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The Wage Effects of Schooling under Socialism and in Transition:

Evidence from Romania, 1950-2000*

Upjohn Institute Staff Working Paper 04-108

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November 2004

Abstract

　　We estimate the impact of schooling on monthly earnings from 1950 to 2000 in Romania. Nearly constant at about 3-4% during the socialist period, the coefficient on schooling in a conventional earnings regression rises steadily during the 1990s, reaching 8.5% by 2000. Our analysis finds little evidence for either the standard explanations of such an increase in the West (labor supply movements, product demand shifts, technical change) or the transition-specific accounts sometimes offered (wage liberalization, border opening, increased quality of education). But we find some support for institutional and organizational explanations, particularly the high productivity of education in restructuring and entrepreneurial activities in a disequilibrium environment.

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1. Introduction

An increasing number of studies have begun to document the rapid rise in relative earnings associated with education in post-communist Eastern Europe (see, e.g., the summary in Fleisher, Sabirianova Peter, and Wang, 2004). Little attention, however, has been paid to the schooling premium in Romania, the topic of this paper. The single available set of previous estimates, in a recent article by Skoufias (2003), pertains to only one cross-section of data in the early transition year of 1994. While these results may be compared with those from other countries, clearly they are limited in their ability to track the impact of transition, as they contain information neither on the pre-transition situation nor on developments as transition progressed through the 1990s. Indeed, many of the studies of earnings differentials in other transition economies are similarly limited to cross-sections or very short time series, and relatively few have analyzed databases with long series of information both before and after the tumultuous changeovers in political-economic system.[1]

In this paper, we use data from 1950 to 2000 to estimate the evolution of the wage impact of schooling for Romanian workers. Romania provides a particularly interesting setting in which to investigate these issues. To an even greater extent than in most other transition economies, Romania's economy during the socialist period up to 1990 reflected a thorough system of central planning and administrative controls, with none of the partial reforms adopted in Hungary, China, or the former Soviet Republics. Labor issues were strictly under the purview of the State Planning Committee, emigration was virtually prohibited, and migration was very strictly

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[1] Brainerd (1998) studies Russia from 1991 to 1994; Chase (1998) contains estimates for 1984 and 1992 in Czechoslovakia; for the Czech Republic, Vecernik (1995) studies 1988-1994, Flanagan (1998) studies 1988 and 1996, and Munich, Svejnar, and Terrell (1999) analyze retrospective data for 1989 and 1991-1996; Kertesi and Kollo (2002) and Campos and Jolliffe (2003) both analyze Hungarian data from 1986 to 1998; Sabirianova Peter (2003) studies retrospective data for 1985 and 1990, and cross-sections for 1994-2000. Most similar to the long time series we study in this paper is Fleisher and Wang's (2004) retrospective data in China from 1950 to 1994.

controlled, with 10 cities "closed" to new residents. Base wages were prescribed by the Wage Law and varied primarily by industry, occupation, and experience. Entry into occupations was restricted by rigid educational requirements, and incentive payments were small (although not uncommon) and, according to most observers, ineffectual. Workers and managers had only very weak incentives to innovate and risked sanctions for stepping outside the plan. Education was also tightly regulated, as each year the plan specified the precise number of new entrants for each field. Consistent with Communist development priorities, the educational system strongly emphasized engineering and vocational training relevant to the industrial sector.[2]

The breakdown of this closed, inflexible regime at the beginning of the 1990s came without warning. While wages in state bureaucracies, and for a time in state-owned enterprises, continued to be prescribed by law, the system was not prepared to deal with changes in corporate governance and the sudden growth of new small enterprises. In the old firms, where explicit regulation was replaced by tax-based wage (incomes) policies, there may have been some inertial tendency to stick with the wage grid, which was still officially promulgated. Yet the gradual accumulation of effects from privatization and liberalization likely increased the pressure for firms to rationalize their wage structures.[3] Meanwhile, the Romanian educational system also underwent big changes, as higher education was liberalized and enrollments dramatically increased (Sapatoru, 2001). Concurrently with the shift of employment towards trade and consumer services, students increasingly shifted from technical fields towards humanities, social sciences, and business; and curricula were restructured under the influence of market pressures and international norms.

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[2] Kornai (1992) contains a general overview of these aspects of socialist economies, while Ben-Ner and Montias (1991) provide some specific discussion on Romania.
[3] Earle (1994), Earle and Oprescu (1995), Earle and Pauna (1996), and Pauna and Pauna (1999) describe Romanian labor markets in transition, while Earle and Sapatoru (1993, 1994) and Earle and Telegdy (1998, 2002) analyze Romanian privatization policies.

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This context suggests a set of contrasting hypotheses about the changing wage structure in Romania. On the one hand, the tendency for central planners to undervalue education and to compress wage differentials suggests that any earnings premia associated with formal schooling would be small under the socialist regime, and they are likely to increase during transition as the economy liberalizes and moves to a market equilibrium. Furthermore, the usefulness of skills acquired through schooling might rise during transition because of skill-biased shifts in labor demand, improvements in the quality of education, or increases in the "value of the ability to deal with disequilibria" (Schultz, 1975). The opening of international borders, particularly to the West, could increase pressure on the educational premium as more educated workers emigrate to exploit the higher returns on international markets.

On the other hand, expanded access to schooling may have led to a skill-biased relative supply shift, implying a decreased measured return. Moreover, the pre-reform educational system was designed to further the industrialization priorities of the Communist elite, and the value of such schooling might therefore decline in a new market environment.[4] The disruptions of transition might result in a declining, rather than improving, quality of education, reducing the return to recent schooling as well. Finally, the large sectoral shifts associated with an economy-wide restructuring process could imply that the return to schooling is influenced by compositional effects – in either direction.

Theoretical considerations alone, therefore, do not provide a single prediction of the evolution of schooling differentials across the socialist and transition periods. In addition to providing empirical estimates of these differentials from 40 years before to 10 years after transition began, our empirical analysis in this paper exploits information on the nature of

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[4] Flanagan (1998) and Filer, Jurajda, and Planovsky (1999) make this point with respect to the Czech Republic. Kertesi and Kollo (2002) argue more generally that skill obsolescence is an important factor in Hungary.

Romanian reforms and institutions to try to sort out some of the relevant explanations for the patterns we observe. An examination of the timing of the changes in schooling returns vis-a-vis the timing of liberalization helps assess the plausibility of "movement towards equilibrium." Evidence on changes in the quantity of workers with more and less education is useful to assess the demand and supply interpretations. Some information on the importance of pressures arising from international border opening can be obtained by examining regional and ethnic differences in the schooling premium. Concerning "dealing with disequilibria," we separately estimate the impact of schooling in the private and self-employment sectors, the loci for entrepreneurial behavior in the economy. The possibility of changing value of the educational system can be approached by permitting the estimated return to vary with the time period in which schooling was acquired. Finally, separate estimates of schooling returns by economic sector can, together with information on sectoral shifts, predict the counterfactual return in the absence of the shifts.[5]

In the next section, we describe our data sources, sample composition, and variables. Section 3 contains estimates of the basic earnings functions, while Sections 4 and 5 provide evidence on possible explanations of the observed patterns, the former focusing on relative supply shifts and movement towards equilibrium and the latter on factors that may have shifted relative demand. The final section gives a brief conclusion.

2. Data

The source of our data is the Integrated Household Survey (IHS) of the Romanian National Commission for Statistics (renamed as National Institute of Statistics since 2001). For the socialist years (back to 1950) and early 1990s, our information is based on retrospective

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[5] We follow the previous literature in referring to the coefficient on years of schooling in a conventional earnings function as the "return to schooling," although consideration of issues such as the costs of schooling (monetary and psychic), the measurement of the value of a job (i.e., including fringe benefits and other work conditions), and the problems of estimation (for example, selection bias in schooling decisions) suggest that "wage differential associated with schooling" would be more cautious and apt, although also clumsier.

information in the 1994 survey, while for 1994 onwards we use the annual household survey. The IHS started in April 1994, running for 12 months over a changing sample (thus, when we refer to "1994 sample," this means April 1994 to March 1995). Subsequent years were organized on a similar pattern up to 1997, when the IHS started in April and ended in November. For the rest of the cross sections (i.e., 1998-2000), the IHS started in January and ran for 12 months. Unfortunately, although originally designed as a panel, the data do not permit linking of individual observations across years.

The sample sizes in these data are larger than in most studies of socialist and transition economies. The number of observations available for analysis varies across the cross sections, starting at 25,565 in 1994, falling to 15,508 in 1997, increasing to 21,518 in 1998, and decreasing again afterwards to 17,480 in 2000. Given the relatively small number of yearly observations before 1994, we aggregate these observations into five 5-year periods (1950-1989) and one 4-year period (1990-1993), the latter capturing the initial years of reforms.

A notable change in the survey across the years for the purpose of this paper is that years of schooling are reported directly by respondents only in 1994 and 1995. In order to estimate the return to years of schooling in 1996-2000, we had to impute years associated with educational attainment, a frequent procedure in such data sets. Our method was to compute the median years of schooling for each attainment category in 1994, and then to associate these medians with the corresponding attainment categories in 1996-2000.

