Social returns to education in a developing country

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Abstract

This paper estimates social returns to education in Turkey. Most evidence on spillovers from human capital comes mostly from developed countries, and estimates vary from country to country. The paper finds that social returns to education are around 3-4%, whereas private returns per year of education amount to 5% in Turkey. Moreover, the findings indicate that workers with lower skills, or working in sectors with lower average wages benefit most from externalities. The results are robust to a series of checks, using a number of individual and regional controls, as well as instrumental variable estimation.

Keywords: *human capital externalities, returns to education, wages*

*This paper was written when I was visiting the Department of Economics at the University of Sheffield. I greatly appreciate their hospitality.
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1 Introduction

There is ample evidence that higher levels of human capital are associated with higher levels of economic growth at the aggregate level. Following seminal papers by Barro (1991) and Mankiw et al. (1992), there has been a large number of studies confirming the importance of human capital at international and at regional levels. While these findings, that human capital significantly increases growth rate, answer one particular question, a second one, who will finance investment in human capital, relies on whether the growth is reflecting simply private returns to human capital or whether there are significant and positive externalities arising from accumulation of skills.

An extensive theoretical literature claims that there are indeed positive externalities arising from accumulation of human capital. Two types of externalities are assumed to exist, market and non-market. The former can be either technological in nature (Lucas, 1988), that a high level of average human capital increases the speed of diffusion of knowledge among workers, or pecuniary (Acemoglu, 1996), that firms choose their investment level by observing the average level of human capital when there is costly search and complementarity between physical and human capital. As non-market externalities, reductions in crime rates, increases in the level of health and quality of involvement in political process are the most cited ones. However, to what extent the predictions of these models are valid is an empirical question.

Recent studies to estimate the degree of social returns have mixed results. Rauch (1993) is the first study that provides a comprehensive estimation of human capital externalities. He finds that geographic concentration of human capital has a significant positive impact on productivity in the US and human capital externalities are in the order of 3-5%. However, this finding is challenged by Acemoglu and Angrist (2000) on the grounds that aggregate education could be endogenous to income and by Ciccone and Peri (2006) that the results could be simply driven by supply changes along a downward sloping demand curve which in turn depends on the substitutability between different levels of human capital. Both papers underline the problems associated with the identification of the social returns to human capital. Using data from the US, yet different identification schemes, Acemoglu and Angrist (2000) con-

clude that the return to human capital is much less than Rauch's estimates, around 1-2%; and Ciccone and Peri (2006) report insignificant human capital externalities by taking into account changes in the composition of skills. Contrary to these studies, using a large set of individual and regional controls and instruments, Moretti (2004b) finds that there are significant human capital externalities in the US and moreover, the social return to education is even higher than the private returns: a one percent increase in the college share yields more than one percent increase in wages.

The discussion about the significance and size of social returns to education in the US has led to a number of studies examining the existence and extent of human capital externalities in some European countries. As these countries subsidize education relatively more than the US (OECD, 2009), the size of the return to social capital has important policy implications. The evidence from the European countries yields consistently significant and positive social returns, however the estimated size is much lower than the estimates of Moretti (2004b). For example, Dalmazzo and de Blasio (2007) estimate the social return to an additional year of aggregate education to be less than half of the private return in Italy; Kirby and Riley (2008) report a social return around 2 to 3 fifths of private returns in the UK; and Heuermann (2011) finds that a percentage point increase in the share of highly skilled workers in a region in Germany increases the wages of highly skilled workers by 1.8%, but the same increase only adds 0.6% more to the wages of unskilled workers.

Finally, there are two papers on human capital externalities in transition countries. Liu (2007) examining China reports social returns as high as twice private returns and Muravyev (2008) finds that a percentage increase in the share of university graduates increases wages around by one percent in Russia, an effect similar to Moretti (2004b) in magnitude, although in some specifications his estimates are statistically insignificant.

Leaving the differences in estimation methodology aside (without ignoring their importance, of course), studies after Moretti (2004b) which use more or the less same set of variables and same methodology report a wide range of estimates. Heuermann (2011) claims that the difference between Germany and the US could be attributable to different labor market institutions, such as labor mobility, the degree of substitutability between skill groups and collective

wage agreements. To what extent these arguments can explain the differences between Italy and Germany or between the US and UK is unknown. Similarly, institutional arguments could be made also for transition economies as their labor markets are, at best, in transition. Then the question is to what extent the findings of these limited but important studies could be generalized to other countries, particularly to developing countries where both income and human capital levels are significantly low, regional disparities are high and spending on education is limited. This last point is also important from a policy perspective as macro studies show that accumulation of human capital is essential for growth, yet these countries face tight public budget constraints and innumerable needs. So, then, is there a justification to continue fully subsidizing education?

