Human capital externalities and return to education in Turkey

Haluk LEVENT* Sezgin POLAT† Ozan BAKIŞ‡

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Abstract

This paper studies local human capital externalities and return to education in Turkey. The data comes from 2006 Household Labor Survey. Ordinary Least Squares estimates yield 2.5 % of human capital externalities while Instrumental Variables estimates are slightly lower: 2.1 %.

Keywords: human capital externalities, returns to schooling
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1 Introduction

Human capital and R&D are the main determinants of growth according to the new endogenous growth theories. In Romer (1986, 1990), Lucas (1988) and Aghion and Howitt (1992) the mechanism by which human capital is the source of growth differs slightly from one work to other. Knowledge spillovers, or external effects of human capital or knowledge underly –at least if one does not take into account semantic concerns– the same thing: the amount of human capital and knowledge is vital for a society to have sustainable growth.

In real life, one of the biggest part of human capital, R&D or knowledge is schooling. Further, numerous empirical works suggest that formal schooling

*Galatasaray University
†Galatasaray University
‡Corresponding author, Galatasaray University 36 Çırağan cad. 34357 Ortaköy-Istanbul Turkey. E-mail: ozanbakis@gmail.com

is an important determinant of productivity levels[1]. Differences in human capital are seen the main reason of the income disparities as pointed by Mankiw *et al.* (1992) and Krueger and Lindahl (2001).

Return to education can be decomposed into two parts: individual returns that can be classified as Mincerian approach and social returns due to externalities that form the main part of the endogenous growth theory. Even if there is not convincing empirical evidence about the letter part, almost all economists accept that it should be the case in an intuitive way. After all, if this was not true, what would be the contribution of the endogenous growth theory?

The major problem about measuring social returns to education (equivalently human capital externalities), in empirical studies, is endogeneity problem. The reason for this endogeneity may be omitted variables[2], measurement errors or the use of bad proxies. Whatever the reason is likely to be for endogeneity problem, the common solution is using instrumental variables.

We use a subsample of 2006 Household Labor Survey for our analysis. Since women participation to labor market is deeply infuenced by historical and cultural factors, we use only data of men aged 30-49. The reason for age restriction is that we want wage profiles be as flat as possible. Before age 30 other factors such as experience, tenure may exerce exerce nonlinear effects on wage.

Ordinary Least Squares (OLS) estimates show positive and important local human capital externalities due to average level of schooling in the region. In order to estimate social returns to schooling correctly we need to estimate private returns as well. According to OLS estimates an extra year of schooling is associated with 7.7 % increase in private returns; similarly a one-year increase in average level of schooling raises average wages by 2.5 %. In order to take into account the endogeneity bias, we used also Instrumental Variables (IV) method. IV estimates yield similar results: a one-year increase in schooling raises personal wages by 11.5 % and a one-year increase in average schooling is associated with 2.1 % increase in average

[1]For instance, Romer (1989), Mankiw *et al.* (1992), Benhabib and Spiegel (1994), Barro (1999), Krueger and Lindahl (2001) and Aghion *et al.* (2004) find that schooling is positively correlated with GDP per worker.

[2]The endogeneity problem due to omitted variables can be seen as follows: a well-educated labor force tend to create better city environment which makes these cities more productive. Thus, wages in these cities with higher average education may be high because of two reasons. The first one is the one which we search: human capital externalities, and the second one is a better city characteristics that make workers more productive. This is the indirect effect of human capital that creates endogeneity. If we do not include a control variable for city characteristics our estimates will be biased.

wages.

Early literature about human capital externalities is concentrated on cross-country regressions[3]. Even this approach may yield biased estimates because of the identification problem inherent in cross-country comparisons[4], the need for work on a single country is obvious when designing public education policy. For a country like Turkey where there are huge differences in socio-economic development between different regions, it is primordial to know where to invest the extra Turkish Lira (TL) and what is to be expected from this investment.

The suggested solution by Rauch is to look at different regions within one country. It is likely to be the case that the technological level and capital cost is the same within borders of a single country.