Table 1 presents some descriptive statistics on the main variables. Throughout the paper, we provide results for the sample of all employees aged 15-59, but we have also analyzed other age ranges (18-59 and 30-50) and separated the sample by gender, obtaining similar results. The net monthly wage is computed as earnings on the primary job in the previous month minus taxes

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and other mandatory contributions. The wage variable refers to the previous month in 1994-2000 and the starting wage for jobs held during 1950-1993. Questions may be raised about recall bias in the retrospective information, but it should be borne in mind that starting wages on new jobs are relative easily recalled, particularly in the socialist context of strong stability in wages, prices, and employment. Age bias may also be present, as workers observed to be starting jobs in earlier years tend to be systematically younger than those starting later. All our regressions control for age (experience) in quadratic form, and we have also investigated quartics with similar results, but these problems might still represent significant limitations if we intended a very extensive analysis of the retrospective information. Most of our analysis in this paper concerns the evolution of the differential from 1994 onwards, however, and we use the socialist period data primarily to establish a baseline for the subsequent changes. Moreover, our findings show little fluctuation in the estimated relationships over the entire socialist period, which is inconsistent with large roles played by recall and age bias. To allay any residual concern, we provide estimates of the basic functions using least absolute deviations (LAD) in addition to ordinary least squares (OLS).

Table 1: Summary Statistics, by Time Period

The stability of wages from 1950 to 1989 is clearly shown in the computations of the mean wage, which evolved slowly until jumping up abruptly in 1990-1993, when prices and wages were quickly liberalized. Consistent with aggregate inflation statistics, the mean wage increases rapidly through most of the 1990s. These are nominal wages, but as the cost of living also rose in these years, the average real wage certainly fell. Our concern in this paper is wage differentials rather than the overall level of real wages, so in principle our approach of estimating repeated cross-sections would seem to require no deflation of the dependent variable. The

significant inflation during the 1990s, however, requires some within-survey-period adjustments. In each of the retrospective periods (1950-1993), where there are fewer degrees of freedom (as shown in the sample sizes at the bottom of Table 1), we include a quadratic monthly time trend in the equation. In each yearly regression from 1994 to 2000, we include a set of monthly fixed effects.

The sample characteristics in Table 1 also show an average years of schooling at 9.04 in the early 1950s, falling to 8.39 in the early 1960s (possibly due to the Communist regime's active campaign against the intelligentsia), and then rising steadily thereafter, with some acceleration after 1990, to 12.19 in 2000. The increase in years of schooling reflects both the increase in the mandatory education during the communist years and the expansion of educational opportunities in post-socialist Romania. Given the characteristics of the retrospective data, it is not surprising that the potential years of experience tend to be low during the socialist period and until 1994, while afterward the analyzed employees have on average around 20 years of work experience.

Table 2 presents some descriptive statistics for other variables we analyze in the 1994-2000 period. The regional and ethnic distributions are relevant for the possibility that opportunities for emigration have increased the schooling premium. Region is defined by classifying counties (*judete*) on the basis of the "development regions" of the National Commission for Statistics (2000, p. 601), while the ethnic variables reflect the information available in the survey; the means show only minor fluctuations from year to year. The share of employees who have graduated after 1992, which we take as a proxy of post-communist schooling (the variable *NEW*), increased from 0.02 in 1994 to 0.15 in 2000. The figures also show some inter-industry shifts, particularly into service sectors; the figures for agriculture are

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much lower than from the Labor Force Survey or other official sources, probably because we exclude the self-employed. The biggest shifts concern firm ownership, where the public share falls from 0.86 in 1994 to 0.40 in 2000, the mixed rises from 0.02 to 0.10, and the private from 0.10 to 0.42. These changes reflect the privatization of the Romanian economy, which if somewhat slower than in some neighboring countries, nonetheless changed dramatically during this period.

Table 2: Summary Statistics for New Education, Ownership, Sector, Region, and Ethnicity, 1994-2000

3. Estimating Earnings Functions in Romania, 1950-2000

The basic earnings function we estimate in this paper is the standard relationship due to Mincer (1974):

$$\ln(W) = \beta_0 + \beta_1 S + \beta_2 X + \beta_3 X^2 + \beta_4 F + \sum_t D_t + u, \tag{1}$$

where the variables are defined in Table 1, the D_t parameterize time to control for general inflation (quadratic monthly time trends in 1950-1993, monthly dummies in 1994-2000), the βs are parameters to be estimated, and u is an error term. Because of some concern about possible measurement error, as discussed above, we estimate using least absolute deviations (LAD) or median regression, as well as by ordinary least squares (OLS).[6] The results from these estimates for cross-sections of employees from 1950 to 2000 are provided in Table 3.

Table 3: Basic Earnings Functions, by Time Period and Estimation Method

Under both estimation methods, we find a small but statistically significant impact of schooling under central planning: our estimates show a fairly constant 3-4 percent premium

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[6] As a further check on the influence of possible measurement error, we also estimated the earnings functions with samples that excluded that top one percent of earners in each period; the results were similar to those reported here.

associated with an additional year of schooling from 1950 through 1989. The slightly higher coefficients in the 1960s might be associated with the industrialization drive that really took off in this period and that relied on wage differentials to induce worker mobility in directions desired by the planners; or they might reflect a recognition that the repression of the intelligentsia during the 1950s had been counterproductive. At any rate, these movements are very slight compared to those beginning in the early 1990s, when the estimated coefficient begins to trend upward steadily, more than doubling – to 8.5 percent – by the year 2000. Throughout the retrospective data analysis, the LAD coefficients are much smoother than the OLS, and in particular they show a smaller jump in 1990-1993, but from 1994 on there is little to choose between them. The results provide new evidence, based on longer time series than previously available, concerning the low "return to schooling" under socialism and the dramatic rise in the return during transition.[7]

Although not the focus of this paper, the results for the other variables are also interesting. The return to the first year of experience rises in the 1990s compared to the pre-reform period. The concavity of the experience profile also tends to increase, consistent with results in other countries. Finally, the coefficient on the female dummy is consistently negative, and the magnitude tends to be larger in absolute value in the transition period.[8]

Our findings for the schooling coefficient may be compared with those obtained in other studies of transition economies. As we noted above, our paper provides the first analysis of the evolution of the wage impact of schooling in Romania from the socialist to the transition period.

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[7] Motivated by the possibility that participation rates of low earners might be falling over this period, particularly those of younger people (who might stay in school), older people (who might retire early), and women (who might be withdrawing to care for children), we also estimated all equations for the central age-group of 30–50 years old, and for men and women separately. The qualitative patterns in these results are again very similar to those reported here. We also discuss changes in participation patterns by schooling category below.
[8] The widening gender gap in our data is an exception to Brainerd's (2000) analysis of gender differentials in several East European countries (not including Romania), but it is consistent with her finding for Russia and Ukraine. Why Romania should be an exception to the East European pattern is a topic worth further research.

Skoufias (2003), however, provides estimates for 1994, and our results for that year are very similar to his.[9] Concerning studies of other economies that examine the evolution over time, Chase (1998) finds a much smaller return during the socialist period in Czechoslovakia but a similar figure for 1993 to ours for 1994. Munich, Svejnar, and Terrell (1999) also report a lower return before transition in the Czech Republic, while their estimate of 5.8 percent in 1996 is similar to Flanagan's (1998), and both are slightly smaller than our 6.7 percent estimate for Romania. For Russia from 1991 to 1994, Brainerd (1998) estimates an increase from 3.1 to 6.7 percent for men and 5.4 to 9.6 percent for women. For Hungary, Campos and Jolliffe (2003) report an estimated return of 6.4 percent already in 1986, rising to 11.2 percent by 1998. Using the same data, Kertesi and Kollo (2002) report that the return to education in Hungary rose quickly from 1989 to 1992 but then leveled off. Our findings differ in showing a steadier and more gradual evolution of the estimated return in Romania. In Fleisher, Sabirianova Peter, and Wang (2004)'s summary of estimates of schooling returns across a number of transition economies, the mean estimate is about 4 percent in the late 1980s, rising to 8.8 percent in 2000; our estimates for Romania are very close to these.

4. Supply, Demand, and Movement toward Equilibrium

As this discussion makes plain, the pattern of increasing wage differentials associated with schooling has been well-documented in a number of transition countries, and our results so far provide evidence of a similar pattern in Romania. But what factors might explain these dramatic changes? Although data limitations prevent us from a detailed investigation of all the possibilities, we are able to provide some evidence relevant to a number of hypotheses. A first

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[9] Skoufias (2003) measures schooling as a set of dummies for educational attainment rather than years of schooling, and his sample differs in several ways (maximum age of 65, restriction to individuals interviewed in 1994), but we receive results similar to his when we estimate using attainment dummies with our sample.

group of these concerns basic supply and demand analysis: an increase in relative pay associated with longer schooling may reflect an adjustment to equilibrium wage relativities, it could be due to a contraction in the supply of more educated workers, or it could reflect skill-biased shifts in labor demand. In this section, we consider these broad categories of explanation, before moving on in the next section to the specific factors that may underlie relative demand shifts.

