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RETURNS TO EDUCATION AND REGIONAL EARNINGS DIFFERENTIALS IN EGYPT

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Abstract

This paper presents an empirical investigation of the determinants of labour market earnings in Egypt. Using Human Capital model, the determinants of regional earnings and returns to education by region are examined. The relative importance of individual and regional effects on earnings inequality is assessed. The main findings of the paper are: (i) the estimated rates of return to education increase with rising educational levels; this is different to the common pattern found in most developing countries. (ii) there are substantial variations in returns to education across regions. (iii) estimates point to the importance of credentials in the Egyptian labour market.

1.   Introduction

One of the most important outcomes that economists seek to explain is the distribution of income. Because the largest component of income for most people is their labour-market earnings, variation in labour earnings is the primary contributor to overall income inequality. This suggests that a valuable step in understanding overall income inequality would be to study the determinants of labour earnings. This paper presents an empirical investigation of the determinants of labour market earnings and of earnings inequality in the Egyptian labour market. My objective is to measure the relative importance of personal and regional effects on earnings inequality. Using a human capital model, I examine the determinants of regional earnings and provide evidence on differentials in regional earnings.

Many economists have advocated human capital investment to improve income and earnings distributions. In recent years, there has been considerable interest in whether schooling affects the distribution of income among individuals. There is an enormous literature devoted to estimating the returns of education in many countries (See Psacharopoulos, 1994). However, there is little knowledge of how different patterns of human capital investment might affect the distribution of household earnings in rural and urban areas of developing countries.

There are very few studies on returns to schooling in Egypt. Most of the recent studies of earnings determinants in the Egyptian labour market have focused on the analysis of earnings differentials according to employment sector, mainly private versus public (See Assaad, 1997, and Zaytoun, 1991). A search of the literature reveals little explicit study of determinants of regional labour market earnings in Egypt. This will be the main contribution of this paper. It will

examine the extent to which education affects earnings among regions and estimate returns to education by region in Egypt.

A brief discussion about the education system in Egypt is a useful starting point. The Egyptian education system has expanded rapidly during the past four decades. Although demand on modern education and training has been very strong in Egypt since the beginning of the twentieth century, it was only in the 1940s when primary schools became free of charge that the basis for equal opportunities in education was provided. Some years later, secondary education followed, and shortly after the 1952 Revolution, university students were exempted from paying university fees. The decisions triggered an unprecedented expansion of the schooling system. Since then a steady expansion has been witnessed. Primary education enrolment increased by 1 million between 1965/6 and 1979/80. Secondary schooling has expanded by 38.5 percent during the period 1975 to 1980, more rapidly than primary and preparatory education (Hansen & Radwan, 1982).

As part of the extensive nationalisation drive in the early 1960s, the Egyptian government initiated a major public employment drive that included guaranteed employment for university and secondary school graduates. In 1973, this scheme was extended to demobilised military conscripts of all educational levels but was suspended in 1976 (Hansen and Radwan, 1982). The employment guarantee followed a period of rapid expansion in the number of graduates from all levels of education. The expansion underscored the commitment of the Nasser regime to making educational opportunities more accessible to the mass of the population (Assaad, 1997). The employment guarantee for graduates has been, and is still, playing a major role in shaping the education system in Egypt (Hansen and Radwan, 1982).

The need to absorb a larger number of workers every year has had major implications for the public sector finances. Whereas throughout the period since the 1960s the government provided jobs for graduates, which were secure if low paid, the burden of the wage bill to the government budget became intolerably large by the late 1980s. The government has become incapable of meeting employment demands and, in an attempt to making the scheme less attractive, it has increased the job search period for graduates before they can apply for entitlement under this scheme. The slowdown in the government hiring of graduates in the1980s caused the waiting period to extend from between two to three years to five to six years and led to a sharp increase in the graduate unemployment rate between 1976 and 1986. Table 1 shows the increasing trend in this period of the rate of unemployment for secondary and university graduates. Thus free education combined with the guaranteed employment scheme for secondary and university graduates has resulted in an excess supply of educated workers.