This paper contributes to the existing literature by estimating social returns in such a country, namely Turkey, using data from the Household Labor Force Surveys (HLFS) from 2004 to 2009. Turkey has lower per capita income and a lower level of schooling than the countries mentioned above (except that per capita income in China is much lower, yet the average level of education is much higher), around $8,000 per capita income and 7.4 years of average education among the working age population in 2010. Regional disparities in Turkey are the highest among OECD countries, the ratio of the highest per capita regional output to the lowest was 4.4 in 2004, and the ratio is even higher when one considers average regional earnings instead of output. There are also wide differences in average human capital, the share of college graduates in the working age population in NUTS II regions ranges from 4% to 18%. In the last couple of decades there has been many public and private initiatives to increase the level of schooling. The 1990 population census figures show that average education level was merely 5.3 years, implying one additional year increase in schooling for every decade since then. The question this paper is looking for an answer to is then whether the extent of social returns is comparable to those obtained in developed countries.

The methodology employed here is similar to Moretti (2004b), Dalmazzo and de Blasio (2007), and Liu(2007). First, a standard Mincerian equation augmented by regional average education is estimated. As mentioned before, the identification of external returns is problematic. First, individual and

regional controls are used to deal with omitted variables bias. Second, instrumental variables estimation is performed using previous levels of regional education and demographic composition. The estimates show that the private returns to a year of education is around 7% and social returns are in the order of 4-6%. Despite significant differences in the characteristics of the Turkish economy from the one observed in developed countries, the estimated returns are of similar magnitude. From a policy perspective, these results confirm the findings of aggregate studies and justify subsidizing education in developing countries.

The rest of the paper is structured as follows. The next section describes the data set used in the analysis and discusses the empirical model specification along with the identification of key parameter estimates. The third section provides estimation results and the fourth section concludes.

2 Data and methodology

2.1 Data

The data used in this paper is from the Household Labor Force Surveys (HLFS) conducted between the years 2004 and 2009 by the Turkish Institute of Statistics covering over 120,000 households representing population in 26 NUTS II regions and the entire country with appropriate weights. In 1997 the compulsory years of schooling has been increased to eight years from the previous requirement of five years. Thus, individuals who were younger than 20 in 2004 are affected by this change. To eliminate the effect of the new legislation the sample is restricted to individuals who are between the ages 20-64, employed permanently at full-time non-agricultural jobs as wage-earners and who declared positive earnings are used in the estimations below. Self-employed individuals and family workers are excluded, as well as workers in agricultural sector, part-time workers[1] and apprentices and trainees as their earnings are usually not comparable to those of full time workers.

Earnings are monthly wages net of tax and social security contributions and

[1]Despite reporting themselves as full-time employees, some individuals reported less than 40 hours a week. These individuals are considered as part-timers, as well.

Table 1: Descriptive Statistics

	2004	2005	2006	2007	2008	2009
Log Wage	1.118	1.188	1.200	1.243	1.275	1.371
	(0.586)	(0.586)	(0.586)	(0.579)	(0.571)	(0.582)
Female	0.181	0.191	0.200	0.211	0.214	0.216
Married	0.751	0.737	0.730	0.719	0.724	0.727
Educ in years	8.81	9.08	9.18	9.26	9.36	9.43
	(3.87)	(3.91)	(3.93)	(3.94)	(3.97)	(4.02)
Sh. of Illit.	0.89	0.68	0.68	0.64	0.59	0.67
Sh. of Lit.	1.05	1.27	1.28	1.27	1.37	1.54
Sh. of Jun. Prim.	38.07	35.01	33.92	33.09	32.01	31.21
Sh. of Primary	13.01	13.17	13.31	13.63	13.59	13.74
Sh. of Highsch.	29.81	30.55	30.41	30.16	30.07	29.27
Sh. of College	17.18	19.33	20.39	21.21	22.36	23.57
Experience	19.16	18.88	18.84	18.93	18.97	19.21
	(10.00)	(10.06)	(10.08)	(10.24)	(10.32)	(10.39)
Tenure	7.23	7.12	6.79	6.66	6.63	6.74
	(7.04)	(7.08)	(6.98)	(7.02)	(7.04)	(7.08)
Informal	0.220	0.194	0.184	0.169	0.143	0.151
Manuf.	0.306	0.313	0.306	0.305	0.308	0.290
Regional Variables						
Unemp.	0.110	0.107	0.103	0.104	0.112	0.146
	(0.034)	(0.033)	(0.028)	(0.027)	(0.025)	(0.035)
Avg. Educ	6.85	6.97	7.04	7.24	7.35	7.36
	(0.84)	(0.82)	(0.83)	(0.89)	(0.96)	(0.96)
Univ Share	0.076	0.083	0.088	0.098	0.107	0.111
Density	5.40	5.42	5.43	5.47	5.47	5.46
	(1.45)	(1.46)	(1.47)	(1.53)	(1.53)	(1.53)
No. of Obs.	57,226	59,741	61,819	62,935	64,814	65,050