The first group of hypotheses can be illustrated with a simple demand-supply diagram, as in Figure 1. The horizontal axis measures the average schooling in a population while the vertical measures the marginal return to additional schooling. The demand and supply functions are expressed in relative terms, the former showing how relative earnings vary with average schooling, and the latter measuring the willingness of workers to acquire additional schooling if faced with a higher return. We have drawn the supply function as relatively inelastic due to the presumed time lags for workers responding to different incentives.

Figure 1: Understanding Changes in Relative Wage ($\partial W/\partial S$) and Quantity of Schooling (S)

Three hypothetical situations are portrayed: a below equilibrium level of the relative wage at the very beginning of transition, labelled W_{1990}; the result of moving to equilibrium with simultaneous outward shift of both demand and supply in the middle of the transition process, W_{1995}; and the result of further outward shifts, W_{2000}. W^*_{1990} refers to the relative wage in 1990 if workers had been paid their marginal products.[10] The relative importance of adjustment to equilibrium at the beginning of transition can be measured in the diagram as $(W^*_{1990}-W_{1990})/(W_{1995}-W_{1990})$. We approach an analysis of this issue in two ways: first, we consider the temporal pattern of the growth in the schooling coefficient in relation to the liberalization of

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[10] The definition of productivity during the socialist period is somewhat problematic, as the system had different goals, prices, and wages; to avoid this confusion we refer to the 1990 situation, when the goals of a market economy are assumed, yet wages were still controlled.

labor markets in Romania; second, motivated by the possibility of inertial wage setting practices for tenured workers, we study the evolution of returns to schooling by cohort.

The first type of analysis comes directly from the figures in Tables 1 and 3, and we have provided a graphical analysis in Figure 2 (using the LAD coefficients from Table 3). The liberalization and adjustment hypothesis would imply a sharp jump in the return to schooling around the time of the dramatic policy changes of the early 1990s, followed by a fairly constant return in the later years.[11] Instead, the figure depicts continuous increases throughout the 1990s, with only a small share of the adjustment taking place in any particular year. The schooling coefficient does jump more in the early 1990s than later on, but the continuing upward trend would seem to provide *prima facie* evidence directly contradicting the hypothesis.

Figure 2: Observed Changes in Relative Wage (∂W/∂S) and Quantity of Schooling (S)

Perhaps this view is too strict, however, as it is likely that individual workers' wages may respond sluggishly and institutional factors may intervene, particularly in the short run, so that the adjustment toward equilibrium takes place only gradually. In this case, however, it would imply that the greatest adjustments would be on the margin: for instance, younger cohorts of workers and those just hired. For this reason, we also estimate a modified version of equation (1):

$$\ln(W) = \beta_0 + \beta_{10}S + \beta_{11}XS + \beta_{12}X^2S + \beta_2X + \beta_3X^2 + \beta_4F + \sum_t D_t + u , \qquad (2)$$

which permits the β_1 coefficient on S in equation (1) to vary with work experience. We pool the years 1970-1989 together for this analysis and also estimate on the 1990-1993 time period and for each year thereafter. The results for $\partial W/\partial S$, graphically displayed in Figure 3, show that initially the schooling wage premium rises more for younger cohorts (β_{10} is larger) and declines

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[11] See Earle and Oprescu (1995) for a discussion of wage regulations and policies in the early 1990s. The biggest change came in February 1991, when wage setting was liberalized, although some controls continued to be imposed in the state sector. Below, we analyze differences in the schooling wage premium by ownership type.

with experience (β_{12} is larger in absolute value), but in fact the estimated return grows rather steadily for each experience group. By the late 1990s, the profile has nearly converged to a profile that is a simple 4 percentage point upward shift of the socialist profile, with little difference in shape.[12]

Figure 3: Evolution of the Experience Profile of Returns to Schooling

The data, therefore, provide only a little support for the simple "movement to equilibrium" interpretation. In terms of Figure 1, W^*_{1990} appears to differ relatively little from W_{1990}, at least compared with the shifts implied by the magnitudes of W_{1995}-W_{1990} and W_{2000}-W_{1995}. Most of these increases must instead be explained by shifts of the relative supply or relative demand functions.

The possibility that a contraction of relative supply caused the rising measured return to schooling is directly contradicted by the increased level of education in the Romanian population. As demonstrated by Figure 2, which portrays the evolution of the average years of schooling and the estimated wage premium associated with schooling over the period 1970 to 2000, the relative supply of educated workers expanded steadily. The supply-side changes, therefore, would have served to reduce, not increase, schooling returns. The continual movement up and to the right in Figure 2 appears to be tracing out the equilibria shown in Figure 1.[13]

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[12] Similarly motivated by the possibility of inertial wage setting for incumbent workers coupled with greater adjustment on the margin (i.e., for those recently hired), we estimated similar equations for 1994 and 1995 with two alternative measures of recent hiring – hired in the previous year and hired since 1991 – based on the job tenure variable, which is available for those two years only. The results were consistent with this motivation, implying a 1-2 percent greater schooling premium for the recently hired, but this small difference (coupled with the small fraction of recently hired workers) is insufficient to account for more than a negligible amount of the growth in the schooling coefficient over this period.

[13] We have also examined the evolution of employment-population ratios for three educational groups ($S<12$, $S=12$, and $S>12$) and find some tendency for the employment probability to decline more for the less educated compared with the more educated group. Thus, the rise in average educational attainment is higher among employed individuals than in the population as a whole.

The relative expansion of skilled worker supply took place at the same time as the liberalization of Romania's borders opened up the possibility of emigration, which may have been especially attractive for better educated workers who could exploit the higher schooling premium to the West. Although such emigration clearly did not offset the overall relative supply increase within Romania, it is possible that the pressure raised the schooling premium in certain groups, those with the greatest tendency to emigrate. Suppose, for example, that the relative supply elasticity is identical for all groups but that the relative demand function faced by groups prone to emigrate happens to be less elastic. In this case, a leftward shift in relative supply of the emigration-prone could raise the schooling premium overall, even if the rightward shift of the non-emigration-prone was great enough to simultaneously raise the overall average level of schooling. Two simple tests of this argument involve two different ways of proxying the tendency to emigrate, the first based on region (distance from the Western border) and the second based on ethnicity – Hungarians and Germans, who have enjoyed not only valuable language abilities but also preferred emigration status in Hungary and Germany, respectively. In both cases, we rely upon variants of equation (1) involving interactions between schooling and the relevant variables: region in the first case and ethnicity in the second.

Summary statistics for the region and ethnicity variables were shown in Table 2, while the results of the regression analyses appear in Tables 4 and 5. Concerning variation in the estimated schooling return by region, shown in Table 4, the coefficients of interest involve the interactions between schooling and the western regions – Southwest, West, and Northwest – which are located closest to Hungary and job opportunities in the European Union and thus may be expected to have the highest returns. Contrary to this hypothesis, all these coefficients are negative, and occasionally they are even statistically significant at conventional levels.

Concerning variation by ethnicity, the coefficients of interest are the interactions of schooling with Hungarian and German background, and again the results are inconsistent with the hypothesis that an improvement in the relative opportunities for more educated workers in these ethnic groups has effectively shifted their relative supply functions backwards.

Table 4: Variation in the Return to Schooling by Region

Table 5: Variation in the Return to Schooling by Ethnicity

Overall, therefore, we find no evidence of any role for supply shifts in explaining the rapidly rising return to schooling in Romania. Indeed, the large supply shifts we observe would imply a decline, not an increase, in the schooling effect. Furthermore, the increases in student enrollments and average worker education imply a still greater reduction in the wage differential associated with schooling as long as schooling and ability are correlated, for the expanded opportunities for schooling would result in lower average ability at higher levels of schooling, lowering the schooling coefficient over this period. The shifts in relative demand must have been large enough to offset these negative effects from the supply side as well as to account for the large observed rises in both the quantity and price of educated labor.

5. Explanations: Relative Demand Shift Factors

The evidence so far clearly suggests that the rising return to schooling in Romania during the 1990s must be explained by large outward shifts in the relative demand for more educated workers. What factors could have led to the increased relative productivity of more educated workers that would underlie such shifts? A first possibility is an increase in the quality of education. Second, demand could shift due to skill-biased technical change. Third, even if there was little change inside Romania, it is possible that international opening of the economy could

effectively raise relative demand, putting upward pressure on skill differentials to bring them in line with neighboring countries. Fourth, product demand shifts across industries – using different technologies and therefore providing different rewards for schooling – could produce compositional effects in the changes in the estimated schooling coefficients. Fifth, similar compositional effects could occur due to shifts across ownership forms, in particular from the state to the private sector, where wage-setting mechanisms are likely to differ significantly. Finally, the opportunities for entrepreneurship in the unstable environment of transition could increase returns if education is associated with a greater ability to "deal with disequilibria." We consider each of these possible explanations in turn.

