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Higher Education Externalities in Egyptian Labor Markets

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Abstract

Augmenting a Mincerian earnings function with governorate level data, this paper estimated the external return to higher education for individuals in Egypt in 2010. The results suggested that these externalities are negative and exist only for female workers, while for males these externalities were again negative but statistically insignificant. A unit increase in governorate average higher education is associated with a 68% decrease in females' hourly wage. This could be explained by the fact that education degrees are simply used as a device to signal higher ability without raising productivity. Another reason could be excess supply of higher education graduates in the Egyptian labor market. These results have been tested through a number of robustness checks. Results survived to the introduction of individual and governorate level variables; it is not due to imperfect substitutability across workers; it still holds when treating local human capital as endogenous variable and instrumented it.

JEL Classifications numbers: I20, J31, J24, D26
Keywords: Human capital, Returns to education, Spillovers from education, Education externalities, Higher education, Wages

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1 Introduction

With the emergence of the concept of "knowledge-based economy" and the endogenous growth models in the mid-1980s, the critical role of education and human capital accumulation in achieving sustainable economic growth, higher living standards and equality in income distribution gained greater emphasize[2]. These endogenous growth theories highlighted the notion of education as a capital good. They attached a high premium to human skills as a factor of production in the development process. Because education plays the most important role in the creation and improvement of human capital, its significance and importance to economic growth and development were well recognized[3]. Accordingly, education as a form of investment became a well-established and generally accepted idea. Like all investments, investment in education, can be judged in terms of their returns.

These endogenous growth theories introduced education externalities as an engine for economic growth. They argued that returns to education might not be restricted to the private returns, which is the benefits to the individual himself, but may spill over to others in the same firm, industry, region or economy in what is known as the external returns to education (Sianesi and Reenen, 2003).

Individuals benefit from education in the form of increased labor productivity and hence higher wages or earnings. Beside these economic benefits other noneconomic benefits of education can be identified, these include the impact of education on personal health, capacity to enjoy leisure and so on (Haveman and Wolfe, 1984).

In addition to this individual benefits, education yields benefits for the society in what is known as externalities or human capital spillovers. Lucas (1988) suggested that human capital spillovers may help explain differences in long run economic performance of countries. A high level of average human capital may favor the diffusion of knowledge among workers through interaction; hence, a worker's schooling enhances his or her own productivity as well as those of co-workers. More recent models built on this idea by assuming that individuals

[2] It is worth noting that the concept of human capital was well developed since the 1960's, through the human capital theory (Schultz 1961 and Becker 1964). According to this theory, education enhances a person's skill level and hence his or her human capital. A higher skill level increases the production capacity. Although this sounds very straightforward, systematic research on how to incorporate human capital in theories of growth started only about two decades ago with the endogenous growth theories. In the 1990s, the standard neoclassical growth model was revised by introducing human capital (Mankiw, Romer, and Weil 1992; Islam 1995 and Canton 2007).

[3] During the past decades, experiences of developing countries have indicated that scarcity of talents and skills needed for development can hinder economic growth (Okuwa 2004).

enhance their human capital through pair wise meetings with more skilled neighbors at which they exchange ideas (Glaeser, 1997; Jovanovic and Rob, 1989). Others focused on the importance of research in promoting technological innovation and productivity, the public good nature of the research and the resulting positive externalities in the form of knowledge spillovers (Arrow, 1962 and Griliches, 1979). Finally, human capital spillovers may arise because the general level of education in the workforce make it profitable to invest in new technologies by facilitating the discovery, adaptation and use of more economically rewarding, though technologically more demanding and knowledge-intensive, production processes (Acemoglu 1996, 1997).

Besides these economic benefits, there are other noneconomic community-level benefits from education. These include improving social equity, strengthening national cohesiveness, lowering crime rates and so on (Dalmazzo and Blasio 2007 and Canton 2007).

Not underestimating the importance of the noneconomic benefits of education, this paper follows Locus 1988 approach and focuses on economic human capital externalities that occur in production and affect wages.

The existence of these externalities is considered a main argument for government subsidization of education (Ciccone and Peri 2006; Gemmell 1997; Heckman and Klenow 1998 and Heckman 2000). These externalities create a wedge between social and private returns to education. Consequently, individuals cannot reap all benefits from their educational investments, which may lead to underinvestment from a social viewpoint. Government subsidization of education will reduce the gap between private and social returns, so that the individual incentives to invest in education are no longer distorted (Canton 2007).

In this context, most developing countries including Egypt have committed themselves to providing free access at all levels of education to all of their citizens. This commitment continues today, as evidenced by the fact that the Egyptian government is the main provider and funder of education, including higher education. In 2010/2011, public expenditure on education amounted to 41.683 billion Egyptian pounds, of which 21.8 percent was allocated to higher education.

However, these commitments entail serious challenges to Egypt. These challenges are twofold: (i) evidence suggests that returns to investment in education mainly private returns are relatively low (World Bank 2008, Salehi-Isfahani et al 2009). And (ii) Given the rising demand for higher education driven by the high share of the young within the general population (32% of population in 2011), technological innovations and more competitive labor market environment, the government budget is more and more under pressure to meet this growing demand.

In view of these challenges together with the argument supporting governments' subsidization of education, measuring education externalities should

be a concern especially in countries like Egypt. This implies estimating the magnitude of these externalities carefully.

While the private rates of return to schooling has been examined in detail for different countries and for Egypt in specific (Herrera and Badr 2011; El-Arabi 2010; Salehi-Isfahani et al 2009; World Bank 2008; Pissarides 2000; Gillespie, 1997; Fergany 1998; Shafik 1996). There are few empirical studies tackling external returns due to spillovers, and none from Egypt, as far as the author is aware of. This study helps to fill in this gap by measuring externalities of higher education in Egypt, using data from the Labor Force Sample Survey LFSS conducted by CAPMAS for the year 2010.

In this context, the paper tests the hypothesis that the returns to higher education are entirely reflected in the earnings of college educated workers (private returns to education) against the alternative theory that other individuals in the same labor market benefit from spillovers associated with higher overall levels of education (external return to education). I focus on local labor markets and identify external returns to higher education by comparing the wages of otherwise similar individuals living in governorates with different shares of college-educated workers in the labor force.

The paper is organized as follows. Section 1 is an introduction followed by Section 2 presenting a critical review of empirical work tackling externalities to education. The econometric procedure adopted is presented in Section 3. Section 4 discusses data and variable construction issues, followed by Section 5 that presents and analyzes the empirical results. Finally, Section 6 includes concluding remarks.