Table 1. Unemployment Rate by Educational Level in Egypt				
	1976[a]	1986[a]	1990	1995
Proportion of Unemployed who are				
Illiterate	27.1	14.6	12.9	1.6
Ability to read & write	12.6	6.5	4.1	1.4
Primary	9.0	4.5	8.4	1.4
Preparatory	38.0	52.2	53.3	74.6
Secondary	2.2	5.0	6.8	8.4
University & higher	11.0	17.2	14.6	12.6
All	100	100	100	100
Number in thousands	513	1574	1345	1774
Unemployment rate				
Illiterate	2.5	4.1	2.6	0.5
Ability to read & write	2.5	4.4	1.8	0.7
Primary	7.0	11.0	12.7	2.6
Preparatory	20.6	28.8	23.2	31.9
Secondary	13.5	27.2	15.4	18.6
University & higher	10.9	25.9	12.3	11.2
All	**5.0**	**12.3**	**8.5**	**10.4**

Source: Population Census for 1976 and 1986. Labour Force Sample Survey: December 1990 and May 1995 (Quoted in Assaad (1997) p.96).

Note: Data are for workers ages between twelve and sixty-four. The definition of open unemployment used in Egypt is a person who did not work at all, but was able and desiring to work and searching for it during the reference period.

[a]The data for 1976 and 1986 are based on a one-day reference period. 1990 and 1995 are based on a one-week reference period.

The plan of the paper is as follows. Section 2 introduces the theoretical framework. Section 3 describes the data and presents descriptive statistics of the main key variables used. Section 4 presents estimates of the determinants of earnings for the whole country. Section 5 discusses the determinants of earnings by region and examines whether regional earnings differentials can be explained by different endowments among the different regions. The conclusion sums up the main findings of this paper.

2.   The Theoretical Framework: The Human Capital Model

The dominant economic theory of wage determination is human capital theory.   Its development is due to important contributions by Mincer (1974) and Becker (1975). The basic framework is one in which the returns to an individual from labour market activity are a function of his/her stock of human capital. The standard form of the earnings function that is usually estimated is one where log earnings are a function of schooling and experience:

$$\ln y = \alpha + \beta_1 s + \beta_2 X + \beta_3 X^2 + \mu, \tag{1}$$

where $\ln y$ is the natural logarithm of earnings or wages, s is schooling and X is potential experience (measured as age minus s minus 6 years). β_1 represents the returns to schooling and β_2 to on-the-job training. The earnings function is concave in experience because of diminishing marginal returns to increased on-the-job training, so β_3 is negative. μ is a well-behaved error term that captures other unobserved factors that contribute to labour earnings.

This basic equation has been extended to include a number of other variables such as hours of work, union membership, gender, race, economic sector, occupation and regions, among others (See Berndt, 1991, for a survey of empirical studies on wage determination).

Following the traditions of a well-established empirical literature, the standard earning function, and variants of it, are estimated by ordinary least squares.   The conventional methodology is used to enhance the comparability of the present estimates with those obtained for other countries.

3.   The Data and Descriptive Statistics

The data used in this analysis are from a special round of the Egyptian Labour Force Sample Survey (LFSS) taken in October 1988. This special round of the survey used for the first time a more detailed set of questions on earnings and other labour market variables. For this study, the data from the earnings module are used. The earnings module covers all the individuals included in the main Household Sample, except non-wage workers. A major limitation of this data set is the lack of information on individuals who either do not participate in the labour market or, if they do, are not employed as wage of salaried workers. This omission is known to cause a bias. For certain individuals the market wage may not be sufficient to attract them to the labour force, that is, their reservation wages are higher than the market wage. Because reservation wages are correlated with unobserved characteristics, such as ability, that may be also correlated with earnings, estimation by ordinary least squares yields upwardly biased estimates. Given the data at hand, we are not able to correct for selectivity bias. In this sense, the present study falls within the framework of the "first generation" models that did not control for the sample selection bias. However, if selection bias is the same across regions, it may be all right to ignore it in the cross-regional comparison. The present study defines earnings as annual income from work. See Table 2 for descriptions of the key variables.

Table 2. Descriptive Statistics of Key Variables

Variable	Mean	Standard Deviation
ln Earning	6.80	1.05
Male[a]	0.79	0.40
Age	34.50	1.65
Experience	23.95	15.75
Experience Sq.	821.30	921.56
Union[b]	0.28	0.45
Schooling	5.46	5.50
Educational Dummies		
Illiterate	0.36	0.48
Read & Write	0.16	0.36
Primary	0.14	0.35
Preparatory	0.18	0.38
Secondary	0.05	0.21
University & Higher	0.12	0.33
Geographical Dummies		
Urban[c]	0.31	0.46
Rural	0.45	0.50
Upper Egypt	0.26	0.44
Lower Egypt	0.39	0.49
Regional Dummies		
Greater Cairo	0.24	0.43
Alexandria & Canal Cities	0.10	0.30
Urban Lower Egypt	0.12	0.33
Urban Upper Egypt	0.09	0.29
Rural Lower Egypt	0.27	0.45
Rural Upper Egypt	0.17	0.38

[a] Dummy 1 if male.
[b] Dummy= 1 if member of union.
[c] Not including Greater Cairo.
Note: The ability to read write denotes literate workers who did not complete primary school. Primary denotes workers who earned a certificate after six years of elementary education. Preparatory denotes workers who earned a certificate after three years of preparatory education. Secondary denotes workers who earned a certificate after three years of secondary education. University and higher denotes workers who earned a university or higher degree.