The first possibility, improvements in the educational system, can be thought of as technological changes to the human capital production function. This idea has only recently surfaced in discussions of rising skill differentials in the West (Bowlus and Robinson, 2004), but it has been more common in East European discussions of these issues (e.g., Kertesi and Kollo, 2002). A popular view among educators in the region is that the educational system has become less productive, the strenuous standards of the socialist system – particularly in mathematics and technical fields – having deteriorated under the lax discipline of transition. If true, this would imply a decreased return to schooling, *ceteris paribus*. As a crude test of these possible changes in the educational production function, we distinguish workers who graduated after 1992 as having "new education." The means by year for this variable (*NEW*) are shown in Table 2.

Our method is to interact *NEW* with *S* in another extension of equation (1). The results are shown in Table 6, and they indicate a small premium for post-communist schooling in 1994 and 1995 of about 2 percentage points. The estimated coefficient shrinks to 1 percent and becomes statistically insignificant in 1996, however, and thereafter is completely negligible in

size as well as statistically insignificant. It is also noteworthy that those with new education receive sharply lower earnings (i.e., a lower intercept) in 1994 and 1995, but this difference converges towards zero over the 1990s. In any case, new entrants are clearly not particularly highly rewarded in the Romanian labor market during this period, and the evidence does not appear to support the hypothesis that improved education has raised the productivity differential associated with more schooling.

Table 6: Variation in the Return to Schooling by New versus Old Education

A second possible explanation for the outward relative demand shift could be skill-biased technical change. The notion that advances in information technology account for increased wage inequality has been extremely fashionable in the U.S., but unfortunately it is very difficult to measure. In our data, there is no variable to proxy for computer usage or technology adoption by the firm. Common sense, however, suggests that it is implausible that technology change, at least of the conventional sort, is a major factor. For one thing, the increase in the wage impact of schooling is much faster in Romania during the 1990s than in Western economies in the entire second half of the twentieth century. Indeed, as noted by Card and DiNardo (2002), the increase in the schooling premium in the U.S. had taken place by 1990, with little change thereafter. Even if Romania started transition in a technologically backward state, investment was very low through most of this period, so adoption of new technology was probably similarly sluggish.[14] Some direct evidence from firm surveys appears in Commander and Kollo (2004) and Earle, Pagano, and Lesi (forthcoming); both studies show low levels of information technology usage, and the former shows that adoption is largely uncorrelated with the rise in the skill premium in the sampled firms. Perhaps technological change in a broader sense including not only physical

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[14] The share of investment in GDP, calculated from official figures in National Commission for Statistics (various issues), was 29.6 percent in 1989, 14.2 in 1991, 16.1 in 1994, 16.3 in 1998, and 10.7 in 2000.

machinery but also new types of organizational practices might be responsible, although these are even harder to measure.[15] We return to a discussion of such changes below.

Another broad category of explanation concerns changes in the composition of the Romanian economy. Research on the increasing schooling premium in the U.S. associates sectoral shifts with changes in product demand, and similarly we may consider the rise of the service sector and the decline of heavy industry in Romania as reflecting the substitution of consumer preferences for central planning in the determination of product demand. For current purposes, we consider shifts across a crude division of the economy into 3 sectors: agriculture, industry, and services.[16] The main hypothesis of interest is that the return to schooling is higher in the services sector (due, for example, to different technology), so that a rise in services leads to a composition of the economy with a higher weight on the wage differential in services.[17] We again employ an interactions specification, with the results shown in Table 7.

Table 7: Variation in the Return to Schooling by Sector

Industry is the omitted category; thus the coefficient on S measures $\partial W/\partial S$ in the industrial sector, while the coefficients on the interaction terms show the difference between the return in agriculture or services from that in industry. The estimates imply an approximate 1 percent additional premium for schooling in services compared with industry, but this difference is small and falls somewhat over these years. Moreover, the level and growth in the estimated

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[15] Brynjolfsson and Hitt (2000) argue that the main effect of computerization works through the complementary organizational changes accompanying new technology adoption; in this case, however, the skill-bias effect should still be correlated with technical change. This implies that other types of organizational change may be more significant.

[16] See Earle (1997) for a more detailed discussion of interindustry mobility of workers in Romania.

[17] The sectoral shares of employees in our data differ from those in official statistics because of large numbers of self-employed in both agriculture and services. If we include self-employed, the shares of agriculture, industry, and services in 2000 would be 36 percent, 25 percent, and 39 percent.

return to schooling in industry look similar to those for the whole economy.   These results

provide little support for a major role of sectoral shifts in explaining the rising wage premium.[18]

Another variety of compositional shift concerns ownership types. As shown in Table 2,

the Romanian economy underwent dramatic changes by ownership during the 1994-2000 period,

with a substantial decline in the fraction of workers reporting their employer was state-owned

(from 86 to 40 percent), and corresponding rises in the fraction private (from 10 to 42 percent),

mixed (from 1.8 to 10.5 percent), and an unknown "other" (from 0.2 to 5.5 percent).   Our

motivation for studying these ownership forms is the possibility that they differ in organizational

practices, due to legal regulations, firm objectives, or corporate governance.   These practices

may result in deviation of relative wages from relative productivity ratios of workers within a

firm. The specific hypothesis is that private firms – placing a higher weight on profits, feeling

more pressure from market competition, and facing harder budget constraints – are less likely to

provide such rents to low-skilled workers than the state sector.   We provide evidence on this

hypothesis with a test analogous to those above, namely by adding to equation (1) interactions

of ownership type with schooling. State ownership is the omitted category.

The results, presented in Table 8, imply a statistically significantly higher schooling wage

premium in privately owned firms.   Interestingly, the estimated magnitude follows a roughly

inverted-U trajectory, rising from 1994 to 1996 and falling thereafter. This difference in wage-

setting behavior in the private sector, combined with the rising private share in total employment,

may partially account for the overall growth in the aggregate schooling return. The contribution

is not large, however: the private sector added about 0.2 percentage points to the aggregate

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[18] A similar analysis with 15 disaggregated industries also finds no indication that interindustry shifts in employment could contribute significantly to the rise in the coefficient overall.

return in 1994 and about 0.7 in 2000. Meanwhile, the estimated return in the state sector grows by 2 percentage points (from 5.7 to 7.7, as shown in the table).

Table 8: Variation in the Return to Schooling by Ownership of Employer

Our findings suggest that, contrary to a number of hypotheses, the rise in the wage premium for additional schooling was both gradual and broadly based. It was not concentrated in only some sectors of the Romanian economy but affected all sectors without many differences among them. The fact that the private sector appears to have led the increasing trend is suggestive, however, as it implies that changes in organizational practices may be part of the story.

What sorts of organizational practices could be relevant, and what changes in the economic environment could have brought them about? One possibility is raised by recent research on skill differentials in the U.S., which maintains that the effect of technological change works through organizational practices to raise the relative productivity of more skilled workers. Brynjolfsson and Hitt (2000), for instance, point to the ways computers have enabled practices such as flexibility in equipment design and job assignments, lower levels of inventories, more outsourcing, more participation in decision making, and flatter hierarchies. But we have argued that the rising skill differential in Romania (and other transition economies) took place much more quickly than can be explained by investments in new technologies and the even slower adoption of such practices.

Our final hypothesis, therefore, concerns a different set of practices that involve particular types of skills and tasks: finding creative solutions to problems, recognizing and exploiting new opportunities, innovating rather than simply following orders. The socialist system provided workers and managers with few incentives to display individual initiative and

exercise these qualities.[19] Not only were many economic decisions prescribed by the plan, the stability of the system meant that there were few gains from searching for new opportunities; innovation and exceeding the plan targets could even be penalized, for instance through the "ratchet effect." In the transition, however, the abilities to think "outside the box" and to act entrepreneurially became extremely important, probably even more so than in stable market economies. If education increases these abilities to "deal with disequilibria," as argued by Schultz (1975), then the relative productivity of workers with more schooling will rise.

The problem is how to measure or provide some evidence on this effect. We do so indirectly, by analyzing the returns to schooling among the self-employed.   For this purpose, we consider the nonagricultural self-employed as entrepreneurs, as they are typically treated in the literature on this topic.[20] Comparing with our estimated coefficient for employees, if we find a similar or lower schooling coefficient for self-employed, then this would imply a rejection of the argument, while finding a substantially higher coefficient would be consistent with it. The return to schooling among entrepreneurs might be expected to first rise and then fall, as the scope for exploiting new opportunities initially rises (as liberalization increases and the opportunities are revealed) and then declines (as the opportunities are exhausted).