2 Literature review

There are mainly two different approaches to measure the size of external returns to education. The first is a macro approach related to the empirical growth literature. According to this approach, income differences across countries and over time are explained by differences in factor inputs used in production and differences in the productivity of these inputs (Canton 2007). This approach to human capital spillovers relied on macroeconomic data and cross-country regressions (Romer 1989; Benhabib and Spiegel 1994 and Barro 1999). It is particularly interested in whether it is stock or accumulation of human capital that produce externalities. However, the studies within this approach have been criticized due to a variety of reasons including data and identification problems as well as heterogeneity bias, (Krueger and Lindahl 2001 and Sianesi and Van Reenen 2003).

The second approach to estimate education externalities is a micro approach. It is based on the idea that due to the presence of human capital externalities, average human capital stock in a region or an industry will have an effect on the productivity of workers in that region or industry (Rauch 1993; Acemoglu and

Angrist 2000; Moretti 2004b and Ciccone and Peri 2006). This approach to estimate external returns to education follows Lucas' (1988) idea that due to the presence of human capital externalities (in addition to the individual benefits), human capital has characteristics of a local public good. Hence, average human capital stock in a region or an industry will have an effect on the productivity of workers in that region or industry. Accordingly, social returns are divided into:

1- Private returns defined as increased individual productivity and measured by empirical studies as the effect of an individual's own education on his or her own wage.
2- External returns defined as spillover in productivity to others in the same firm, industry, region or economy and measured by empirical studies as the effect of average educational attainment in the region or sector where the individual works or lives on his or her wage.

Lucas (1988) proposed that the best field for empirical research on human capital externalities should be local labor markets (LLMs), as any human capital externalities would reflect the interaction of workers within firms in the same industry or region and hence these externalities will be washed out by aggregating. Studies that tried to test Locus proposition empirically, used Mincerian regressions augmented by a proxy for average educational attainment in the region or sector where the individual works or lives. This gives a quantitative estimate of such human capital externalities, as will be explained latter in methodology section.

Studies within this approach analyze human capital externalities either within sub-national regions (Rauch 1993; Acemoglu and Angrist 2000 and Moretti 2004a, b) or within industry sectors (Sakellariou 2001; Sakellariou and Maysami 2004; Winter-Ebmer 1994 and Kirby and Riley 2008).

Rauch (1993) used US data for Standard Metropolitan Statistical Areas (SMSA), and generalized least squares. He found that there are local external effects to average schooling, while average experience level does not matter. Rauch used a random effects model to reflect unobserved city characteristics to get out of the endogeneity of human capital. One major shortcoming of this approach is the assumption of zero correlation between the random effect and other explanatory variables.

Acemoglu and Angrist's (2000) utilized US data for a sample of white men aged 40-49 from the 1960-80 Censuses, and instrumental variables OLS technique. Their results are similar to those reported by Rauch (1993). However, when they addressed the endogeneity problem using instrumental variables, they found no significant human capital externalities. They used state compulsory attendance laws and child labor laws as instruments of average human capital of US states, because such laws are correlated with future human capital levels and are exogenous to future adult wages.

Moretti (2004b) also used instrumental variables technique to address the possible endogeneity of metropolitan college shares in the USA and reached

relatively different results. The instruments used are regional age structure and the presence vs. absence of land-grant colleges in American SMSAs. In the first case, the secular increase in college education leads to better educated younger cohorts throughout the USA. This gives rise to a valid instrument, which is uncorrelated with other regional characteristics. In the latter case the presence of land-grant colleges –established more than 100 years ago, thus independent from current conditions– instruments for local human capital. He finds that a one-percentage point increase in college share, after controlling for private returns, raises average wages by 0.6% to 1.3%.

Going a step further, Wirz (2008) estimated education externalities on the firm level. This study investigated for such externalities within narrowly defined occupational groups of a given firm, going thus a step further than earlier studies focusing at employer level or within regions. Using panel data from a Swiss employer-based labor force survey of 1996, they find evidence for education externalities on individual wages (2%).

Another group of studies used a two-stage OLS technique to estimate the externalities of education on the industry level. Sakellariou (2001) analyzed micro data from the Guatemala household Survey using a testable model of endogenous growth in order to detect any external effects of education. In the first stage of the analysis, a wage equation is estimated and the internal effects of education are filtered out. In the second stage, the resulting industry wage premiums are regressed on average human capital as well as industry-specific characteristics to account for external effects. While the results could not reach stronger conclusions, the hypothesis that external effects may be present could not be rejected.

Monastiriotis (2002) used a large panel of regional UK data to estimate the private and external effects of education on wages. The results offer strong evidence in support of the predictions of the endogenous growth theory (Lucas, 1988), where the spatial or sectoral concentration of human capital is expected to generate increasing returns in the production process.

Sakellariou and Maysamiz (2004) used micro data from Venezuela and a two-stage micro econometric approach to estimate the external effects of human capital on wages and therefore productivity. Strong evidence is found of external effects to education and in particular, years of schooling and job-related training.

3 Methodology

This study follows the micro approach adopted in the literature by focusing on local labor markets at the Egyptian governorate level. External returns to higher education are obtained by comparing the wages of similar individuals living in governorates with different shares of college graduates in their employment. This is done by estimating the effect of average human capital at the governorate level on individual log earnings (hourly wage rate) using a Mincerian

wage-equation (Mincer 1974) augmented with a local human capital term. Accordingly, wages are determined as in Eq. (1):

$$\ln wij = \beta Xi + \eta \mathrm{HCj} + \delta Zj + \varepsilon ij \quad (1)$$

where, w_{ij} is log of hourly wages for individual *i* residing in governorate *j*; X_i *is* a vector of individual observable characteristics (years of schooling, potential experience, marital status, firm type and gender); HC_j denotes regional human capital in governorate j measured as the share of college graduates in each governorate employment. Z_j is a vector of regional observable indicators (regional unemployment rate, some measures of education quality at the governorate level (student teacher ratio, classroom density, school dropouts) and some measures of amenities (ratio of designed sewage capacity to population and ratio of number of health units with beds to population)); finally, εij *is* an error term. The goal of the paper is to estimate η, denoting the impact of local human capital on individual wages.

A primary concern in measuring returns to education empirically is the endogeneity problem; that is the presence of unobservable factors that are correlated with regional and individual human capital and wages across regions leading to upward biased OLS estimation. First, the unobserved individual characteristics mainly ability or motivation that is correlated both with wages and individual human capital. Following the idea that more able individual choose to obtain higher education more frequently than less able individuals, this correlation is expected to be positive and OLS estimated private returns to education are excepted to be overestimated .