Table 3 provides data on annual earnings by region. The mean annual earnings amounted to L.E. 1394.8 for the whole sample. There is an apparent difference in average annual earnings across the different regions. Upper Egypt (urban and rural) seems to have the lowest average annual earnings.

Studies have shown that despite large differentials in earnings between one geographical area and another, the great bulk of earnings inequality is within geographical areas rather than between them (See Fields & Schultz, 1980). In several developing countries, such as Taiwan, Pakistan and Colombia, variations within regions are far more important in accounting for inequality than variations between regions. Egypt is no exception in that respect. It is clear from Table 3 that earnings variation within regions is substantial.

Table 3. Regional Annual Earnings

Region	Mean	Std. Dev.	Skewness	N
1. Greater Cairo	1702.7	1768.0	4.96	2691
2. Alex. & Canal Cities	1532.3	1840.6	11.5	1097
3. Urban Lower Egypt	1380.7	2583.9	17.67	1332
4. Urban Upper Egypt	1235.8	1343.6	10.93	986
5. Rural Lower Egypt	1313.3	1654.6	7.45	3019
6. Rural Upper Egypt	1101.8	1575.1	9.62	1904
All Regions	**1394.8**	**1813.1**	**11.56**	**11029**

Source: Author's calculations.

Regional inequality may be due to differences in the educational composition of various regions. To address this issue, mean earnings for the sample are disaggregated by region and educational level and depicted in Figure 1. Wide interregional differences are observed in all educational categories., in most regions, the average annual earnings of those who can only read and write is higher than those with less than a university degree. It is interesting to note that in four out of the six regions (all regions except for Alexandria & Canal cities and Urban Upper Egypt), the average annual earnings of those who can only read and write is higher than those with primary, preparatory or secondary education. In other words, only university education or higher results in significantly better average earnings opportunities. Figure 2 shows this pattern

clearly for the entire country. Fergany's (1993) findings support this same pattern. In Colombia, Fields and Schultz (1980) also find that workers with no schooling sometimes receive higher incomes than those with some primary schooling.

4.   The Determinants of Earnings

4.1. Returns to Education

A standard human capital specification of the earnings equation is used, where log earnings are assumed to depend on schooling and experience. The results of estimating the basic earnings function are presented in Table 4, column 1. These estimates of the rate of returns to education are compared to estimates from studies of other countries that use the same methodology. As documented in previous studies, rates of returns to education are inversely related to the level of economic development. Psacharopoulos (1994) has compiled estimates for more than 60 countries (See Table 5). Returns to education are highest in Africa and lowest in the advanced industrial countries.