Defining and measuring the income of entrepreneurs is always a difficult problem, but in the case of the IHS a special section of the questionnaire provides unusually detailed and precise information: gross revenue from entrepreneurial activities, capital inputs, material inputs, labor costs, taxes, and in-kind payments – all with respect to the reference month.[21] We define net

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[19] One should not entirely discount the usefulness of creativity in solving such problems as the supply breakdowns endemic under central planning; the assumption here is only that the scope for and return to exercising creative initiative were greatly attenuated compared to a market or transition economy.
[20] See, e.g., Evans and Leighton (1989), Fairlie and Meyer (1996), or Hamilton (2000). Consistent with most literature, we omit the agricultural self-employed from the analysis as they are less likely to be genuine entrepreneurs, particularly in Romania, where the land privatization policy resulted in tiny family farms.
[21] In-kind payments, which would mostly refer to crops given to workers, are available only in 1994 and 1995, but they would represent subtractions from gross revenue in later years. The use of data for a reference month is somewhat problematic, but we have little alternative with the data available.

income as the first variable minus the sum of all the others and use this as the dependent variable in the conventional earnings regression (1). Table 9 presents estimates for the sample of nonagricultural self-employed, aged 15-59, in the IHS from 1994 to 2000.

Table 9: Return to Schooling for the Nonagricultural Self-Employed

The estimated coefficient on S is larger for the nonagricultural self-employed than for employees in all years. The coefficient grows strongly until 1998, when it peaks at 15.5 percent, and then declines somewhat thereafter.[22] The pattern is not due to changes in the supply of individuals engaged in self-employment, as the fraction of total employment accounted for by the nonagricultural self-employed steadily expanded, cumulatively nearly doubling (from 3.58 to 6.03 percent) in just six years from 1994 to 2000.[23]

These results are consistent with the proposition that education plays an important role in enhancing the ability of workers to deal with disequilibria. We believe they shed light not only on the self-employed, but also on the increased return to education among employees. Employees may also be involved in entrepreneurial activities, in the sense of recognizing and exploiting new opportunities. If education enhances the ability of the self-employed to act creatively, then it may be inferred that it has a similar effect for employees as well.

6. Conclusion

This paper makes a number of contributions to research on the growth in the estimated return to schooling during the transition from socialism. Ours is the first paper to examine the changes in the return for Romania, a relatively large country in Eastern Europe that has been

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[22] Studies of these relationships in other countries have found varying results: Gill (1988), Borjas and Bronars (1989), Evans and Leighton (1989), and Fairlie and Meyer (1996) find a higher return for self-employed, but Rees and Shah (1986), Earle and Sakova (2000), and Hamilton (2000) find the opposite.

[23] The fraction would of course be much greater if we followed the convention of calculating the rate in nonagricultural employment: the relevant figures for 1994 and 2000 in this case would be 4.7 and 8.3 percent, respectively.

somewhat neglected by researchers. Our paper is also one of very few to contain information for long periods during both the central planning and transition years: we analyze 40 years and 11 years of data for the two periods, respectively. Our estimates of basic earnings functions in Romania reinforce previous research findings from other countries that the schooling wage premium was low under central planning (although our point estimates, at around 3-4 percent, are somewhat larger than those for the Czech Republic and smaller than those for Hungary, for instance) and that it grew substantially during the transition years – more than doubling in our analysis of Romanian data through the year 2000.

Our paper also goes beyond estimating the schooling coefficient to assemble evidence concerning a number of explanatory hypotheses for the observed patterns. We first investigate the conventional explanations for an increased schooling premium in Western research, including relative supply shifts, product demand shifts, and skill-biased technical change. The rise in average schooling in our data is inconsistent with an overall contraction in supply of more educated workers in Romania, and the lack of evidence of higher returns for workers in the West and for ethnic groups with better emigration possibilities (Germans and Hungarians) leads us to reject any role for border liberalization in putting upward pressure on the schooling differential. Our analysis of interindustry variation in estimated schooling returns provides no evidence of a significant impact of product demand shifts. The possibility of skill-biased technical change is difficult to measure and cannot be completely discounted, but the much faster pace of increase in the measured schooling return in Romania compared to the West and the very low level of investment during the same period undercut the plausibility of the large or exclusive role assigned to this factor in many studies of Western economies.

We therefore consider a set of additional hypotheses that we derive from a broader understanding of Romania and other transition economies. First among these is the possibility that the increased return reflects a movement from centrally planned determination to an equilibrium in which relative wages more closely reflect relative marginal products. While again we cannot unequivocally reject this hypothesis, which has dominated most previous research on returns to education in transition economies – at least implicitly – the rather gradual pace of the growth in returns throughout the 1990s, even among new cohorts of recently hired workers, provides evidence against a dominant role for this factor.

The results of our analysis also challenge interpretations based on improvements from the socialist to the transition period in the quality or value of formal schooling. We find neither that education received during the socialist period lost value when market reforms were introduced, nor that newly acquired education after 1990 was consistently valued much higher in the labor market. Indeed, while of course the share of the work force with "new education" steadily increased through the 1990s, the estimated return is significantly larger than that for "old education" in 1994 and 1995, and the difference is negligible and statistically insignificant thereafter. Nevertheless, the overall return to education continued to steadily increase.

Our analysis does find support, however, for a category of explanations that has received little attention in the literature: organizational and institutional changes that increase the value of education. The two main pieces of evidence for this hypothesis are the greater wage effects of schooling among private sector employees and among self-employed entrepreneurs, both of which grew substantially in their share of Romanian employment over this period. The differential in the return averages 1.8 percent for the private sector and 5.0 percent for entrepreneurs, and the evolution of both displays a pronounced inverted U-shape over the 1994-

2000 period. Our interpretation of these results is that the adoption of new organizational practices, particularly the higher rewards for individual initiative, increased the value of education within the private sector, while the possibilities of exploiting new opportunities did the same even more so among entrepreneurs. The state sector, meanwhile, was itself gradually commercializing, undergoing organizational change, and experiencing increased labor market pressure to conform to the wage differentials in the growing rest of the economy. The inverse U-shape reflects the leadership of private sector and entrepreneurial returns in pushing the more sluggish state sector in this direction, as well as the gradual exhaustion of great opportunities for dealing with the disequilibria of economic transition.

The analysis we have carried out provides support for these interpretations, but the data are insufficient to refute or substantiate them entirely. Therefore, it is appropriate to conclude by reiterating some important caveats about our work. We should again emphasize that our analysis suffers from the standard problems in studies of "returns to schooling" in that we observe only wages, not other economic or psychic benefits from work, we do not observe costs of acquiring education, and we cannot control for self-selection in individual educational choices. The transition context may particularly aggravate the first two of these problems, as fringe benefits and work conditions changed drastically as did individual variation in schooling costs, with the entry of new private educational institutions and the introduction of the practice of charging fees to some students even in state organizations. Concerning the third problem, we may take the acquisition of schooling-based skills under central planning as exogenous to earnings during the transition, particularly under our argument concerning the large increase in the value of the ability to deal with disequilibria. Thus, the transition context may partially ameliorate this standard problem.

We should also emphasize an important caveat about our analysis of earnings functions prior to 1994, which are based on retrospective questions asked of respondents in 1994. As always, questions about the reliability of such data may be raised, and the results should be treated with caution. Indeed, the relatively low R^2 that we obtain in most of the pre-1994 period certainly suggests the possibility of higher measurement error during this period. To avoid mistaken inferences, we estimate our equations on a variety of samples, including eliminating outliers, and we use LAD as well as OLS estimation methods. All the results from these different approaches show great stability in the estimated schooling coefficient over the entire 40 years, which suggests that mistakes in answering the retrospective questions are not leading to systematic biases.

A final caveat concerning measurement problems applies to nearly all the hypotheses we consider for the observed pattern of increasing return to schooling. Lack of information prevents us from undertaking a more thorough analysis of schooling quality, product demand shifts, and technical change, for instance. We do find little evidence supporting major roles for these factors, but further analysis based on better data would certainly be useful. Concerning the evidence we find for our hypothesis that the transition involves an increased value of education in dealing with disequilibria, data limitations again prevent us from measuring important factors such as creativity, innovation, and initiative. Our findings of higher returns to education in paid private sector work and in entrepreneurship cannot be considered decisive, but we find them highly suggestive of the value of education in a disequilibrium period full of opportunities.