Statistics are weighted to population proportions. Standard errors of continuous variables are in parentheses.

include overtime work and bonuses. They are converted to hourly wages using reported usual weekly hours (monthly earnings/(4.33*weekly work hours)). They are adjusted to real values using the national consumer price index, though no adjustment is made with respect to regional purchasing power parities as the theoretical model on which the estimation is based refers to nominal wages, that are not corrected for regional purchasing power. To eliminate some extreme values, log real hourly wages are trimmed at one percent from both lower and upper tails[2].

The remaining sample has a little less than 350 thousand observations, with on average around 60 thousand individuals per year. The data has information on gender, marital status, schooling, age and tenure on the current job, as well some information on the job characteristic, such as one digit sector and firm size. The schooling variable is reported as the highest degree completed, which is converted to years of schooling using the appropriate number of years required to obtain the degree. Unlike most developed countries, there is a significant amount of informal workers in Turkey, that is workers that are not registered for any kind of social security. These workers constitute around 20% of all workers using appropriate weights in the data and around 4% of them are university graduates. They are also included in the data set but are identified with a dummy variable indicator whether they are working as formal or informal employees. The variables at the regional level are calculated using the entire HLFSs with the proper weighting provided by the Institute, therefore representing all individuals in the region.

Table 1 reports summary statistics on these variables. There are a few noteworthy observations that somehow differentiates Turkey from the earlier studies. First and foremost, the share of females in total employment is around 20%. The female labor force participation is also very low in Turkey, which is mostly related to the traditional family structure but also to some economic factors such as that educational attainment being much lower within female population, the alternative to home production being relatively expensive, and females being usually employed as unpaid and unreported family workers. Second important property of the Turkish work force is that they are substantially

[2]Trimming does not change empirical results qualitatively in any way. These estimation results are available upon request.

less educated than in developed (or transition) countries. In the last couple of decades there is some improvement, as can be seen by increasing years of education in the data. The rate of increase in the education level is partially due to the fact that Turkey has a relatively young population, and that every year the new entrants have significantly higher education than the exiting ones.

2.2 Econometric model

The econometric model is based on the theoretical framework discussed in Moretti (2004a, 2004b) which yields a Mincerian wage equation augmented with aggregate human capital in the region. The model is an extension of Roback (1982) which discusses firms' and workers' location choice in a general equilibrium setting with externalities. Firms and workers are free to move across regions. Firms produce a tradable good using land and two types of human capital, high and low skill. Each worker's productivity is assumed to be a function of his own human capital and aggregate human capital to the extent spillovers affect individual's productivity. While the model is general enough to capture a wide variety of externalities, the aim in this paper is not to identify them separately despite their importance in policy making, because with the available data such a task is simply not possible. The worker's indirect utility function involves housing prices, wages and amenities of which aggregate human capital is an element. The model predicts that low skilled workers benefit from externalities, if they ever exist, positively, through their increased productivity due to imperfect substitutability between skill types and through spillovers. However, the impact of aggregate human capital on the wages of the high skilled workers depends on the magnitude of two counteracting forces: an increase in the supply of skilled workers reduces their wages as the demand curve is downward sloping, on the other hand, increasing the level of human capital increases their efficiency and thus wages.

Estimation is based upon the following equation of (log) real wages, $ln(w)$, of worker i residing in region r at time t:

$$ln(w_{irt}) = \alpha_t + X_{it}\beta + \eta H_{jrt} + R_{rt}\gamma + u_{irt} \tag{1}$$

where α_t controls for time effects, X_{it} is a vector of individual specific observable variables, including years of schooling, experience, tenure and their squared terms, H_{rt} is average years of schooling in region r at time t, R_{rt} is a set of constant or time varying regional characteristics.