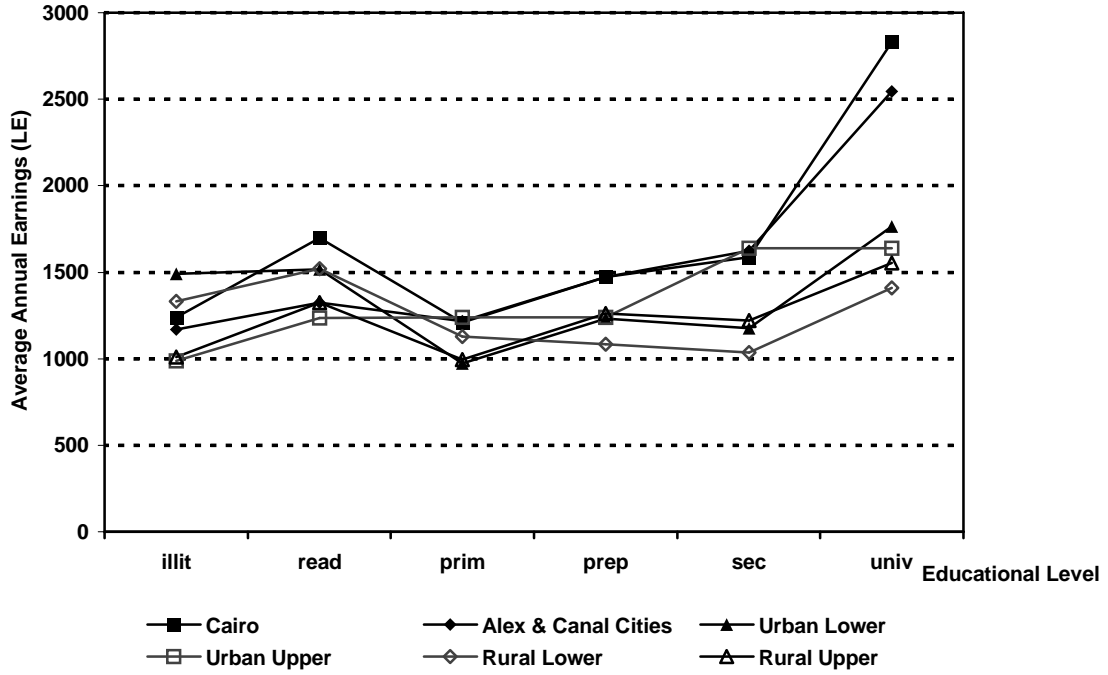**Figure 1. Average Annual Earnings by Education & Region**
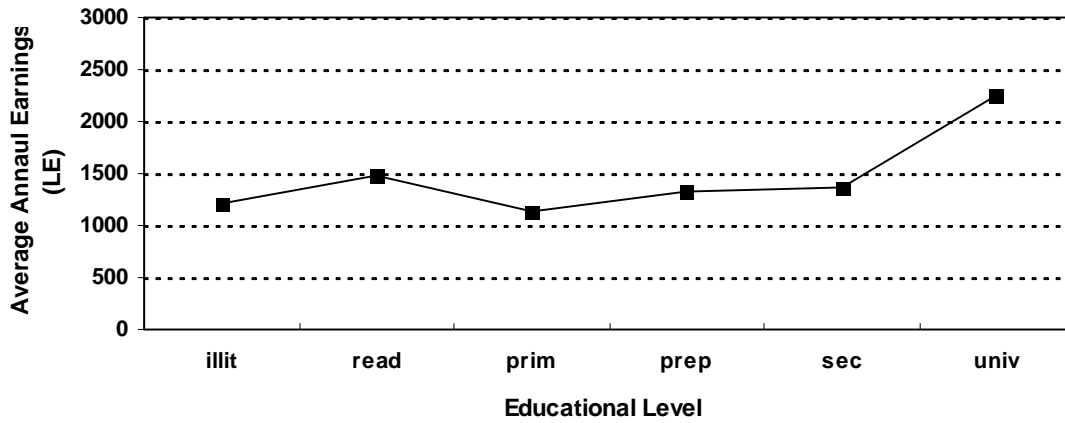

Figure 2. Average Annual Earnings in Egypt

Table 4. Impact of Human Capital Variables on Earnings

	1	2	3	4
Constant	4.894	4.597	4.651	4.963
	(180.33)	(148.84)	(147.75)	(172.26)
Schooling	0.078	0.081	0.073	
	(46.55)	(49.06)	(37.75)	
Experience	0.104	0.102	0.073	0.103
	(54.50)	(54.60)	(50.78)	(53.86)
Experience Squared	-0.001	-0.001	-0.001	-0.001
	(-37.90)	(-38.27)	(-35.97)	(-37.99)
Male		0.386	0.382	
		(19.14)	(18.98)	
Union			0.175	
			(8.23)	
Educational dummies[a]				
Read				0.220
				(8.80)
Primary				0.282
				(10.31)
Preparatory				0.611
				(24.03)
Secondary				0.746
				(18.06)
University & Higher				1.315
				(45.22)
F-statistics	1852	1852	1243	809
R^2	0.335	0.357	0.361	0.340
Adj. R^2	0.335	0.357	0.361	0.340
N	11013	11013	11013	11013

t-statistics are in parentheses.
[a]Illiterate is the reference group.

Table 5. The Coefficient on Years of Schooling: Mincerian Rate of Return (regional averages)

Country	Years of Schooling	Coefficient
Sub-Saharan Africa	5.9	13.4
Asia	8.4	9.6
Middle East	8.5	8.2
Latin America	7.9	12.4
OECD	10.9	6.8
World	8.4	10.1

Source: Psacharopoulos (1994) p.1329.