Second, the unobserved regional characteristics correlated with local human capital that makes workers more productive. Regions differ widely in geographical location, industrial structure, weather and amenities. Areas where the productivity of skilled workers is particularly high—because of unobserved differences in industrial mix, technology or natural resources—pay higher wages and therefore attract more skilled workers. In order to get unbiased estimates of human capital spillovers, we need to control for such regional characteristics.

In principle to control for such unobserved effects, the Instrumental Variables (IV) method is adopted. We need to instrument for individual and for regional human capital levels. These instruments must be correlated with individual and regional human capital but uncorrelated with other unobserved factors that affect wages. In the case of individual knowledge, there exists substantial evidence that the “upward ability bias” is of about the same order of magnitude as the downward bias caused by measurement error in educational attainment (Krueger and Lindahl 2001). This leaves instrumenting for regional human capital. Such an instrument must account for the observed variation in local human capital, but not to be correlated with the residual of the earning equation. We propose three Instrumental variables that are likely to satisfy this property. These instruments are:

1- Percent of general secondary students to total secondary students in each governorate in 2002. This variable is assumed not to be correlated to the unobserved regional variables as individuals take the decision of entering general secondary tracks based on their will to enter university even before they reallocate to work in different governorate due to these unobserved factors. In addition, we base our argument for this variable on the fact that the government tries to limit the number of individual entering university by determining the number joining general secondary without any pressure from the local people. Finally, this variable is lagged by 8 years[4] to minimize any correlation with unobserved factors in 2010.
2- Rate of change in ratio of university and above university graduates who entered the labor market in the 80s, 90s and 2000s by governorate. This variable is a flow of university graduates over time not a stock hence it eliminates time invariant unobservables. It is also a flow for previous periods so it is not affected by the unobserved factors in 2010.
3- Lagged regional demographic structure: Percent of population under 5 years old in each governorate in 1996 and percent of population between 5 and 10 years old in each governorate in 1996. Because of the compulsory schooling system, 1996's local demographic structure is strongly related to 2010's local education but, at the same time, it is unlikely to be correlated with local wages. Governorates with a larger share of population, who where younger than 5 in 1996 experienced, in 2010, an increase in the share of population who completed the preparatory school (starting from age 12), a less pronounced increase in the share of population who completed high school (additional three years of schooling, starting from age 15 and fulfilled by the age of 18) and a less share of population who graduated from universities. Hence, a higher share of population under the age of five in 1996 will tend to reduce the 2010's local human capital level. On the other hand, governorates exhibiting a large share of population between the age of five and the age of ten in 1996 experienced, later in 2010, an increase in the share of residents who: (1) completed high school, and (2) graduated from universities. Thus, these governorates experienced an increase in their local human capital.

Another problem is that the observations within the cluster of a governorate are not independent and they can have some common characteristics, which cannot be controlled for. To solve this problem clustering robust linear regression is used in order to acquire independence of observations across governorates. In sum, least squares regression technique or two-stage least square regression is used jointly with the clustering robust linear regression.

[4] Eight years lag was chosen based on data availability. Data on number of general and technical secondary by governorate is available only since 2002.

4 Data sources and variables construction

Data comes mainly from the 2010 Labor Force Sample Survey LFSS conducted by CAPMAS quarterly. The LFSS collects detailed information on Egyptian households. For each member of the family, it gathers data on demographic features and economic behavior including wage, age, sex, marital status, schooling, work experience, and employer's branch of activity. It covers three main issues household socio-economic and demographic characteristics, job characteristics and unemployed individuals' characteristics. Other sources of data are CAPMAS statistical yearbook, 1996 Census and the ministry of education website.

Following the previous literature, we restrict our sample to wage workers and exclude self-employed individuals and those who work for family without wage (Dalmazzo and Blaso 2007; Kirby and Riley 2008 and Zhu 2011). This restricted our sample to 64275 individual. I use governorate as the local labor market. Our 64275 worker's observations are distributed over 27 governorates. The details of the variables used in the paper are reported in the Table (A-1) in the appendix.

Table 1: Descriptive Statistics

	obs.	Mean	std. Dev.	Min	Max
Individual level variables					
Hourly wages	49588	4.62	5.47	0.06	369.23
age	64275	35.93	11.77	7.00	91.00
Numbers of hours worked per week	64275	47.24	10.49	1.00	99.00
Years of education	64275	9.95	5.50	0.00	18.00
Years of experience	64275	19.99	13.15	0.00	85.00
Marital status	64275	0.72	0.45	0.00	1.00
Enterprise	64275	0.42	0.49	0.00	1.00
Male	64275	0.84	0.37	0.00	1.00
Female	64275	0.16	0.37	0.00	1.00
Governorate level variables					
Unemployment rate	64275	9.26	3.37	1.05	25.90
Student teacher ratio	64275	19.57	4.13	4.92	28.13
Class room density	64275	41.67	3.98	19.81	51.49
Dropout ratio	64275	5.11	2.17	0.79	12.62
Amenities 1	64275	0.00	0.00	0.00	0.01
Amenities 2	64275	0.42	0.61	0.00	3.94
Local human capital	64275	0.22	0.07	0.11	0.37

Some descriptive sample statistics are reported in Table 1. A look at the first column of this table indicates the characteristics of this sample of the employed workforce in Egypt in 2010. Employees have on average 10 years of education and 20 years of experience, and are around 36 years old. Around 42 percent of employees work in public enterprises, 84 percent of the sample are males and 72 percent are married.

Turning to the governorate level, Figures 1, 2 and 3 reveals discrepancies between governorates in various aspects. Cairo has the highest local human capital reaching 37% while it is the lowest in Beni-Suef(11.3%); Port Said has the highest unemployment rate and Aswan has the highest share of employees working in public enterprises. Moreover, Figure 1 displays hourly wages, years of schooling and governorate human capital; it is obvious that there is no explicit pattern between these variables. Cairo has the highest local average human capital however still; it does not pay the highest hourly wages.

