569***	0.560***	0.528***	0.492***	0.431***	0.392***
	(0.021)	(0.014)	(0.010)	(0.020)	(0.015)	(0.011)
$\beta_{MSc/MA}$	1.057***	0.906***	0.868***	1.005***	0.680***	0.637***
	(0.088)	(0.046)	(0.031)	(0.096)	(0.051)	(0.032)
β_{PhD}	1.252***	1.002***	0.961***	0.950	0.943***	0.716***
	(0.282)	(0.086)	(0.044)	(0.699)	(0.141)	(0.068)
z	0.074***	0.068***	0.077***	0.035***	0.007	−0.006
	(0.014)	(0.009)	(0.007)	(0.010)	(0.008)	(0.006)
z^2	−0.002**	−0.002***	−0.002***	−0.001	0.000	0.001**
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
$cons$	8.354***	8.422***	8.509***	8.371***	8.557***	8.707***
	(0.050)	(0.036)	(0.028)	(0.043)	(0.033)	(0.027)

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A3: Differences in Coefficients between Mincerian wage regression with and without ability

	Males			Females		
	2004	2006	2008	2004	2006	2008
2-year UG	−0.017	−0.009	0.005	0.015	0.004	−0.007
	(0.029)	(0.018)	(0.013)	(0.027)	(0.020)	(0.016)
4-year UG	0.039***	0.037***	0.026***	0.063***	0.061***	0.028***
	(0.011)	(0.006)	(0.004)	(0.011)	(0.007)	(0.005)
MSc/MA	0.087***	0.058***	0.040***	0.092***	0.100***	0.055***
	(0.025)	(0.010)	(0.007)	(0.014)	(0.011)	(0.008)
PhD	0.104***	0.079***	0.068***	0.067***	0.110***	0.072***
	(0.034)	(0.012)	(0.008)	(0.021)	(0.010)	(0.008)

Note: The differences are calculated as $\beta_j^{baseline} - \beta_j^{ability}$, where $\beta_j^{baseline}$ and $\beta_j^{ability}$ are regression coefficients from Equation 1 and 2, respectively. Standard errors, reported in parentheses, are calculated as in Clogg, Petkova, and Haritou (1995). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A4: Estimation results: Mincerian wage regression for private sector, annual net wages

	Males			Females		
	1994	2001	2008	1994	2001	2008
$\beta_{2-yearUG}$	0.343***	0.361***	0.331***	0.283***	0.337***	0.292***
	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)
$\beta_{4-yearUG}$	0.599***	0.649***	0.577***	0.583***	0.682***	0.591***
	(0.007)	(0.005)	(0.004)	(0.008)	(0.006)	(0.005)
$\beta_{MSc/MA}$	0.822***	0.984***	0.886***	0.901***	1.147***	0.991***
	(0.026)	(0.018)	(0.012)	(0.040)	(0.027)	(0.016)
β_{PhD}	0.834***	1.054***	1.041***	1.252***	1.286***	1.108***
	(0.068)	(0.040)	(0.026)	(0.156)	(0.077)	(0.040)
z	0.027***	0.038***	0.040***	0.034***	0.047***	0.051***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
z^2	0.000***	−0.001***	−0.001***	0.000***	−0.001***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$cons$	8.382***	8.431***	8.679***	8.249***	8.103***	8.226***
	(0.011)	(0.008)	(0.007)	(0.009)	(0.009)	(0.009)

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A5: Estimation results: Mincerian wage regression, annual net labor income

	Males			Females		
	1994	2001	2008	1994	2001	2008
$\beta_{2-yearUG}$	0.319***	0.383***	0.327***	0.250***	0.370***	0.331***
	(0.005)	(0.005)	(0.005)	(0.003)	(0.004)	(0.004)
$\beta_{4-yearUG}$	0.650***	0.733***	0.614***	0.610***	0.739***	0.628***
	(0.005)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)
$\beta_{MSc/MA}$	0.958***	1.168***	0.981***	0.891***	1.186***	1.014***
	(0.014)	(0.011)	(0.009)	(0.016)	(0.012)	(0.009)
β_{PhD}	1.312***	1.444***	1.220***	1.196***	1.407***	1.221***
	(0.017)	(0.014)	(0.011)	(0.030)	(0.021)	(0.014)
z	0.037***	0.039***	0.042***	0.045***	0.055***	0.053***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
z^2	-0.001^{***}	-0.001^{***}	-0.001^{***}	-0.001^{***}	-0.001^{***}	-0.001^{***}
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$cons$	8.313***	8.428***	8.660***	8.184***	8.061***	8.203***
	(0.007)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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