This acknowledgment initiated a large body of ongoing works. Naturally, the studied externalities are local human capital externalities due to geographical concentration in cities and/or states. This is already in parallel with the pioneer paper of Lucas (1988) who stated explicitly the role of cities as center of spillover effects when he discusses the importance of interaction between different agents.

Rauch (1993) uses average level of formal education and work experience data from Standard Metropolitan Statistical Areas in the USA as *proxies* of the average level of human capital. He finds that there are local external effects of average schooling in SMSAs, while average level of experience is not significant. He shows that R&D per capita is not significant while city amenities are significant and have a positive effect on wages. Similarly, city climate is found to be insignificant while city coastal location is significant and has a positive coefficient. In all these regressions, the coefficient on the average education does not change substantially. Two critics that have been made to Rauch (1993) are the followings: firstly, he does not discuss the endogeneity of human capital. And secondly, he does not distinguish between externality effect and complementarity effect between skilled and unskilled workers.

Moretti (2004a) is a survey paper about human capital externalities that presents a unifying framework. He discusses, in detail, alternative ways of measuring social returns to education in the particular model used by Rauch (1993). There are two important remarks in his analysis: the first

[3]See Romer (1989), Benhabib and Spiegel (1994) Barro (1999), Krueger and Lindahl (2001) and Aghion *et al.* (2004) among others.

[4]Rauch (1993) claim that high wages are associated with a high level of economic development whic is, in return, associated with higher levels of capital stock. So, it is very difficult to identify the effects of human capital externalities in cross-country data.

one is that wages should be nominal in the regression analysis. And the second one is that we should separate externality effect from the mechanical complementarity effect on wages.

Acemoglu and Angrist (2000) find similar results to the ones obtained by Rauch (1993) when they use OLS estimates. But, endogeneity problem of human capital leads the authors to make the same regression using instrumental variables and then they find no significant of human capital externalities. They use state compulsory attendance laws and child labor laws (in individuals' state of birth when they were 14) as instruments of average human capital of the states, because these laws are correlated with future human capital averages and are exogenous to future adult wages. Their results are based on a sample of white men aged 40-49 from the 1960-80 Censuses. An interesting point of the paper is the use of quarter of birth as an instrument for individual schooling. But, one has to be careful when selecting individual schooling instruments: it is necessary that individual schooling instrument generates the same average return as would be generated using state schooling instruments as instruments for individual schooling. This is only then, we can have consistent estimates of social returns (See Appendix A in their paper).

Moretti (2004b) uses instrumental variables in order to solve endogeneity problem. Used instruments are age structure of cities and presence of land-grant colleges in cities. The basic idea is that younger cohorts are better educated than older ones and presence of land-grant colleges –established more than 100 years ago– is an instrument for human capital. He founds that a one percentage point increase in college share, after controlling for private return, raises average wages by .6%-1.2%.

Tansel (2004) is about private return to education in Turkey. Firstly, she reports her results based on the 1987 Household Expenditure survey (HES). The private return of education is calculated for each education level[5] and for men and women separately. Her method is joint maximum likelihood estimation of equation and the wage equation. For men she finds a rate of return between 1.90 and 16.20 for wage earners (all ages included). Secondly, she reports the results based on 1989 Household Labor Force (HLF) where two-step estimation method of Heckman is used. Results for wage earners are very close to the 1987 HES ones, i.e. the private return is between 1.72 and 16.90 depending on the level of schooling. For self-employed people, the range is between 6.14 and 14.70.

Guner and Duygan (2005) use 2002 Household Income and Consumption

[5]Identified levels are primary, middle, high, vocational high schools and university.

Expenditures Surveys (HICES) to estimate the private return to education. They find that one extra year of education increases earnings by 12.57% – on average – in a standard Mincerian approach. Their dependant variable is logarithm of the annual wage earnings[6] and independent variables are: years of schooling, years of experience, years of experience squared. They use a sample of all males between the ages of 20-54 in the 2002 HICES for their regressions.

The papers by Tansel (2004) and Guner and Duygan (2005) are important in their contribution of private returns to education. However, social returns to education are not studied. Following this relatively new and important line of research about local human capital externalities, our paper aims to be the first paper studying social returns to education in Turkey.