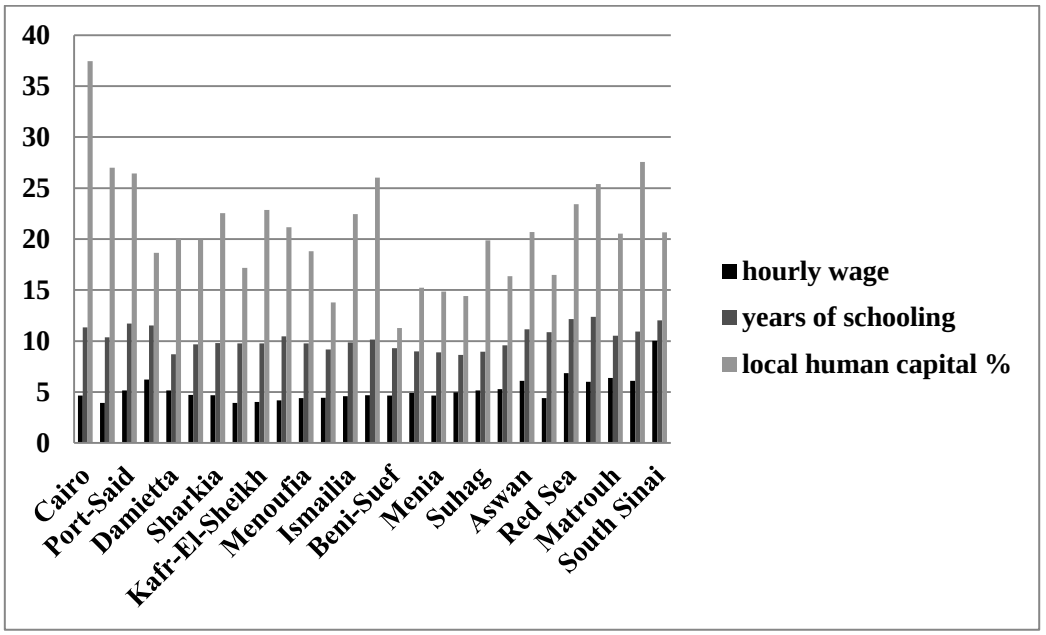

Figure 1: Hourly wages, years of schooling and local human capital at the governorate level 2010

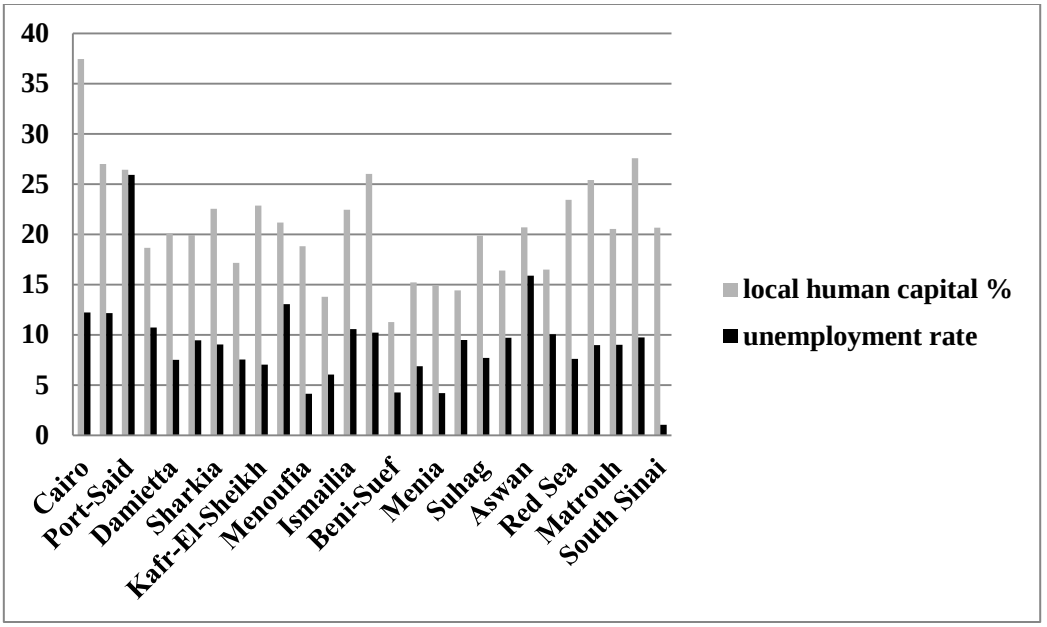

Figure 2: Unemployment rate and local human capital at the governorate level 2010

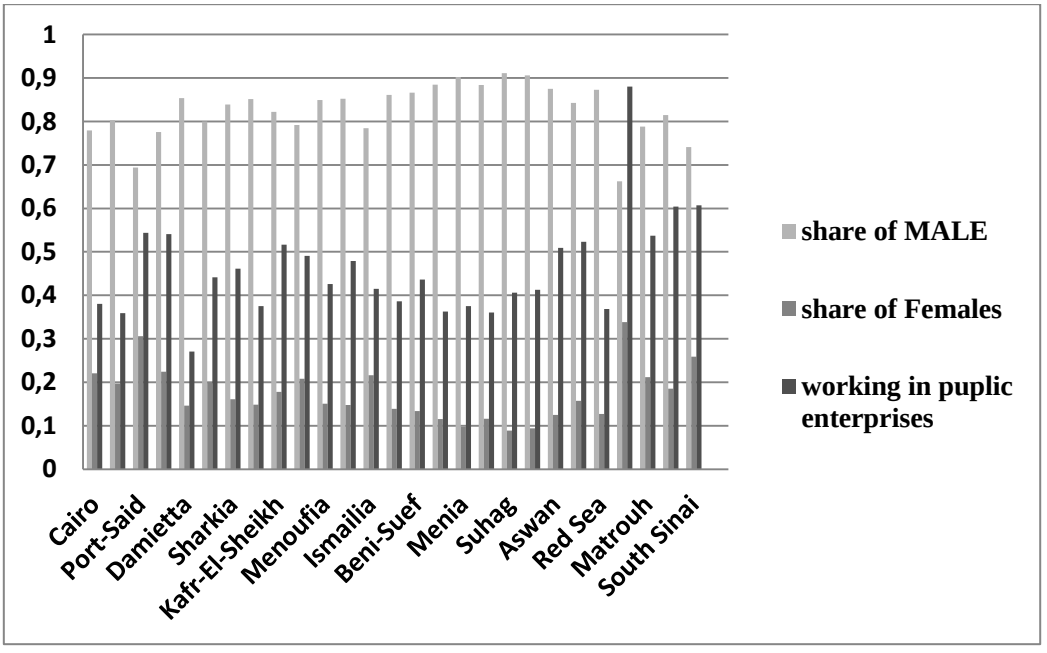

Figure 3: Share of males, females and population working in public enterprises by governorate in 2010

5 Estimation

5.1 Baseline Estimation

We start by estimating a baseline specification, which includes local human capital, and the basic Mincerian set of individual characteristics. These characteristics consist of labor market experience, its squared value, individual human capital measured as the number of years of schooling, and two dummies for gender and marital status.