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Figure 1: Understanding Changes in Relative Wage ($\partial W/\partial S$) and Quantity of Schooling (S)

Supply$_{1990}$

Supply$_{1995}$

Supply$_{2000}$

$\partial W/\partial S$

W$_{2000}$

W$_{1995}$

W*$_{1990}$

W$_{1990}$

Demand$_{2000}$

Demand$_{1995}$

Demand$_{1990}$

S$_{1990}$ S*$_{1990}$ S$_{1995}$ S$_{2000}$

S
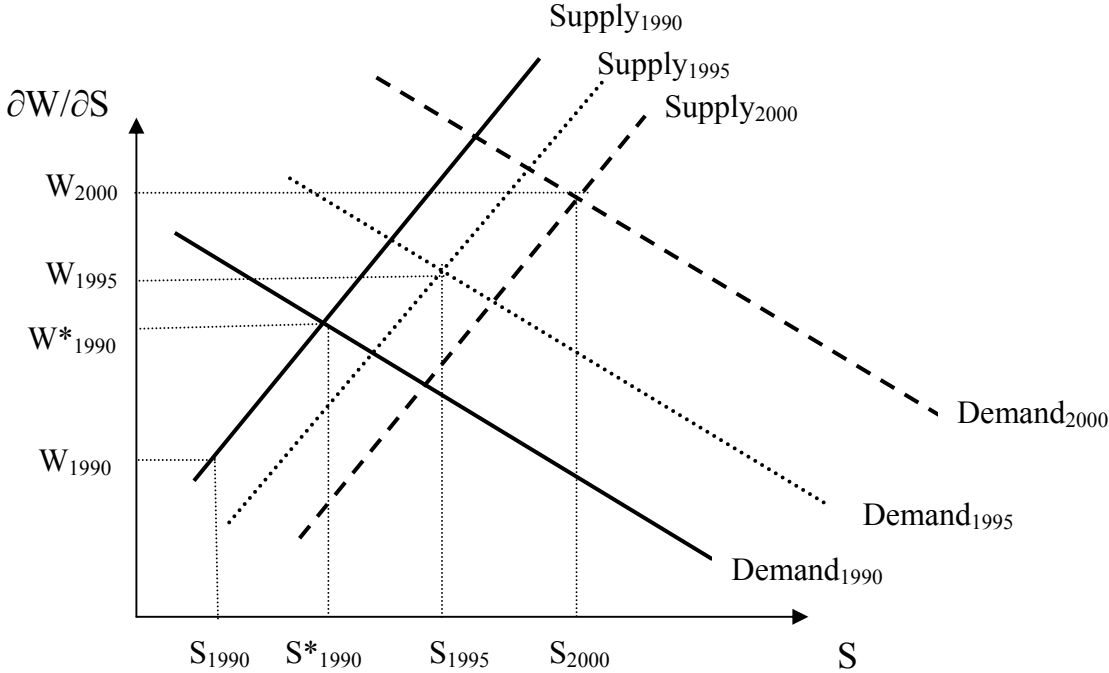
Figure 2: Observed Changes in Relative Wage (∂W/∂S) and Quantity of Schooling (S)
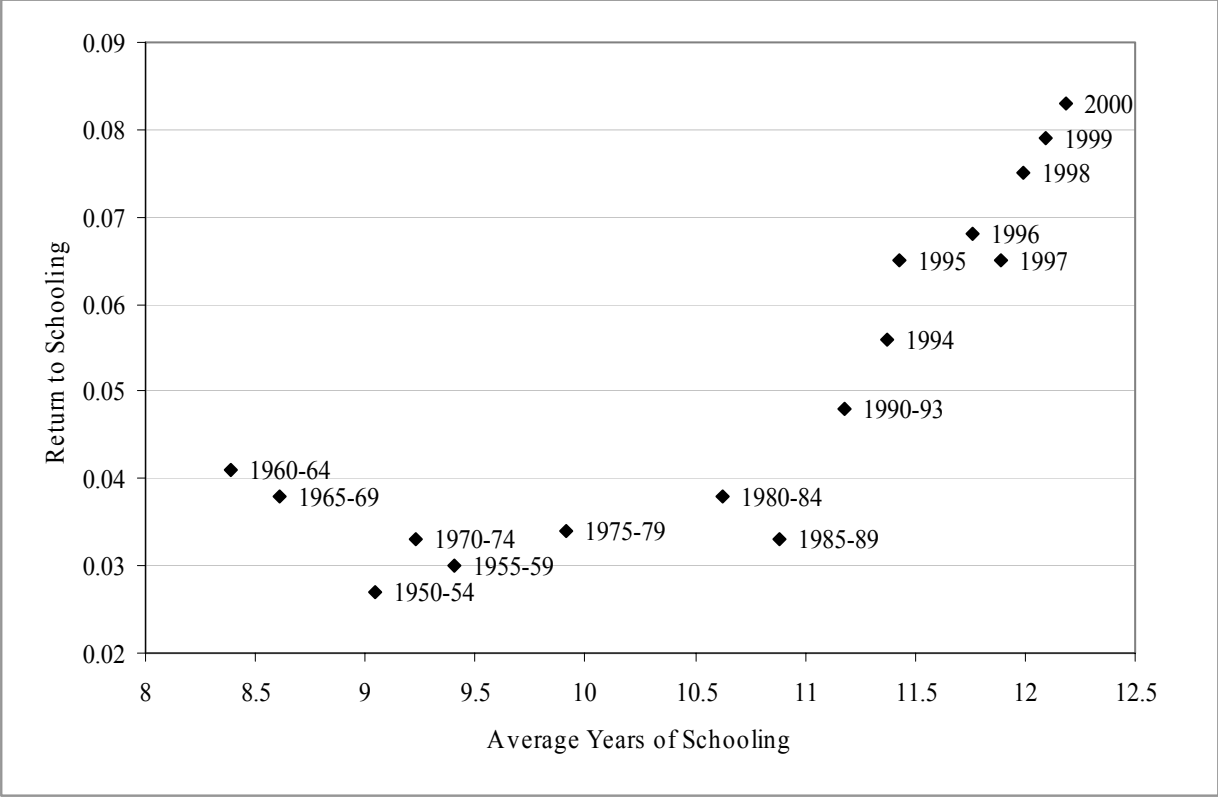
Figure 3: Evolution of the Experience Profile of Returns to Schooling
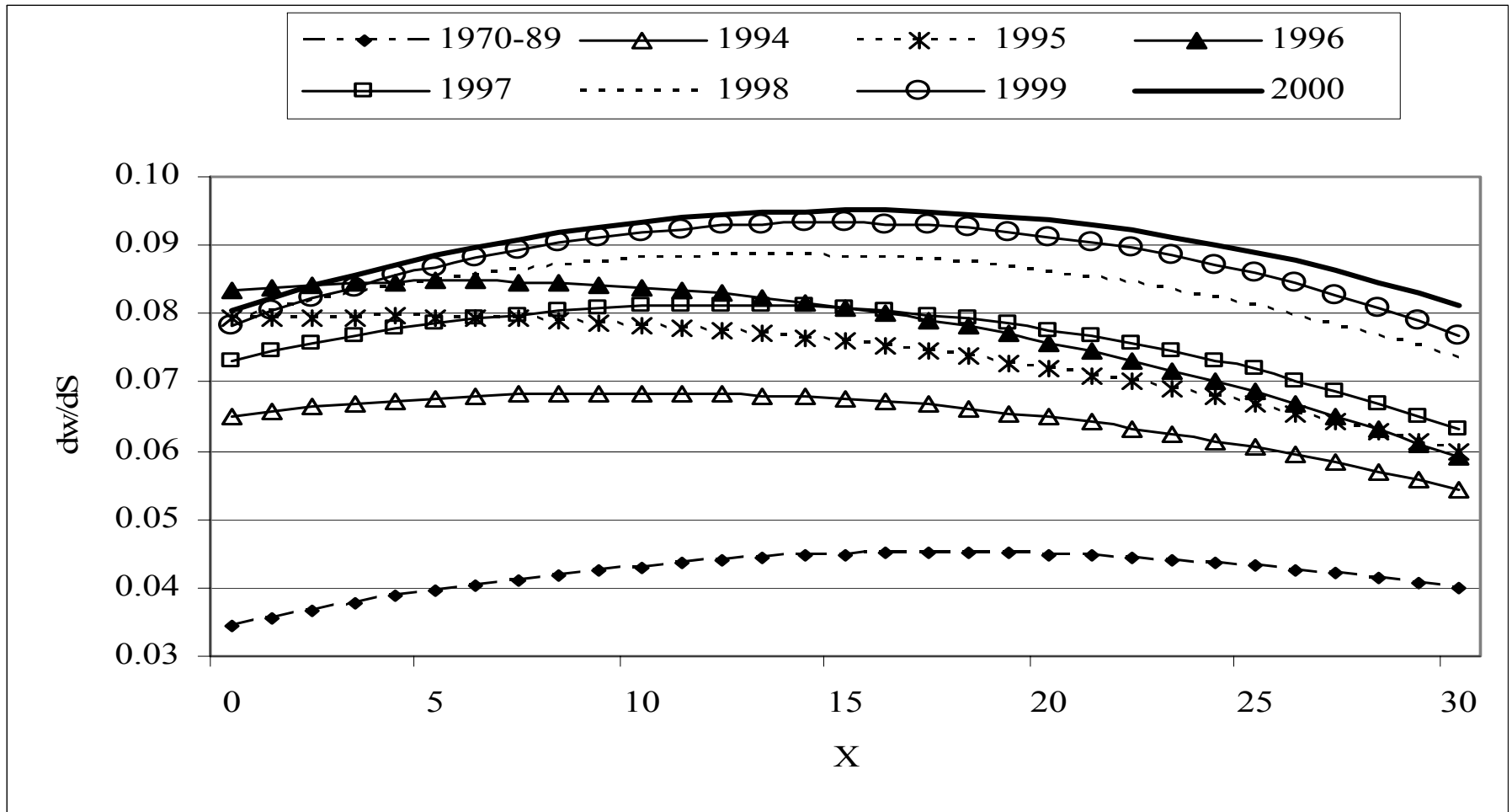
Table 1: Summary Statistics, by Time Period