Thus my estimates of the rate of returns to education of 7.8 percent for the whole sample Table 4 (column 1), and 8.1 percent controlling for gender (column 2), are not very different from regional average for the Middle East (8.2 percent in Table 5), although the mean years of schooling for my sample is lower (5.47 years). Table 2, columns 2 and 3, show that a male worker earns 47 percent more than a female worker. Column 3 adds a further variable to the earning function, Union, to control for trade union membership. The estimates suggest that the increase in earnings associated with unionisation is 19 percent. Estimates for industrialised countries are usually of the order of 10 to 20 percent. The estimated rate of return to on-the job training is around 7 percent.

The extended earnings function method is used to estimate returns to education at different levels by including a set of dummy variables for educational qualifications in Table 4, column 4 (Table 2 gives the description of these educational dummies). A comparison of these estimates of the rates of return to the different educational levels with estimates from other countries (Table 6) would be useful. Psacharopoulos (1994) reports average rates of return to primary education of 41.3 percent in Africa, 39 percent in Asia and 17.4 percent in the Middle East (see Table 6) compared to our estimates of 4.7 percent in Egypt.[1] He also reports rates of return to secondary education of 27 percent, 19 percent and 16 percent in Africa, Asia, and the Middle East respectively; however, in the case of Egypt our estimates of the rate of returns to secondary schooling are much lower, around 7.7 percent. In addition, returns to university and higher levels

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[1] See Psacharopoulos (1994) pp. 1325-6 for a discussion on methodological issues dealing with estimation of returns to education. In the extended (dummy) specification, each education coefficient has to be related to the one referring to the previous educational level and divided by the number of incremental years of schooling separating the two levels in order for the result to be interpreted as a rate of return.
For example, the rate of returns to university education is equal to: $(1.315 - 0.746) / 4 = 14.2$ percent.
See Notes of Table 11 for elaborate discussion on calculation of returns to education.

are lower in Egypt, 14.2 percent, compared to the world average of around 20.3 percent. By international standards, rates of return to all educational levels (primary, secondary and university) are *lower* in Egypt.

Table 6. Returns to Investment in Education by Level

Country	Primary	Secondary	University
Sub-Saharan Africa	41.3	26.6	27.8
Asia	39.0	18.9	19.9
Middle East	17.4	15.9	21.7
Latin America	26.2	16.8	19.7
OECD	21.7	12.4	12.3
World	29.1	18.1	20.3

Source: Psacharopoulos (1994) p.1328.

According to the literature, the rates of returns are highest to primary education followed by secondary and then university levels (See Psacharopoulos, 1994). The declining rate of return, by level of education, is also observed across different levels of per capita income. The largest improvements in productivity occur during the early years of primary education. However, our estimates suggest that the lowest returns to education are to the first few years of schooling and the highest are to university. Thus our finding of an increasing rate of returns seems unconventional. Cohen and House (1994) find similar pattern in Khartoum, the Sudan. Their estimate of the rate of returns to university education is around 12 percent. In Malaysia, Mazumdar (1994) finds increasing return to education at levels higher than lower secondary, while Gindling et al. (1995) find that private rates of return to education in Taiwan are highest for the higher levels (university levels) and lowest for the lower educational levels.

4.2 Regional Impact

An important feature of income disparity in developing countries is the substantial differential between rural and urban sectors. This is typically accompanied by sizeable inequalities of income within the urban sector. Table 7 presents the estimates of the determinants

of earnings functions used to examine the extent to which regional differences in the level of earnings is due to regional differences in human capital variables. Six variants of the extended human capital earnings function are estimated. First, five regional dummies are added; these are Alexandria & Canal Cities, Urban Lower, Urban Upper, Rural Lower and Rural Upper. The next set of variables is included to capture differences in earnings that arise due to geographical considerations. Thus, in column 4, two dummies are included: Rural and Urban. In column 5, another two geographical dummies are added: Upper and Lower. Greater Cairo is used as the reference category for the regional and geographical dummies.