Table 2 provides OLS estimates for our model. The results are in line with what is usually obtained in the literature. We find that each individual year of schooling increases hourly wages by 4.32%. Experience increases wages up to 47 years of experience. Wages of males are 19% higher than women's wages. Married workers enjoy a 5.2% premium. Crucially, local human capital enters the earning equation with a negative and statistically insignificant coefficient for males. However, this variable is found to be negative and significant for females, a one-unit increase in local human capital decreases female hourly wages by 46.7%.

Table 2: Basic Estimation

	All	Male	Female
Local human Capital	-0.207	-0.145	-0.467***
Individual human capital	0.0432***	0.039***	0.068***
Experience	0.034***	0.031***	0.039***
Experience square	-0.036***	-0.032***	-0.032***
Dummy if male	0.191***	----	----
Dummy if married	0.052**	0.048*	0.109***
Constant	0.207***	0.464***	-0.216
Number of observations	49583	39507	10076
R^2	0.19	0.16	0.29

*,**,*** denote significance at 10%, 5% and 1% levels.

5.2 Additional individual controls

To check the robustness of these results we tried to control for individuals working in public or private sector. This may be particularly relevant for the Egyptian case since the public sector is considered a major employer in the Egyptian labor market (42% of employees worked in public sector in 2010). Moreover, wage differentials between public and private sector appear to be quite relevant. To this purpose, we added in Table 3 a dummy to pin down the type of

enterprise for which each individual works being public or private. We find that working for a public enterprise decrease wages by 4.9%. However, the introduction of this variable had very little impact on the estimated effects of individual human capital and experience. More importantly, even thought the estimates of external returns turn out to be slightly higher for males, they remain negative and highly insignificant. While for women, they are a little lower but still negative and significant.

Table 3: Individual control: Working in public versus private enterprises

	All	Males	Females
Local human capital	-0.264	-0.22	-0.398**
Individual human capital	0.045***	0.0422***	0.064***
Experience	0.035***	0.0327***	0.038***
Experience square	-0.037***	0.0335***	-0.031***
Dummy for male	0.179***	----	---
Dummy for married	0.057***	0.052**	0.092***
Dummy for working for a public enterprise	-0.049***	-0.066***	0.065
Constant	0.199***	0.467***	-0.222*
Number of observations	49583	39507	10076
R^2	0.19	0.16	0.29

*,**,*** denote significance at 10%, 5% and 1% levels

Furthermore, previous literature suggests that controlling for the sector of economic activity increases accuracy of estimates (Dalmazzo and Blasio 2007). This is particularly relevant for the Egyptian case, since inter-industry wage differentials appear to be quite relevant. Moreover, industry dummies can partly capture endogenous matching of higher skilled workers with high-wage firms (Bartel and Sicherman 1999). To this purpose, we added twenty dummies to pin down the sectors of economic activity of the firm for which each individual works (see Table A-2 in appendix). Inter-industry wage differentials turn out to be relevant. However, including this variable had no effect on the local human capital coefficient; it remained negative and insignificant for males and negative but significant for females.

Table 4: Individual control: Economic Activity

	All	Males	Females
Local Human Capital	-0.226	-0.170	-0.507**
Individual human capital	0.044***	0.041***	0.065***
Experience	0.035***	0.031***	0.039***
Experience square	-0.035***	-0.031***	-0.031***
Dummy for married	0.052**	0.047*	0.098***
Dummy for male	0.162***		
Economic activity			
1	0.375***	0.340***	0.824***
2	0.020	0.031	-0.137**
3	0.206***	0.210***	0.154*
4	-0.135***	-0.130**	-0.168
5	0.228***	0.230***	-0.013
6	-0.181***	-0.163***	-0.403***
7	0.103***	0.110***	-0.138**
8	-0.019	-0.017	-0.236
9	0.054	0.076**	-0.103
10	0.235***	0.252***	0.091***
11	0.085	0.103	-0.265**
12	-0.160***	-0.159***	-0.255
13	-0.049	-0.055	-0.117***
14	-0.114***	-0.114***	-0.219**
15	-0.017	-0.011	-0.151***
16	-0.159***	-0.153***	-0.246***
17	-0.204***	-0.168***	-0.431***
18	-0.344***	-0.348***	-0.165
19	-0.568***	-0.610***	-0.281***
20	0.389**	0.275	0.494**
Constant	0.246***	0.469***	0.004
No. of observations	49486	39424	10062
R^2	24	22	30

5.3 Additional regional controls

Many local characteristics may introduce spurious correlation between average human capital and individual wages through affecting both the concentration of human capital as well as wages. In this section, we check the robustness of our findings when additional local variables are included.

I started Table 5, line 2 by augmenting the individual-level regression with governorates unemployment rates as a measure of local unemployment. The correlation of education with earnings might be affected by the distribution of unemployment across governorates. If better-educated individuals are less likely to be unemployed, then average human capital might pick up the effect of the unemployment rate. Results showed that local unemployment rate enters with a negative sign; however, it is statistically insignificant. Local human capital effect is indifferent from the basic model although significance level is lower for females.

Next, I consider the quality of education in each governorate (line 3). I include three variables as measures of education quality; student teacher ratio, classroom density and dropout ratio, all at the preparatory schools level. Student teacher ratio is insignificant; classroom density has a weak negative effect, however, it is only significant at 90%. Dropout ratio has a strong negative and significant effect. Crucially, the coefficient of local human capital turned out to be significant and negative for the three models. A unit increase in governorate average higher education is associated with a 44% decrease in wages for whole sample.

Local human capital may also be correlated with omitted variables related to the availability of amenities at the local level that determine the local quality of life. This could entail a downward bias for the estimated coefficient of average local education in the wage equation. To control for such correlation, we augmented our regressions with some measures of the local level of amenities (line 4). This is measured by two variables, ratio of designed sewage capacity to population in each governorate in 2010 and ratio of number of health units with beds to population in each governorate in 2010. Results showed that these variables had an insignificant effect on individual wages. However, the coefficient of local human capital turned out to be significant and negative. A unit increase in governorate average higher education is associated with a 106 % decrease in wages, i.e. again, we have negative externalities to higher education.