2 Model

The underlying model is adapted from Rauch (1993) and Moretti (2004a). The model that will be developed will permit us to test for externality of human capital in cities. In order to have positive externalities, we need that in some developed regions wages are higher than some – less developed – others. Why is this in that way? Why wages are not equal in all country? The answer is based on the assumption that thanks to migration to high wage areas, we will have higher residential and commercial rents in these areas. As a result, the utility level is almost equal in all regions. A worker is indifferent between high wages/high rents and low wages/low rents.

Consider a fixed number of regions in a country. A region i has a fixed amount of land t_i and an amenity a_i, with $i = 1, \ldots, N$ denoting for regions. a_i is a common public good for (amenity) which households do not pay for. There are many firms and households who can migrate at zero cost between regions. There are many households with different levels of human capital. A household j has a level of human capital (or equally, efficient labor) h_j which she supplies inelastically at wage per efficiency unit, w_i, in region i.

There is a single consumption good y – nationally traded– produced by capital, labor and land under perfect competition. Consumption good's price is normalized to unity, $p = 1$. Returns to scale are constant in private inputs: labor, land and capital. Representative firm in region i has the

[6] The use of total wage is not a good measure of *marketed* education return. One should use hourly wages as dependent variable to capture the market value of education –this is what we do in this paper. The use of total wage, however, is a good measure if one wants to measure the overall effect of education.

following production function:

$$y_i = A(h_i)F(k_i, h_i, t_i)$$

$A(h_i)$ is the externality effect that depends on the aggregate level of human capital at the region i. Individual firm does not have control on it. The important point is that the rental price of capital r is common to all regions while the prices of land and labor are region specific. The reason is that land and labor are traded locally, while capital not. Land's rental price is denoted z_i in region i.

Preferences are all identical and homothetic across households. Households gets utility from land, amenity and consumption good. Representative household living in region i has the following utility function:

$$U_i = u(a_i, y_i, t_i)$$

It is standard to derive cost function for firms and indirect utility function for households. Under constant returns to scale and perfect competition, unit cost is given by (we neglect r as it is common to all regions),

$$p = 1 = C_i(w_i, z_i, A)$$

and indirect utility per efficiency unit of labor

$$V_i = V_0 = v(w_i, z_i, a_i)$$

The spatial equilibrium is obtained when households and firms are indifferent between regions. Common nationwide utility of one efficiency unit of labor is denoted V_0. Then, equilibrium is there where all firms have unit marginal costs and all households have V_0 for one efficiency unit.

3 Regression analysis

In order to isolate the market price of education we use only hourly wages as our dependent variable in all regressions. This evidently does not capture the overall effect of education but only the market return.

regress lwwage edu age age2 senior senior2 ortegt_reg_n2 ind_tot if gend==0, robust beta

Table 1: Dep = lwwage

Variable	**Coefficient**	**(Std. Err.)**
edu	0.077**	(0.001)
age	0.081**	(0.002)
age2	-0.001**	(0.000)
senior	0.035**	(0.001)
senior2	-0.001**	(0.000)
ortegt_reg_n2	0.025**	(0.004)
ind_tot	-0.088**	(0.005)
Intercept	-1.674**	(0.040)

Significance levels : † : 10% * : 5% ** : 1%

ivreg lwwage age age2 senior senior2 ind_tot (edu ortegt_reg_n2 = hno ind_h) if gend==0, first

Table 2: Dep = lwwage

Variable	Coefficient	(Std. Err.)
edu	0.115**	(0.002)
ortegt_reg_n2	0.021**	(0.008)
age	0.079**	(0.001)
age2	-0.001**	(0.000)
senior	0.030**	(0.001)
senior2	-0.001**	(0.000)
ind_tot	-0.072**	(0.006)
Intercept	-1.943**	(0.070)

Significance levels : † : 10% * : 5% ** : 1%

ivendog

Tests of endogeneity of: edu ortegt_reg_n2 H0: Regressors are exogenous Wu-Hausman F test: 158.72268 F(2,57958) P-value = 0.00000 Durbin-Wu-Hausman chi-sq test: 315.77060 Chi-sq(2) P-value = 0.00000

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