Table 7, column 2 presents the model with no regional or geographical dummies. This model explains 36.7 percent of the variance in log earnings. Adding regional dummies increases this to 38 percent of the variance (column 3). However, inclusion of geographical dummies (columns 4 & 5) does not alter the overall explanatory power. The regional dummies measured against the benchmark of Greater Cairo indicate pronounced variations in regional earnings. Thus, earnings in Alexandria and Canal Cities are only about 2.7 percent less than Greater Cairo. However, in Rural Lower Egypt earnings can be at least 11.5 percent less than Greater Cairo and up to 28 percent less in the case of Rural Upper Egypt. Also, earnings are about 18 percent and 27 percent less in Urban Lower Egypt and Urban Upper Egypt respectively compared to Greater Cairo. Moreover, there is a clearer distinction between Lower and Upper Egypt than between Urban and Rural. Thus, as in column 4, earnings in Urban Egypt are less than Greater Cairo by 16 percent while those of Rural Egypt are less by 18 percent. However, earnings in Upper Egypt are 27 percent less than Greater Cairo, while those in Lower Egypt are less by 13 percent.[2]

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[2] See Halvorsen and Palmquist (1980) for interpretation of dummy variables in semilogarithmic equations. To calculate the precise percentage change (d_1), it is necessary to compute the antilog of the regression coefficient (β_1) and then subtract one; i.e. $\beta_1 = \ln(1 + d_1)$.

5.   Determinants of Regional Earnings

In order to increase our understanding of the relationship between earnings and regions, we examine each region separately. Studies show that earnings inequality within regions is as important as between regions. Also, rates of return to schooling tend to be higher in less economically developed regions (Heckman & Hotz, 1985). Table 8 presents estimates of the extended earnings function for different geographical areas. Comparing column 1 to 6 or Urban to Rural areas, it seems that earnings in rural areas are higher for most educational levels, except for read & write and university & higher. Workers with no primary education (only read & write) and holders of university & higher degrees earn more in urban areas, especially in Greater Cairo. In the case of rural areas, only 32 percent of the log variance is explained compared to 40 percent in the case of urban areas. Also, returns to on-the-job training are higher in urban areas (11 percent) than in rural ones (8 percent).

Table 7. Summary of Results with Alternatives Specifications

	1	2	3	4	5
Constant	7.010	4.721	4.891	4.896	4.891
	(349.86)	(146.16)	(133.20)	(132.61)	(138.40)
Male		0.412	0.431	0.417	0.430
		(20.03)	(21.12)	(20.33)	(21.06)
Experience		0.097	0.096	0.417	0.430
		(50.01)	(49.82)	(20.33)	(21.06)
Experience Squared		-0.001	-0.001	-0.001	-0.001
		(-35.91)	(-35.45)	(-35.59)	(-35.42)
Union Dummy		0.71	0.161	0.165	0.157
		(8.08)	(7.65)	(8.20)	(7.49)
Educational dummies[a]					
Read		0.132	0.096	0.115	0.093
		(5.34)	(3.88)	(4.63)	(3.76)
Primary		0.181	0.123	0.136	0.118
		(6.60)	(4.43)	(4.87)	(4.28)
Preparatory		0.592	0.552	0.550	0.545
		(22.50)	(20.56)	(20.37)	(20.64)
Secondary		0.718	0.680	0.675	0.673
		(16.79)	(15.89)	(15.69)	(34.37)
University & Higher		1.208	1.143	1.148	1.136
		(36.78)	(49.82)	(34.07)	(34.37)
Regional dummies[b]					
Alex. & Canal Cities	-0.020		-0.027		
	(-0.55)		(-0.91)		
Urban Lower	-0.268		-0.203		
	(-7.69)		(-7.33)		
Urban Upper	-0.248		-0.309		
	(-6.41)		(-9.98)		
Rural Lower	-0.300		-0.122		
	(-10.88)		(-5.24)		
Rural Upper	-0.442		-0.329		
	(-14.19)		(-12.49)		
Geographical dummies[b]					
Urban				-0.177	
				(-9.16)	
Rural				-0.197	
				(-8.20)	
Lower					-0.142
					(-7.15)
Upper					-0.317
					(-14.87)
R^2	0.024	0.367	0.380	0.373	0.380
Adj.R^2	0.023	0.367	0.379	0.372	0.379
F-statistics	53.7	709	482	593	612
N	11013	11013	11013	11013	11013

t-statistics are in parentheses.
[a]Illiterate is the reference group.
[b]Greater Cairo is the reference group.