Table 5: Additional regional controls

	All	Males	Females
(1) Basic	-0.207	-0.145	-0.467***
(2) Including governorate unemployment rate	-0.249	-0.192	-0.438*
(3) including governorate teaching quality measures	-0.443**	-0.429*	-0.422*
(4) Including governorate measures of amenities	-1.066*	-1.04*	-1.101*

*,**,*** denote significance at 10%, 5% and 1% levels. Each entry represents the coefficient on the local human capital. The specifications used in this table replicate the basic specification.

5.4 Imperfect substitutability across workers

In this section, I try to examine whether imperfect substitution between high and low skilled workers -as suggested by a demand and supply models- explains the correlation between local human capital and wages instead of education externalities. If workers with different levels of education are imperfect substitutes in production, the parameter η will pick up effects that can be determined both by "composition effects", due to a larger proportion of skilled workers on average productivity, and by actual spillovers, due to human capital externalities. Imperfect substitutability implies that an increase in the relative supply of skilled workers would decrease their wage while increasing the wage of the unskilled workers. Accordingly, economic theory predicts that on one hand the effect of an increase in college share on the wage of low education workers is positive, since it is the sum of two positive components: imperfect substitution and spillover effect. On the other hand, the effect of an increase of college share on the wage of high education workers may be ambiguous, since it is the sum of two opposite forces: the decrease in the private return to education and the spillover effect (Ciccone and Peri 2006 and Moretti 2004a,b).

Thus, we estimate education spillover for two skill groups separately. These two groups are (a) the unskilled, those with 8 years of schooling, corresponding to below intermediate education. And (b) the skilled group, those with more than 8 years of schooling (high school, university and above university).

Table 6: Skilled versus unskilled workers

	Skilled	Unskilled
Local Human Capital	-0.354**	-0.646***
Individual Human Capital	0.083***	0.014***
Experience	0.027***	0.021***
Experience square	-0.012**	-0.024***
Dummy if male	0.197***	0.375***
Dummy if married	0.101***	0.043
Constant	-0.294***	0.659***
Number of observations	35535	14048
R^2	24%	8%

*,**,*** denote significance at 10%, 5% and 1% levels

Results are reported in Table 6. Average education is found to be negative and significant for both skilled and unskilled workers and it is stronger and more

significant for the unskilled group. This confirm our previous results of negative externalities, since the increase in average skill level has a negative and stronger significant effect on wages of unskilled workers implying that imperfect substitution between high and low skilled workers does not contributes to this negative effect.

5.6 Males versus females

When estimating all previous specification for males and females separately the results were the same for males. However, for females we found a negative and significant correlation between average local human capital and females' hourly wages in all cases.

5.7 IV estimates

So far, our results suggest that there is a weak and negative correlation between local human capital and average wages only after controlling for local regional characteristics for males while for females there is a negative and strong correlation in all cases. However, as previously mentioned this correlation cannot be interpreted as a causal relation of local average schooling on local wages. There might still be some omitted variables that are correlated with both wages and local human capital. Furthermore, there might be a reverse causality problem for example; areas characterized by high wages might be able to afford higher human capital. We use the instrumental variable approach to tackle this problem and check the robustness of our previous conclusions[5]. Three groups of IVs were used for estimation, each group at a time. The estimation were run for two models one for males and the other for females. Results are reported in Table 7. For males using any of the three IVs (columns 7-1, 7-2 and 7-3), the results suggested no significant relationship between local human capital and wages. This was also the case when using all the IVs in one model. For females, the story is different; a negative significant relationship was found when using the first and the third IVs. A unit increase in governorate average higher education is associated with a 67% and 139% decrease in females' wages respectively, i.e. negative externalities to females higher education.

According to the literature, these negative externalities could be attributed to the fact that education degrees are simply used as a device to signal higher ability

[5] Our identifying hypothesis is that the variables used as instruments affect wages in 2010 at the governorate level only through the supply of human capital. We check this hypothesis by testing the implied overidentifying restrictions and find it cannot be rejected at standard significance levels.

without raising productivity. Another reason behind these negative externalities could be excess supply of higher education graduates in the labor market. Findings highlighted that in developing countries higher education is positively associated with unemployment so that the increase in level of education may actually reduce total output (Krueger and Lindahl 2001). This is specially the case in Egypt as the unemployment rate among university graduates and above in 2010 was the highest reaching 18.9% compared to an overall rate of 9%, 16.6% for above intermediate and 12.3% for intermediate education graduates.

Table 7: IV estimation

	Males			Females		
	7-1	7-2	7-3	7-4	7-5	7-6
Local Human Capital	-0.178	0.438	-0.629	-0.668***	-0.32	-1.392**
Individual Human Capital	0.0396***	0.0389***	0.04***	0.0681***	0.0674***	0.0693***
Experience	0.031***	0.030***	0.031***	0.039***	0.039***	0.04***
Experience square	-0.032***	-0.032***	-0.032***	-0.031***	-0.032***	-0.031***
Marital status	0.048**	0.058**	0.0399	0.101***	0.114***	0.077**
Constant	0.47***	0.336***	0.569***	-0.188**	-0.263*	-0.033
No. of observations	39507	39507	39507	10076	10076	10076
R^2	0.16	0.16	0.16	0.29	0.29	0.28
First stage estimation						
Share of general secondary schools students	0.0056***			0.0058***		
Rate of change in ratio of university and above university graduates in the 1980s		-0.054*			-0.053*	
Rate of change in ratio of university and above university graduates in the 1990s		-0.189			0.181	
Rate of change in ratio of university and above university graduates in the 2000s		-0.138*			0.122	
1996 share of population 0–5			-0.021**			-0.0198*
1996 share of population 5–10			-0.003			-0.0064

*,**,*** denote significance at 10%, 5% and 1% levels.

6 Conclusion

This study tried to identify higher education externalities from an individual's co-workers on the estimates of his or her private returns to education in Egypt at the governorate level. The results suggested that these externalities are negative and exist only for female workers, while for males these externalities were again negative but statistically insignificant. These results were tested through a number of robustness checks. I have shown that these results survived to the introduction of individual and governorate level variables; it was not due to imperfect substitutability across workers; it still holds when treating local human capital as endogenous variable and instrumented it.

The empirical results suggested that a unit increase in governorate average higher education is associated with a 68% decrease in females' wage. This could be explained by the fact that education degrees are simply used as a device to signal higher ability without raising productivity. Another reason behind these negative externalities could be excess supply of higher education graduates in the Egyptian labor market.