	1950-54	1955-59	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-93	1994	1995	1996	1997	1998	1999	2000
W	0.63	0.61	0.76	0.97	1.25	1.71	1.90	2.11	16.00	133.59	192.78	287.35	513.36	857.80	1231.38	1938.38
	(0.96)	(0.34)	(0.47)	(0.77)	(0.67)	(5.00)	(3.04)	(1.55)	(27.27)	(72.82)	(98.71)	(163.38)	(310.14)	(484.83)	(658.47)	(1142.07)
Ln(W)	-0.76	-0.63	-0.46	-0.21	0.11	0.32	0.53	0.65	1.96	4.77	5.15	5.53	6.11	6.63	7.01	7.44
	(0.69)	(0.52)	(0.65)	(0.63)	(0.50)	(0.51)	(0.43)	(0.39)	(1.28)	(0.50)	(0.48)	(0.51)	(0.50)	(0.49)	(0.47)	(0.50)
S	9.04	9.40	8.39	8.61	9.23	9.91	10.62	10.88	11.18	11.37	11.43	11.76	11.89	11.99	12.09	12.19
	(3.70)	(3.88)	(3.62)	(3.52)	(3.29)	(3.29)	(3.21)	(2.79)	(2.49)	(2.87)	(2.78)	(2.60)	(2.56)	(2.52)	(2.50)	(2.41)
X	4.48	6.35	10.88	12.52	12.50	12.34	11.09	9.95	8.91	20.26	20.21	19.81	20.10	20.14	20.17	20.08
	(4.22)	(5.51)	(6.70)	(8.41)	(10.05)	(11.11)	(11.19)	(11.19)	(9.55)	(10.42)	(10.30)	(10.15)	(10.04)	(9.95)	(9.83)	(9.74)
F	0.27	0.38	0.33	0.35	0.42	0.46	0.43	0.46	0.43	0.41	0.41	0.43	0.43	0.44	0.45	0.45
N	459	609	854	805	1237	1339	1676	2606	1228	25565	23644	23919	15508	21518	18963	17486

Note: *W* is net monthly wage (thousand Romanian lei), *ln(W)* is the natural log of *W*, *S* is schooling (years), *X* is potential experience (years), *F* is female dummy, and N is the number of observations. Standard deviations are shown in parentheses (for continuous variables).

Table 2: Summary Statistics for New Education, Ownership, Sector, Region, and Ethnicity, 1994-2000

	Definition	1994	1995	1996	1997	1998	1999	2000
Region								
BUCHAREST		0.127	0.112	0.113	0.116	0.108	0.112	0.113
NORTH-EAST		0.134	0.137	0.133	0.132	0.135	0.130	0.132
SOUTH-EAST		0.123	0.123	0.121	0.122	0.126	0.126	0.114
SOUTH		0.153	0.151	0.155	0.148	0.149	0.146	0.145
SOUTH-WEST		0.105	0.106	0.103	0.104	0.106	0.107	0.114
WEST		0.093	0.096	0.096	0.094	0.098	0.093	0.096
NORTH-WEST		0.135	0.144	0.139	0.144	0.141	0.145	0.152
CENTER		0.130	0.132	0.142	0.140	0.137	0.140	0.133
Ethnicity								
ROMANIAN		0.922	0.919	0.915	0.916	0.916	0.917	0.912
HUNGARIAN		0.063	0.068	0.070	0.069	0.068	0.069	0.074
GERMAN		0.003	0.002	0.003	0.003	0.002	0.003	0.002
ROMA		0.005	0.004	0.006	0.006	0.008	0.006	0.006
OTHER		0.007	0.006	0.006	0.006	0.006	0.005	0.006
New education								
NEW	graduated after 1992	0.019	0.034	0.059	0.078	0.098	0.122	0.147
Ownership type								
STATE	state	0.864	0.806	0.753	0.705	0.622	0.481	0.404
PRIVATE	private	0.100	0.149	0.184	0.224	0.268	0.343	0.423
MIXED	mixed	0.018	0.029	0.048	0.057	0.094	0.119	0.105
COOP	cooperative	0.016	0.014	0.012	0.012	0.013	0.013	0.011
OTHER	other ownership	0.002	0.002	0.003	0.002	0.002	0.042	0.055
Sector of employer								
INDUSTRY	industry	0.446	0.432	0.441	0.436	0.419	0.408	0.410
AGRIC	agriculture	0.085	0.085	0.074	0.068	0.063	0.057	0.047
SERVICES	services	0.469	0.483	0.485	0.496	0.517	0.535	0.543

Note: Regions are defined on the basis of National Commission for Statistics (2000, p. 601).

Table 3: Basic Earnings Functions, by Time Period and Estimation Method

	1950-54	1955-59	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-93	1994	1995	1996	1997	1998	1999	2000
								OLS								
S	0.031	0.024	0.047	0.046	0.039	0.042	0.043	0.034	0.064	0.059	0.067	0.067	0.069	0.078	0.082	0.085
	(0.015)	(0.008)	(0.008)	(0.008)	(0.006)	(0.005)	(0.004)	(0.003)	(0.011)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
X	-0.003	0.016	0.006	0.014	0.020	0.009	0.013	0.015	0.036	0.022	0.024	0.027	0.032	0.027	0.026	0.031
	(0.022)	(0.010)	(0.010)	(0.010)	(0.004)	(0.004)	(0.003)	(0.002)	(0.008)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$X^2/100$	0.048	-0.102	-0.050	-0.066	-0.051	-0.019	-0.018	-0.030	-0.061	-0.030	-0.034	-0.042	-0.051	-0.039	-0.037	-0.049
	(0.104)	(0.048)	(0.043)	(0.039)	(0.014)	(0.011)	(0.008)	(0.006)	(0.026)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Female	-0.170	-0.115	-0.278	-0.183	-0.147	-0.147	-0.116	-0.126	-0.159	-0.215	-0.216	-0.231	-0.217	-0.197	-0.185	-0.216
	(0.076)	(0.047)	(0.049)	(0.050)	(0.027)	(0.027)	(0.019)	(0.015)	(0.050)	(0.006)	(0.005)	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)
R^2	0.043	0.054	0.144	0.120	0.085	0.091	0.108	0.096	0.537	0.247	0.254	0.296	0.267	0.308	0.295	0.312
								LAD								
S	0.027	0.030	0.041	0.038	0.033	0.034	0.038	0.033	0.048	0.056	0.065	0.068	0.065	0.075	0.079	0.083
	(0.011)	(0.009)	(0.006)	(0.006)	(0.005)	(0.004)	(0.003)	(0.003)	(0.007)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
X	0.009	0.021	0.001	0.012	0.018	0.010	0.009	0.010	0.026	0.023	0.024	0.026	0.032	0.025	0.025	0.034
	(0.019)	(0.013)	(0.008)	(0.006)	(0.005)	(0.003)	(0.002)	(0.002)	(0.005)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$X^2/100$	0.083	-0.100	-0.007	-0.026	-0.043	-0.022	-0.009	-0.015	-0.041	-0.034	-0.034	-0.039	-0.053	-0.037	-0.036	-0.054
	(0.102)	(0.052)	(0.028)	(0.020)	(0.015)	(0.009)	(0.006)	(0.005)	(0.015)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Female	-0.120	-0.091	-0.192	-0.058	-0.144	-0.131	-0.103	-0.091	-0.097	-0.194	-0.211	-0.224	-0.223	-0.193	-0.180	-0.206
	(0.066)	(0.053)	(0.034)	(0.032)	(0.027)	(0.021)	(0.015)	(0.015)	(0.035)	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)
Pseudo R^2	0.021	0.047	0.054	0.043	0.057	0.085	0.072	0.063	0.435	0.154	0.154	0.173	0.156	0.179	0.173	0.185
N	459	609	854	805	1237	1339	1676	2606	1228	25565	23644	23919	15508	12518	18963	17486

Note: Dependent variable is ln(net monthly wage). N is the number of observations. For the period 1950–1993, a quadratic monthly time trend is included, and for the period 1994–2000, monthly dummies are included, to control for wage inflation. Standard errors are shown in parentheses.