As mentioned earlier, identification of the main parameter of interest, η is complicated by the possibility that there could be some unobservable variables that are important in wage determination at both the individual level and the regional level. The residual therefore can be thought of a composite of three factors:

$$u_{ijt} = \mu_r \epsilon_i + \nu_{rt} + \varepsilon_{irt} \tag{2}$$

where ϵ_i is an individual level permanent unobservable component involving ability or family background, and μ_r is the region specific coefficient enabling ability to be valued differently in each region. The second term, ν_{rt}, captures time-varying demand and supply shocks in region r, and finally ε_{irt} is the error term assumed to be independently and identically distributed over all individuals in every region at each point in time.

In most labor market studies, fixed effects are used to control for individual ability. However, the HLFS does not have a panel structure. Therefore, a set of individual characteristics are used to control for unobserved ability. Along with variables identifying gender, marital status, experience and job tenure of the individual that are used in any standard Mincerian equation estimation, dummy variables of the industry and the size of the firm the individual works are also employed. To control for individual ability, another variable that measures the average education level of her immediate family, an average of spouse's, children's (if they have completed their studies and are still living in the same household), and parent's education if they are co-residing with the individual, is constructed[3]. Using parents' education is common in labor studies. However there are very few individuals who live together with their parents. If parents' skill level is a proxy for children, the reverse must also be true. Finally, assortative mating (Hyslop, 2001) indicates that high-skilled men tend to marry high-skilled women, while less-skilled men are more likely

[3]Each degree is converted into years of schooling by using the appropriate years required to earn the degree.

to marry less-skilled women. Indeed, 45-50% of individuals in our data set are married to someone with the same completed degree. Unobserved individual heterogeneity is then controlled by using this family background variable interacted with region specific dummies.

There could be several region specific characteristics that may affect wages the omission of which may cause average human capital to be biased. These could be fixed characteristics, such as amenities, or time varying factors that affect demand and supply. Following the literature, the model is extended to include a full set of regional dummies, to control for time-invariant amenities; regional unemployment rates, to eliminate the possibility that regional education may capture the unemployment effect in case more educated people are less likely to be unemployed; and regional population density, to account for agglomeration economies. Similar to Moretti (2004b), to control for demand shifts, a set of indices based on Katz and Murphy (1992) are also generated. If regions do not have same specialization pattern, then sectoral shocks may have different effects on each region. In the case of sectors employing different compositions of skills, then the demand shocks may also not be constant over different skill groups in every region. Moretti (2004b) proposes an index that is related to national employment growth in sectors weighted by the regional employment shares of each sector and education group, namely $DS_{kr} = \sum_s^S w_{sr} \Delta E_{ks}$, where DS_{kr} is the demand shock for workers employed in sector s in region r, ΔE_{ks} is the change in national employment of kth education group in sector s, and w_{sr} is the employment share of sector in region r.

Finally, the regional average education level is instrumented by using demographic variables and schooling in 1990. Despite all the controls there could be still some reverse causality in the data. To test for the robustness of the results a set of instrumental variable models are estimated. Demographic variables are a commonly used instruments in labor studies and earlier studies that examined social returns to education (Ciccone and Peri, 2006; Dalmazzo and de Blasio, 2007). Considering that children under the age of 10 in 1990 will have partially completed their education in 2004 and younger people have more education than the older, regions with a higher share of children are expected to have higher regional human capital in 2004. In the same way, since older

people are less educated than the young ones, regions with a higher share of old people in 1990 are expected to observe a higher increase in their regional education level as most of these people are already retired in 2004. The share of children under the age of 10 and the share of individuals above 50 in 1990, and the square terms to allow for possible non-linearity along with average years of schooling in the region in 1990 are used to instrument regional human capital.

3 Estimation results

3.1 OLS estimates

Table 2 presents the result of the first set of regressions using ordinary least squares. The first specification is the basic one and includes only the standard Mincerian equation co-variates and the average years of schooling in each region. The results indicate that while an additional year of schooling increases private returns by 8%, a one-year increase in the average regional education level provides an additional 6.5% increase in wages. Experience and tenure have positive coefficients and their square terms negative coefficients as usual, implying that returns to experience and tenure are increasing at a decreasing rate. Surprisingly, in this specification the coefficient of female dummy is insignificant.