However, this approach of estimating education externalities by looking at wage differences across governorates may underestimate the full amount of education spillovers for two reasons. First, local human capital may have effects that go beyond the borders of the governorates. Second, wage differences capture only a portion of the full "social" effects of education. It simply measures economic externalities neglecting other society level noneconomic benefits. Further research to examine this issue is needed.

Given results reached by previous studies (Birdsall and O'Connell, 1999; El Baradei, 2000; Fergany, 1998; Shafik, 1996), confirming that private rate of return to higher education in Egypt is higher than that to other lower education stages, together with the negative higher education externalities reached in this study; government subsidization of higher education in Egypt is under question. Moreover, this means that higher education is a valuable investment for individuals. Thus, more attention should be given to the various methods of cost sharing, including the use of fees for tuition or for meals and accommodation, student loans, and contributions from employers to help finance vocational education and training. This can free funds to help the government to finance expansion or improvements that at present cannot be supported because of competing claims on public funds.

This shift from public to private finance may be highly resisted based on equity issues. However, the shift to cost sharing may actually improve the equity of educational finance and have positive distributional impacts. Previous studies found that at present the high-income students are the ones who are most likely to benefit from education subsidies in Egypt (Asaad 2010; Galal 2002). Accordingly, if the public funds saved are then used to increase selective subsidies for the poor or to increase the provision of education or the quality of schooling for disadvantaged groups or make public funds available for greater expansion of

primary education, both equity and efficiency objectives may be achieved. This raises the need for further empirical analysis of equity implications of alternative education investment policies.

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Appendix A

Table A-1: Variables definition and construction

Variable	Description	Source
Hourly wages	Log of hourly wages. Hourly wages are calculated by dividing the annual earnings (from any activity as employee, including fringe benefits, net of taxes and social security contributions) by the total amount of hours worked in a year (average hours worked per week ×4.3333).	LFSS 2010
Local human capital	Share of university graduates in each governorate labor force in 2010	LFSS 2010
Individual human capital	Number of years required to achieve the highest qualification earned by the individual (years of education). We derived the length of education by assigning: 0 years to illiterate; 4 years to read and write; 8 years to bellow intermediate; 12 years to general secondary school; 12 years to technical secondary schools; 14 years to above intermediate; 16 years to university degree; 18 years to above university.	LFSS 2010
Potential Experience	Potential labor market experience calculated as age- 6-schooling. A few negative values are recorded as zero	LFSS 2010

Marital status	Dummy variable that equals one for married individuals	LFSS 2010
Enterprise type	Dummy variable that equals one for individuals working in a public enterprises	LFSS 2010
Governorate unemployment rate	2010 Unemployment rate at the governorate level	LFSS 2010
Student teacher ratio	number of students divided by the number of teachers for the preparatory stage at the governorate level in 2010	Ministry of education website
Class room density	Total number of preparatory stage students divided by numbers of classes in that stage for each governorate in 2010	Ministry of education website
Drop out ratio	measures the proportion of students who drop out in a single year without completing preparatory school.	Ministry of education website
Amenities 1	ratio of designed sewage capacity to population in each governorate in 2010	CAPMAS statistical year book
Amenities 2	ratio of no. of health units with beds to population in each governorate in 2010	CAPMAS statistical year book
Share of general secondary schools students	The number of general secondary school students divided by the total number of students in secondary education in each governorate in 2002	CAPMAS statistical year book
Rate of change in ratio of university and above university graduates	The rate of change in the ratio of number of university and above university graduates to all who entered the governorate labor market in each of the three decades: the 1980's, 1990's and the 2000's.	LFSS 2007-2010
1996 share of population 0–5	Share of the governorate population between the age of zero and five from total governorate population in 1996	Census 1996
1996 share of population 5–10	Share of the governorate population between the age of five and ten from total governorate population in 1996	Census 1996

Table A-2: Classification of Economic Activities

Dummy value	Section	Division	Description
0	A	01–03	Agriculture, forestry and fishing
1	B	05–09	Mining and quarrying
2	C	10–33	Manufacturing
3	D	35	Electricity, gas, steam and air conditioning supply
4	E	36–39	Water supply; sewerage, waste management and remediation activities
5	F	41–43	Construction
6	G	45–47	Wholesale and retail trade; repair of motor vehicles and motorcycles
7	H	49–53	Transportation and storage
8	I	55–56	Accommodation and food service activities
9	J	58–63	Information and communication
10	K	64–66	Financial and insurance activities
11	L	68	Real estate activities
12	M	69–75	Professional, scientific and technical activities
13	N	77–82	Administrative and support service activities
14	O	84	Public administration and defense; compulsory social security
15	P	85	Education
16	Q	86–88	Human health and social work activities
17	R	90–93	Arts, entertainment and recreation
1	S	94–96	Other service activities
8	T	97–98	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
19	U	99	Activities of extraterritorial organizations and bodies

References

[1] D. Acemoglu, Training and Innovation in an Imperfect Labor Market, *Review of Economic Studies*, **64**, (1997), 445-464.

[2] D. Acemoglu, A Micro Foundation for Social Increasing Returns in Human Capital Accumulation, *Quarterly Journal of Economics*, **120**, (1996), 779-804.

[3] D. Acemoglu and J. Angrist, How Large are Human Capital Externalities? Evidence from Compulsory Schooling Laws, *NBER Macroeconomics Annual*

2000, ed. by B. Bernanke and K. Rogoff. Cambridge, MIT Press, (2000), 9-59.

[4] K. Arrow, *Economic Welfare and the Allocation of Resources for Inventions*, in the Rate and Direction of Inventive Activity, ed. R. Nelson. Princeton University Press, 1962.

[5] R. Assaad, Equality for All? Egypt's Free Public Higher Education Policy Breeds Inequality Of Opportunity, *Economic Research Forum Policy Perspective*, **2**, (December, 2010).

[6] R.J. Barro, Human Capital and Growth in Cross-country Regressions, *Swedish Economic Policy Review*, **6**, (1999), 237-277.

[7] A.P. Bartel and N. Sicherman, Technological Change and Wages: An Inter-industry Analysis, *Journal of Political Economy*, **107**, (1999), 285-325.

[8] G.S. Becker, Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education, University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership, Historical Research Reference in Entrepreneurship, 1964. Available at SSRN: http://ssrn.com/abstract=1496221.

[9] J. Benhabib and M. Spiegel, The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-country Data, *Journal of Monetary Economics*, **34**, (1994), 143-174.