Table 8. Estimates of Earnings Function for Different Regional Areas

	All Urban	Urban (except Greater Cairo)	Urban (except Greater Cairo, Alexandria or Canal Cities)	Lower Egypt	Upper Egypt	Rural only
Constant	4.721	4.852	4.809	4.735	4.682	4.690
	(146.16)	(83.73)	(67.96)	(97.69)	(71.71)	(99.48)
Male	0.306	0.227	0.204	0.403	0.528	0.581
	(11.57)	(6.39)	(4.61)	(12.85)	(12.50)	(17.70)
Experience	0.107	0.106	0.104	0.097	0.080	0.085
	(39.43)	(29.77)	(24.43)	(32.20)	(21.51)	(29.91)
Experience Squared	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-27.82)	(-21.25)	(-16.97)	(-22.13)	(-16.00)	(-21.71)
Union Dummy	0.183	0.187	0.276	0.116	0.284	0.105
	(7.27)	(5.59)	(6.46)	(3.51)	(6.11)	(2.66)
Educational dummies[a]						
Read	0.120	0.035	0.004	0.029	0.120	0.095
	(3.31)	(0.78)	(0.07)	(0.76)	(2.57)	(2.73)
Primary	0.116	0.112	0.060	0.097	0.188	0.163
	(3.18)	(2.31)	(0.99)	(2.15)	(3.33)	(3.64)
Preparatory	0.516	0.422	0.382	0.477	0.549	0.549
	(14.67)	(9.34)	(6.91)	(10.83)	(10.51)	(11.96)
Secondary	0.641	0.561	0.473	0.620	0.657	0.682
	(12.34)	(8.20)	(5.61)	(8.25)	(7.41)	(8.36)
University & Higher	1.144	0.977	0.901	0.980	1.048	1.039
	(28.09)	(18.25)	(13.41)	(16.97)	(14.20)	(14.69)
R^2	0.401	0.391	0.407	0.381	0.305	0.320
Adj.R^2	0.399	0.389	0.404	0.379	0.303	0.318
F-statistics	451	242	176	296	141	256
N	6097	3410	2316	4345	2887	4917

t-statistics are in parentheses.
[a]Illiterate is the reference group.

Next, the earnings equations were estimated separately for each of the six regions in Egypt. These results are summarised in Table 9. Credentials seem to be important across all regions. University degree holders earn at least 146 percent more than illiterate workers across all regions. Given the large differential in absolute earnings between males and females, and since we are interested in regional earnings differentials rather than gender differentials, we estimate the same earnings functions by region, as in Table 8, for males only. The estimates support our previous

results. Returns to education vary across regions, though the rising returns are found across all

regions.

Table 9. Estimates of Earnings Function by Region

	Greater Cairo	Alexandria & Canal Cities	Urban Lower Egypt	Urban Upper Egypt	Rural Lower Egypt	Rural Upper Egypt
Constant	4.643	4.989	4.731	4.731	4.734	4.561
	(64.88)	(51.35)	(50.37)	(44.35)	(83.92)	(55.65)
Male	0.410	0.318	0.200	0.258	0.551	0.691
	(10.43)	(5.58)	(3.27)	(3.79)	(13.63)	(12.35)
Experience	0.117	0.107	0.116	0.101	0.092	0.078
	(28.55)	(16.99)	(20.69)	(16.17)	(12.83)	(17.24)
Experience Squared	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001
	(-19.57)	(-12.38)	(-13.23)	(-11.61)	(-18.67)	(-13.02)
Educational dummies[a]						
Read	0.286	0.049	-0.0004	0.005	0.037	0.159
	(4.85)	(0.70)	(-0.01)	(0.60)	(0.87)	(2.82)
Primary	0.152	0.172	0.025	0.239	0.138	0.196
	(2.73)	(2.25)	(0.32)	(2.59)	(2.49)	(2.75)
Preparatory	0.672	0.506	0.471	0.522	0.485	0.719
	(12.27)	(6.89)	(6.41)	(6.98)	(8.81)	(10.58)
Secondary	0.803	0.742	0.674	0.662	0.581	1.000
	(10.40)	(6.74)	(6.08)	(5.93)	(5.90)	(8.16)
University & Higher	1.436	1.114	1.057	1.176	0.999	1.287
	(25.40)	(14.49)	(13.53)	(13.54)	(12.83)	(11.16)
R^2	0.419	0.376	0.436	0.342	0.362	0.279
Adj.R^2	0.418	0.372	0.433	0.336	0.360	0.276
F-statistics	242	82	128	63	213	91
N	2687	1096	1331	985	3014	1902

t-statistics are in parentheses
[a]Illiterate is the reference group.

Table 10 shows the rates of return to education by region. The increase in the rate of returns

with rising educational levels is found in each region. Table 10 shows differences in the returns

to education among regions: the lowest returns are for primary education and the highest returns

are for university and higher education.