Table 4: Variation in the Return to Schooling, by Region

	1994	1995	1996	1997	1998	1999	2000
S	0.065	0.074	0.080	0.076	0.082	0.084	0.092
	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)
S*North-East	0.001	-0.003	-0.011	0.002	-0.003	-0.004	-0.010
	(0.004)	(0.004)	(0.004)	(0.006)	(0.004)	(0.005)	(0.005)
S*South-East	-0.013	-0.014	-0.014	-0.010	-0.009	-0.006	-0.009
	(0.003)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)
S*South	-0.013	-0.015	-0.014	-0.014	-0.004	-0.006	-0.004
	(0.003)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)
S*South-West	-0.008	-0.006	-0.023	-0.011	0.000	-0.003	0.004
	(0.004)	(0.005)	(0.004)	(0.006)	(0.005)	(0.005)	(0.006)
S*West	-0.011	-0.012	-0.020	-0.016	-0.005	-0.006	-0.015
	(0.004)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)
S*North-West	-0.003	-0.003	-0.015	-0.007	-0.004	0.007	-0.013
	(0.003)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)
S*Center	-0.007	-0.011	-0.017	-0.018	-0.013	-0.010	-0.020
	(0.003)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)
North-East	-0.112	-0.097	-0.001	-0.182	-0.105	-0.106	0.008
	(0.043)	(0.052)	(0.051)	(0.070)	(0.051)	(0.060)	(0.064)
South-East	0.165	0.130	0.131	0.084	0.041	-0.028	0.055
	(0.039)	(0.051)	(0.047)	(0.061)	(0.051)	(0.058)	(0.066)
South	0.098	0.085	0.079	0.090	-0.024	-0.058	-0.063
	(0.040)	(0.049)	(0.047)	(0.063)	(0.052)	(0.056)	(0.065)
South-West	0.061	0.017	0.211	0.064	-0.063	-0.076	-0.104
	(0.049)	(0.056)	(0.054)	(0.073)	(0.058)	(0.065)	(0.071)
West	0.135	0.147	0.203	0.123	-0.038	-0.031	0.122
	(0.052)	(0.056)	(0.062)	(0.072)	(0.061)	(0.062)	(0.073)
North-West	0.031	-0.027	0.111	0.034	-0.042	-0.210	0.062
	(0.042)	(0.050)	(0.049)	(0.062)	(0.051)	(0.057)	(0.063)
Center	-0.013	0.049	0.097	0.123	0.049	-0.029	0.131
	(0.041)	(0.051)	(0.048)	(0.062)	(0.050)	(0.056)	(0.066)
R^2	0.256	0.262	0.304	0.276	0.314	0.305	0.318

Note: Standard errors are shown in parentheses. Regions are defined on the basis of National Commission for Statistics (2000, p. 601). The equations also contain the other variables shown in Table 3 and monthly dummies to control for general wage inflation. Other variables are defined in Tables 1 and 2.

Table 5: Variation in the Return to Schooling, by Ethnicity

	1994	1995	1996	1997	1998	1999	2000
S	0.059	0.067	0.068	0.070	0.079	0.083	0.087
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
*S*Hungarian*	-0.002	-0.001	-0.008	-0.016	-0.009	-0.004	-0.020
	(0.004)	(0.004)	(0.004)	(0.006)	(0.004)	(0.005)	(0.005)
*S*German*	-0.007	-0.012	0.008	0.007	-0.043	0.002	0.002
	(0.012)	(0.012)	(0.013)	(0.020)	(0.022)	(0.017)	(0.026)
*S*Roma*	-0.024	-0.030	-0.022	-0.013	-0.037	-0.052	-0.039
	(0.013)	(0.010)	(0.010)	(0.011)	(0.013)	(0.011)	(0.018)
*S*Other*	-0.037	-0.018	-0.029	-0.015	-0.035	0.000	-0.024
	(0.014)	(0.012)	(0.011)	(0.017)	(0.012)	(0.014)	(0.013)
Hungarian	-0.027	-0.058	0.011	0.116	0.066	-0.009	0.172
	(0.045)	(0.044)	(0.048)	(0.070)	(0.050)	(0.063)	(0.063)
German	0.065	0.102	-0.107	-0.118	0.514	-0.083	0.162
	(0.141)	(0.154)	(0.164)	(0.255)	(0.265)	(0.200)	(0.305)
Roma	0.018	0.125	0.140	0.092	0.224	0.475	0.336
	(0.089)	(0.086)	(0.076)	(0.095)	(0.118)	(0.097)	(0.163)
Other	0.420	0.239	0.331	0.202	0.398	-0.056	0.266
	(0.135)	(0.126)	(0.131)	(0.216)	(0.156)	(0.162)	(0.153)
R^2	0.249	0.256	0.298	0.268	0.309	0.297	0.314

Note: Standard errors are shown in parentheses. The equations also contain the other variables shown in Table 3 and monthly dummies to control for general wage inflation. Variables are defined in Tables 1 and 2.

Table 6: Variation in the Return to Schooling, by New versus Old Education

	1994	1995	1996	1997	1998	1999	2000
S	0.059	0.067	0.068	0.069	0.078	0.082	0.086
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
*S*NEW*	0.021	0.022	0.010	0.003	0.007	0.004	0.000
	(0.009)	(0.007)	(0.006)	(0.006)	(0.004)	(0.004)	(0.004)
NEW	-0.352	-0.357	-0.215	-0.100	-0.172	-0.127	-0.083
	(0.114)	(0.085)	(0.073)	(0.074)	(0.054)	(0.049)	(0.051)
R^2	0.248	0.255	0.297	0.267	0.308	0.295	0.312

Note: Standard errors are shown in parentheses. The equations also contain the other variables shown in Table 3 and monthly dummies to control for general wage inflation. Variables are defined in Tables 1 and 2.

Table 7: **Variation in the Return to Schooling, by Sector**

	1994	1995	1996	1997	1998	1999	2000
S	0.055	0.062	0.066	0.067	0.076	0.080	0.084
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
*S*AGRIC*	0.005	-0.003	-0.009	0.000	0.002	0.003	-0.001
	(0.003)	(0.003)	(0.004)	(0.005)	(0.004)	(0.004)	(0.006)
*S*SERVICES*	0.011	0.012	0.010	0.010	0.008	0.005	0.008
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)
AGRIC	-0.229	-0.194	-0.159	-0.269	-0.273	-0.240	-0.212
	(0.037)	(0.036)	(0.043)	(0.056)	(0.049)	(0.054)	(0.069)
SERVICES	-0.208	-0.237	-0.275	-0.266	-0.229	-0.123	-0.190
	(0.024)	(0.025)	(0.027)	(0.035)	(0.029)	(0.031)	(0.036)
R^2	0.261	0.275	0.327	0.296	0.332	0.306	0.326

Note: Standard errors are shown in parentheses. The equations also contain the other variables shown in Table 3 and monthly dummies to control for general wage inflation. Variables are defined in Tables 1 and 2.

Table 8: Variation in the Return to Schooling, by Ownership of Employer

	1994	1995	1996	1997	1998	1999	2000
S	0.057	0.063	0.063	0.063	0.072	0.075	0.077
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
S*PRIVATE	0.018	0.017	0.022	0.022	0.015	0.017	0.014
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
S*MIXED	0.004	0.007	-0.003	0.005	0.005	0.003	-0.005
	(0.007)	(0.006)	(0.005)	(0.006)	(0.004)	(0.004)	(0.005)
S*COOP	0.028	0.011	0.016	0.048	0.004	0.001	-0.001
	(0.009)	(0.010)	(0.013)	(0.016)	(0.013)	(0.013)	(0.015)
S*OTHER	0.046	0.013	0.011	-0.008	-0.049	-0.001	0.010
	(0.018)	(0.012)	(0.018)	(0.023)	(0.019)	(0.005)	(0.005)
PRIVATE	-0.257	-0.251	-0.339	-0.338	-0.282	-0.271	-0.269
	(0.038)	(0.034)	(0.035)	(0.042)	(0.032)	(0.032)	(0.036)
MIXED	-0.036	-0.056	0.065	-0.026	-0.029	-0.023	0.088
	(0.075)	(0.063)	(0.057)	(0.076)	(0.049)	(0.048)	(0.059)
COOP	-0.638	-0.445	-0.520	-0.839	-0.320	-0.216	-0.283
	(0.099)	(0.116)	(0.147)	(0.190)	(0.146)	(0.149)	(0.179)
OTHER	-0.733	-0.361	-0.350	-0.226	0.295	-0.029	-0.169
	(0.223)	(0.153)	(0.215)	(0.264)	(0.245)	(0.071)	(0.069)
R^2	0.258	0.264	0.308	0.278	0.322	0.303	0.325

Note: Standard errors are shown in parentheses. The equations also contain the other variables shown in Table 3 and monthly dummies to control for general wage inflation. Variables are defined in Tables 1 and 2.

Table 9: Return to Schooling for the Nonagricultural Self-Employed

	1994	1995	1996	1997	1998	1999	2000
S	0.072	0.095	0.137	0.132	0.155	0.137	0.127
	(0.013)	(0.013)	(0.009)	(0.011)	(0.009)	(0.008)	(0.008)
R^2	0.158	0.181	0.223	0.237	0.265	0.234	0.239
N	801	789	1310	861	1441	1492	1548

Note: These are coefficients on *S* (with standard errors in parentheses) from estimation of equation (1) by year for the nonagricultural self-employed respondents in the IHS.