In the second specification, a full set of regional dummies is included in the model. While there is no change in private returns, social returns decline to 4.4%. It is immediately apparent that if heterogeneity at the regional level is controlled for, the social returns will capture all other effects. In the third column some additional individual characteristics are added to the model. These are a set of dummies indicating the sector of the individual's job, the size of the firm and whether the individual is employed in the formal sector. The inclusion of individual characteristics do not affect social returns but significantly reduces private returns to education. While not reported in the table, the wages increase as the firm gets larger, and the industry dummies are jointly significant. Individuals who have a formal job earn 17% more. Considering that the wages are measured in net terms, net of taxes and

social security payments, this is a large difference. A plausible explanation for this finding is that more able workers are preferred by the formal sector employers. Thus, the omission of a control for the sector of employment may produce biased results. Notice that, once individual attributes are controlled for, females earnings are significantly lower than male earnings.

The fourth and fifth columns incorporate additional terms to control for unobserved heterogeneity. First only family background interacted with region dummies are introduced. The family background variables are individually and jointly significant at conventional levels, and the average return is a little above two percent. Controlling for unobserved individual ability this way, private returns decrease to 5.2% and social returns are 3.3% while the latter is now marginally significant. The last column in the table reports results of the regression that includes regional population density, unemployment and two demand shift variables one for highschool and above, the other for lower than highschool graduates as defined above. None of these regional variables turn out to be significant even though they have expected sign, that is, the density variable has a positive coefficients and unemployment has a negative coefficient. Most probably these variables change very little in the period examined here.

To explore the robustness of the results in Table 2 a few additional regressions are run. The first one allows private returns to vary across regions. The estimated coefficients for both private[4] and social returns are very close to the coefficient estimates in the final specification of the table, and thus are not reported here.

To assess who benefits more from human capital externalities, a specification where gender, being employed in the manufacturing sector, and being an employee in the formal sector are interacted with private and social returns in addition to all variables in the fifth column of Table 2 is also formulated. The results presented in Table 3 has some interesting implications.

In this specification, females on average earn less than around 25% than males. However, there is an additional 1.3% return to every year of schooling for females. Females in Turkey have much fewer years of education than males,

[4]The average of region-specific estimates is around 5.5%.

Table 2: OLS Results

	(1)	(2)	(3)	(4)	(5)
Years of Sch.	0.081***	0.082***	0.063***	0.052***	0.052***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Reg. Ed.	0.065***	0.044**	0.050***	0.033*	0.037**
	(0.023)	(0.018)	(0.017)	(0.017)	(0.017)
Exp.	0.020***	0.019***	0.016***	0.016***	0.017***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Expsq.	-0.029***	-0.029***	-0.024***	-0.026***	-0.027***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Tenure	0.039***	0.040***	0.027***	0.028***	0.027***
	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)
Tenuresq	-0.066***	-0.064***	-0.039***	-0.039***	-0.037***
	(0.011)	(0.012)	(0.005)	(0.006)	(0.006)
Female	-0.020	-0.023**	-0.056***	-0.088***	-0.090***
	(0.012)	(0.010)	(0.009)	(0.008)	(0.008)
Married	0.094***	0.107***	0.073***	0.061***	0.060***
	(0.017)	(0.013)	(0.007)	(0.008)	(0.009)
Formal			0.169***	0.162***	0.155***
			(0.031)	(0.031)	(0.031)
Pop. Dens.					0.024
					(0.0598)
Unemp.					-0.297
					(0.185)
DS_1					0.250
					(0.162)
DS_2					0.032
					(0.043)
Region×Fam. Backgr.	No	No	No	Yes	Yes
Regional Dummies	No	Yes	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes	Yes	Yes
Industry Dummies	No	No	Yes	Yes	Yes
Observations	347564	347564	337949	286107	286107
R^2	0.433	0.452	0.558	0.557	0.558

Region-level cluster corrected standard errors are in parentheses.
Regressions are weighted to population proportions.
***, **, * denote significance at 1%, 5%, and 10% levels.

Table 3: Different returns to individual characteristics

	Constant	Priv. Ret.	Soc. Ret.
Male/Non-manuf./Inf.	-1.406***	0.024***	0.102***
	(0.442)	(0.001)	(0.021)
Interaction with			
Female	-0.248***	0.013***	0.004
	(0.078)	(0.001)	(0.010)
Manufacturing	-0.225***	-0.018***	0.042***
	(0.066)	(0.002)	(0.009)
Formal	0.563***	0.041***	-0.100***
	(0.150)	(0.001)	(0.022)

Regression includes region and time dummies,
as well as Region×Fam. Backgr. and other regional variables.
Region-level cluster corrected standard errors are in parentheses.
Regressions are weighted to population proportions.
***, **, * denote significance at 1%, 5%, and 10% levels.