[10] N. Birdsall and L. O'Connell, Putting Education to Work in Egypt, Growth Beyond Stabilization: Prospects for Egypt, *Conference Proceedings*, the Egyptian Center for Economic Studies, Cairo, Egypt, (1999).

[11] E. Canton, Social Returns to Education: Macro-Evidence, *De Economist*, **155**, (2007), 449-468.

[12] A. Ciccone and G. Peri, Identifying Human Capital Externalities: Theory with Applications, *Review of Economic Studies*, **73**(2), (2006), 381-412.

[13] A. Dalmazzo and G. de Blasio, Social Returns to Education in Italian Local Labor Markets, *Ann. Reg. Sci.*, **41**, (2007), 51-69.

[14] M. El Baradei, Towards a Pro-poor Educational Policy for Egypt, Paper presented in the *Conference on Socioeconomic Policies and Poverty Alleviation Programs in Egypt*, sponsored by the Center for Economic and Financial Research and Studies, Cairo, 16-17 October, (2000).

[15] A. El -Arabi, Determinants of the Demand on Education in Egypt, *Partners in Development Conference*, (2010).

[16] N. Fergany, Human Capital and Economic Performance in Egypt, *mimeo*, (1998).

[17] A. Galal, The Paradox of Education and Unemployment in Egypt, *The Egyptian Center for Economic Studies* (ECES), (March, 2002).

[18] N. Gemmell, Externalities to Higher Education, *Report to the National Committee of Inquiry into Higher Education*, St Clements House, Norwich, HMSO Copyright Unit, (1997).

[19] N. Gillespie, Explaining Returns to Education in the Middle East and North Africa, *mimeo*, (1997).

[20] E.L. Glaeser, Learning in cities, *Mimeographed*, (1997).
[21] Z. Griliches, Issues in Assessing the Contribution of R&D to Productivity Growth, *Bell Journal of Economics*, **10**, (1979), 92-116.
[22] R. Haveman and B. Wolf, Schooling and Economic Well-being: the Role of Non-Market Effects, *Journal of Human Resources*, **19**(3), (1984), 377-407.
[23] J. Heckman, Policies to Foster Human Capital, *Research in Economics*, **51**(1), (2000), 3-56.
[24] J. Heckman and P. Klenow, *Human Capital Policy*, in M. Boskin (ed.) Policies to Promote Capital Formation, Stanford, CA: Hoover Institution, 1998.
[25] S. Herrera and K. Badr, Why Does the Productivity of Education Vary across Individuals in Egypt? Firm Size, Gender, and Access to Technology as Sources of Heterogeneity in Returns to Education, *Policy Research Working Paper*, **5740**, World Bank, Washington D.C, (2011).
[26] N. Islam, Growth Empirics: A Panel Data Approach, *Quarterly Journal of Economics*, **110**(4), (1995), 1127-1170.
[27] B. Jovanovic and R. Rob, The Growth and Diffusion of Knowledge, *Review of Economic Studies*, **56**(4), (1989), 569-582.
[28] S. Kirby and R. Riley, The External Return to Education: UK Evidence Using Repeated Cross Sections, *Labor Economics*, **15**, (2008), 619-630.
[29] A. Krueger and M. Lindahl, Education for Growth: Why and for Whom? *Journal of Economic Literature*, **39**, (2001), 1101-1136.
[30] R.E. Lucas, On the Mechanics of Economic Development, *Journal of Monetary Economics*, **22**, (1988), 3-42.
[31] N.G. Mankiw, D. Romer and D.N. Weil, A Contribution to the Empirics of Economic Growth, *Quarterly Journal of Economics*, **107**, (1992), 407-437.
[32] V. Monastiriotis, Human Capital and Wages: Evidence for External Effects from the UK Regions, *Applied Economics Letters*, **9**, (2002), 843-846.
[33] E. Moretti, *Human Capital Externalities in Cities*, Chapter 51, **4**, in Handbook of Regional and Urban Economics, J. V. Henderson and J. F. (eds), Thisse, Amsterdam, Elsevier, 2004a.
[34] E. Moretti, Estimating the Social Return to Higher Education: Evidence from Longitudinal and Repeated Cross-Sectional Data, *Journal of Econometrics*, **121**, (2004b), 175-212.
[35] O.B. Okuwa, Private Returns to Higher Education in Nigeria, *AERC Research Paper*, **139**, African Economic Research Consortium, Nairobi, (March, 2004).
[36] C.A. Pissarides, Human Capital and Growth: A Synthesis Report, *OECD Working Paper*, **168**, OECD Development Center, (November, 2000).
[37] J.E. Rauch, Productivity Gains from Geographic Concentration of Human Capital: Evidence from the Cities, *Journal of Urban Economics*, **34**, (1993), 380-400.
[38] P.M. Romer, Human Capital and Growth: theory and evidence, *NBER Working Paper*, **3173**, (1989).

[39] C. Sakellariou, Identifying the External Effects of Human Capital: a Two-stage Approach, *Applied Economics Letters*, **8**, (2001), 191-194.
[40] C. Sakellariou and R. Maysami, Lucas Type External Effects of Human Capital: Strong Evidence Using Micro Data, *Applied Economics Letters*, **11**, (2004), 343-346.
[41] D. Salehi-Isfahani, İ. Tunalı and R. Assaad, A Comparative Study of Returns to Education of Urban Men in Egypt, Iran, and Turkey, *Middle East Development Journal*, **1**(2), (2009), 145- 187.
[42] T.W. Schultz, Investment in Human Capital, *American Economic Review*, **51**(1), (1961), 1-17.
[43] N. Shafik, Big Spending, Small Returns: The Paradox of Human Resource Development in the Middle East, *Working Paper*, **2**, The Egyptian Center for Economic Studies, Cairo, Egypt, (1996).
[44] B. Sianesi and J. Van Reenen, The Returns to Education: Macroeconomics, *Journal of Economic Surveys*, **17**, (2003), 157-200.
[45] R. Winter-Ebmer, Endogenous Growth, Human Capital and Industry Wages, *Oxford Bulletin of Economic Research*, **46**, (1994), 289-314.
[46] A.M. Wirz, Private Returns to Education Versus Education Spill-over Effects or What Co-workers Account For, *Empirical Economics*, **34**, (2008), 315-342.
[47] World Bank, The Road Not Traveled, Education Reform in the Middle East and North Africa, Washington, DC, World Bank, (2008).
[48] R. Zhu, Individual Heterogeneity in Returns to Education in Urban China during 1995–2002, *Economics Letters*, **113**, (2011), 84-87.