6.8 years versus 8 years in 2010. Most probably only women who have higher ability than average continue with their education and apparently markets reward their ability. On the other hand, being an employee in the manufacturing sector provides on average 22% less wages and there is a 1.8% additional penalty for each year of schooling in this sector. This may be related to the fact that textiles is the predominant industry in Turkey and it requires certainly less skills. Finally formal education has now a much higher average return and an additional premium of 4% per year of schooling. While the share of informal workers is not highest in manufacturing sector (18%, as opposed to more than 25% in construction, trade and transportation sectors), the highest number of informal workers are in the manufacturing industry. Once controlling for returns to vary between manufacturing industry and the rest, being in the formal sector becomes more important determinant of wages.

The table also reports social returns by these characteristics. The base social return is now much higher around 10%, more than four times the private return. While there is no difference between males and females in benefiting from human capital externalities, there are no significant social returns to workers in the formal sector. This finding could be attributable to the fact

that informal workers have on average less years of schooling. Possible non-linearities in returns to education are discussed later in Table 4. The table also shows that manufacturing workers enjoy an additional four percent of social returns, compounding to more than 14%. The theoretical model discussed above assumes that firms produce a tradable product and thus the model's prediction is that there would be higher returns in the manufacturing industry is supported by the data.

In the presence of non-linearities to returns the model could be misspecified and there would be bias in the estimates of externalities. Given that average years of schooling are around eight years and the share of university graduates is around 10% in Turkey (over nine years and 20% among employed population), there would be more grounds to expect some non-linear returns. Table 4 replaces years of schooling with the highest degree earned by individual, and each category is also interacted with aggregate human capital. Indeed, every additional degree has increasing private returns, a three-year highschool degree provides 25%, around 8% per year, additional wages, when a four-year university degree provides 40% higher wages, a 10% premium for each additional year.

The table also allows for non-linear social returns. An important prediction of the model is that while externalities would be unambiguously positive for workers with lower skill levels, the returns to high skill types are determined by the competing forces of positive externalities and declining wages due to the increased supply of more educated individuals (to the extent that the two types are imperfect substitutes). The second column of Table 4 shows additional social returns to each education group and the third column reports F-statistics (p-values in parentheses) indicating whether net social return to particular group is significantly different from zero. Social return to illiterate workers is around 6%, and declines with each additional degree. The net return to employees with a highschool degree and above are statistically insignificant at conventional levels. The results are similar to earlier research, with the exception of Heuermann (2011), however, net social returns are statistically zero for individuals who have higher than average education. Plausibly, there are very few jobs that require high degrees in Turkey, as expected in most developing countries since they specialize in industries with lower skill requirements,

Table 4: Non-linear private and social returns

	Priv. Ret.	Soc. Ret.	F-test (p-value)
Illiterate	-0.842***	0.061***	
	(0.402)	(0.001)	
Interaction with			
Literate	0.160***	-0.014**	7.45
	(0.045)	(0.006)	(0.012)
5-year Prim.	0.177***	-0.013***	7.85
	(0.035)	(0.004)	(0.010)
8-year Prim.	0.316***	-0.022***	4.99
	(0.045)	(0.005)	(0.035)
Highschool	0.561***	-0.035***	2.24
	(0.049)	(0.006)	(0.147)
University	0.952***	-0.038***	1.69
	(0.056)	(0.007)	(0.205)

Regression includes region, time and industry dummies,
as well as Region×Fam. Backgr. and other regional variables.
Region-level cluster corrected standard errors are in parentheses.
Regressions are weighted to population proportions.
***, **, * denote significance at 1%, 5%, and 10% levels.

and the demand for higher education is pretty steep.

3.2 IV estimates

The results above show that there are significant human capital externalities in Turkey. However, despite all the controls in the regressions there might be still reverse causation and even some measurement problems. To tackle these problems, regional average years of education are instrumented by demographic variables and past levels of schooling in the region. Table 5 reports the first stage regressions where average years of regional schooling are expressed as a function of the share of children under the age of 10, the share of the population over the age of 50, and the average years of schooling in previous years. Since younger generations are most likely to have higher levels of education, over time average education will increase in general. Regions with higher shares of both groups in the past are expected to have higher human capital levels at the present time.

Table 5: IV – First Stage Regressions

	Using 1990 Census		Using 2000 Census	
Sh. of kids	-12.784***	22.778***	-38.476***	12.704***
	(0.168)	(0.143)	(0.194)	(0.140)
Sq. Sh. of kids	-14.726***	-10.998***	26.113***	-9.653***
	(0.331)	(0.271)	(0.413)	(0.276)
Sh. of old	-4.174***	44.400***	1.975***	24.637***
	(0.309)	(0.273)	(0.247)	(0.142)
Sq. Sh. of old	-29.948***	-78.416***	-52.660***	-45.747***
	(0.975)	(0.718)	(0.751)	(0.406)
Lag. Years of Educ.		1.631***		1.286***
		(0.004)		(0.002)
R^2	0.824	0.916	0.843	0.940

Regression includes time dummies.
Robust standard errors are in parentheses.
Regressions are weighted to population proportions.
***, **, * denote significance at 1%, 5%, and 10% levels.

The data for the instruments are obtained from Population Censuses conducted in 1990 and 2000. Two different censuses are used for robustness pur-

poses, on the grounds that age structure may reflect expectations about the changes in the regional economy. In all specifications the instruments are significant even though when lagged average years of schooling are not included the coefficients on the share of the young and old population have unexpected signs. But after controlling for lagged average education, the current level of regional years of schooling is an increasing function of both the share of the young and old population as expected.

Table 6: IV – Second Stage Regressions

	Using 1990 Census		Using 2000 Census	
	IV (1)	IV (2)	IV (1)	IV (2)
Private return	0.052***	0.052***	0.052***	0.052***
	(0.001)	(0.001)	(0.001)	(0.001)
Social return	0.043***	0.045***	0.077***	0.048***
	(0.004)	(0.004)	(0.003)	(0.004)

Using the same set of variables as specification (5) in Table 2.
Region-level cluster corrected standard errors are in parentheses.
Regressions are weighted to population proportions.
***, **, * denote significance at 1%, 5%, and 10% levels.

The second-stage estimates are presented in Table 6 using the instruments as in the same order of previous table. The estimated social returns are slightly higher than the OLS estimates for three specifications. Only in one IV estimation, when only the age structure in 2000 is used to instrument regional education, human capital externalities exceed private returns. The instrumental variable estimation confirms the findings of previous subsection.

3.3 The share of university graduates

Finally, the same set of regressions are run using the share of university graduates in regions rather than using average years of schooling. In a country with low levels of education, using the share of university graduates may not be appropriate. Besides, Acemoglu and Angrist (2000) point out that most human capital accumulation in currently developed countries in early stages of their development is accounted for by increases in secondary schooling. Nonetheless, to be able to compare results with some of the previous research, the results

in Table 2 are replicated using the share of university graduates in each region and presented in Table 7 together with the earlier results for convenience.

Table 7: Regional human capital measured as the share of university graduates

	Using Avg. Years of Schooling		Using Sh. of Univ. Grads.	
	Priv ret.	Soc. ret.	Priv ret.	Soc. ret.
Spec. (1)	0.081***	0.065***	0.081***	1.748**
	(0.002)	(0.023)	(0.001)	(0.742)
Spec. (2)	0.082***	0.044***	0.082***	1.008***
	(0.002)	(0.018)	(0.001)	(0.196)
Spec. (3)	0.063***	0.050***	0.063***	1.080***
	(0.002)	(0.017)	(0.001)	(0.161)
Spec. (4)	0.052***	0.033*	0.052***	0.817***
	(0.001)	(0.017)	(0.001)	(0.169)
Spec. (5)	0.052***	0.037**	0.052***	0.765***
	(0.001)	(0.017)	(0.001)	(0.206)

Using the same set of variables as in Table 2.
Region-level cluster corrected standard errors are in parentheses.
Regressions are weighted to population proportions.
***, **, * denote significance at 1%, 5%, and 10% levels.

The main finding that significant human capital externalities exist is unaffected by the use of a different measure. However, the magnitude of the estimates are much smaller than the estimates reported in earlier research. A one percent increase in the share of university graduates in a region increases wages by around 80% which is lower than those reported in other studies. Corresponding estimates for the coefficient of share of university graduates ranges from 1.2 in China (Liu, 2007) to 1.8 in Germany (Heuermann, 2011). Although a one year increase in university education seems to have a much higher impact on wages than a year of average schooling, it would be more costly to increase the share of university graduates than increasing average years of schooling at any level.

4 Conclusion

This paper estimates social returns in Turkey. Human capital has been shown to have an important effect on the economic growth of countries. However,

whether it contributes through increasing the efficiency of individuals who acquire higher levels of education or through externalities that also increase the wages of those who have lower human capital is a subject that has been investigated only very recently. The paper finds a strong correlation between the aggregate level of education and wages regardless how local human capital is measured, or the methodology used to estimate the magnitude of spillovers.

The private returns to education in Turkey are found to be around 5%, lower than typical estimates in most developed countries (Card, 1999; Middendorf, 2008). Considering the rather scarce human capital in Turkey, one would expect higher returns. Yet similar estimates are reported for China and Russia, though these countries have higher levels of education. This could be due to either the quality of education in Turkey being lower, or that human capital unless accompanied with the appropriate physical capital and technology is not as productive as it should be.

Social returns to education in Turkey, on the other hand, have a similar size as in developed economies, around 3-4%, when measured as average years of education, but much smaller when measured as the share of university graduates in the region. At an early stage of development, degrees lower than university degrees may play more important role. Given that the estimates from developed countries also vary, new research on why and how externalities are internalized by employees, and what is the role of institutional factors and existing levels of technology in the country is required.

The positive association between aggregate education and wages, and particularly the fact that it contributes to the wages of less skilled workers, or workers that are employed in sectors with lower average wages, implies that subsidizing education in developing countries will not only increase the growth rate but will also improve income distribution. Nonetheless, the size of total returns to education is less than 10%, and as claimed by Acemoglu and Angrist (2000), the evidence is not supporting the importance attached by macro studies to human capital to explain wide income differences across countries and regions.

References

Acemoglu, D., (1996). A micro-foundation for social increasing returns in human capital accumulation. *Quarterly Journal of Economics*, 111, 779-804.

Acemoglu, D., Angrist, J. (2000). How large are human capital externalities? Evidence from compulsory schooling laws. *NBER Macroeconomic Annual*, 15, 9-59.

Barro, R., (1991), Economic growth in a cross-section of countries. *Quarterly Journal of Economics*, 106(2), 407-443.

Card, D., (1999). The causal effects of education on earnings. In O. Ashenfelter and D. Card (eds.) *Handbook of Labor Economics*, Amsterdam, Elsevier-North Holland.

Ciccone, A., Peri, G. (2006). Identifying human capital externalities: theory with applications. *Review of Economic Studies*, 73, 381-412.

Dalmazzo, A., de Blasio, G. (2007). Social return to education in Italian local labor markets. *Annals of Regional Science*, 41, 51-69.

Heuermann, D. (2011). Human capital xxternalities in Western Germany. *Spatial Economic Analysis*, 6, 139-165.

Hyslop, D.R., (2001). Rising U.S. earnings inequality and family labor supply: The covariance structure of intrafamily earnings. *American Economic Review*, 91, 755-777.

Katz, L.F., Murphy, K.M., (1992). Changes in relative wages, 19631987: supply and demand factors. *The Quarterly Journal of Economics*, 107, 3578.

Kirby, S., Riley, R. (2008). The external returns to education: UK evidence using repeated cross-sections. *Labour Economics*, 15, 619630.

Liu, Z., (2007). The external returns to education: Evidence from Chinese cities. *Journal of Urban Economics*, 61, 542-564.

Lucas, R. (1988), On the mechaniscs of economic development. *Journal of Monetary Economics*, 22, 3-42.

Mankiw, N.G., Romer, D., and Weil, D. (1992), A contribution to the empirics of economic growth. *Quartery Journal of Economics*, 107(2), 407-437.

Middendorf, T., (2008). Returns to education in Europe. *Ruhr Economic Papers*, No. 65.

Moretti, E., (2004a). Human capital externalities in cities. In J. Henderson and J.-F. Thisse (eds.) *Handbook of Regional and Urban Economics Vol. 4: Cities and Geography*, Amsterdam, Elsevier-North Holland.

Moretti, E., (2004b). Estimating the social return to higher education: evidence from longitudinal and repeated cross-sectional data. *Journal of Econometrics*,121, 175-212.

Muravyev, A., (2008). Human capital externalities: Evidence from the transition economy of Russia. *Economics of Transition*, 16, 415-443.

OECD, (2009). *Education at a Glance 2009: OECD Indicators*.

Roback, J. (1982). Wages, rents and the quality of life. *Journal of Political Economy*, 90, 12571278