Table 10. Estimates of Male Earnings Function by Region

	Greater Cairo	Alexandria & Canal Cities	Urban Lower Egypt	Urban Upper Egypt	Rural Lower Egypt	Rural Upper Egypt
Constant	5.074	5.202	4.884	4.952	5.358	5.273
	(72.73)	(50.56)	(55.61)	(50.49)	(86.25)	(7.027)
Experience	0.120	0.115	0.122	0.105	0.089	0.078
	(26.32)	(15.66)	(19.40)	(15.87)	(22.61)	(16.43)
Experience squared	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001
	(-18.76)	(-11.79)	(-12.54)	(-11.36)	(-16.22)	(-12.60)
Educational dummies[a]						
Read	0.249	0.054	-0.030	0.028	0.020	0.146
	(4.05)	(0.72)	(-0.37)	(0.33)	(0.44)	(2.60)
Primary	0.096	0.169	0.022	0.225	0.093	0.161
	(1.61)	(2.08)	(0.25)	(2.45)	(1.60)	(2.26)
Preparatory	0.609	0.503	0.441	0.348	0.670	0.549
	(9.75)	(5.86)	(5.53)	(5.46)	(9.43)	(11.96)
Secondary	0.752	0.721	0.433	0.589	0.362	0.848
	(8.09)	(6.28)	(2.66)	(4.54)	(2.95)	(6.23)
University & higher	1.342	1.108	1.002	1.106	0.848	1.186
	(21.16)	(12.63)	(11.42)	(11.89)	(9.94)	(9.92)
R^2	0.424	0.391	0.474	0.381	0.290	0.227
Adj.R^2	0.422	0.386	0.470	0.375	0.288	0.224
F-statistics	214	77	132	69	139	69
N	2039	841	1034	788	2395	1642

t-statistics are in parentheses.
[a]Illiterate is the reference group.

The hypothesis of equality of slope coefficients across regions is strongly rejected by F tests. Rates of return to education differ among regions. Various explanations are consistent with such regional variation in the estimates. One possible explanation is that the Egyptian labour market is geographically segmented, such that returns do not equilibrate across regional markets. Difference in costs of living will affect the intercept or the constant term. Geographical segmentation may be due to factors influencing the demand for or the supply of labour. Differences in the demand for labour may arise because regions differ with respect to the availability of complementary factors of production (for example, natural resources) which alter the returns to schooling. Also, the supply side may be affected if mobility costs are not negligible or there are other forms of barriers. Evidence that estimated earnings equations are

different in different regions suggests that there are in fact different markets or segments. This empirical strategy is pursued in many studies of labour market segmentation. However, according to Heckman & Hotz (1985), the presence of differences in earnings equations by region does not, by itself, constitute irrefutable evidence in favour of segmented labour markets. Yet, this is still the most widely used approach in studies of geographically segmented labour markets.

Another hypothesis about labour market segmentation is that it influences the rate of return to the education and experience variables (See Mazumdar, 1981). This will happen if firms in the formal sector pursue wage policies which put a premium on formal education and seniority in employment. At this point the argument needs to take account of the debate between those who think of human capital attributes as enhancing the productivity of workers themselves and those who think of them as primarily screening devices. A formal sector employer may attach special importance to education or experience itself as a consequence of institutional factors in the wage determination process (for example, in the public sector).

Table 11. Returns to Education by Region (percent)

	Primary Education	Secondary Education	University Education
Greater Cairo	2.53	4.37	15.8
Alex. & Canal Cities	2.87	8.74	9.30
Urban Lower	0.40	6.77	9.58
Urban Upper	3.98	4.67	12.85
Rural Lower	2.30	3.20	10.45
Rural Upper	3.27	9.37	7.18
Urban	3.17	5.83	12.90
Rural	3.33	6.07	8.70
Lower	2.57	6.10	7.10
Upper	4.60	7.10	9.75

Note: Primary denotes workers who earned a certificate after *six* years of elementary education. Secondary denotes workers who earned a certificate after *three* years of secondary education. University and higher denotes workers who earned a university or higher degree after *four* years of higher education. To calculate the rate of return of education in the extended (dummy) specification, each education *coefficient* has to be related to the one referring to the previous educational level and divided by the *number* of incremental years of schooling separating the two levels in order for the result to be interpreted as a rate of return. These estimates are based on Table 8 (re-estimated without union dummy) and Table 9.

Assaad (1997) and Zaytoun (1991) suggest that the Egyptian labour market is segmented along private/public sectors. To examine whether our estimates are reflecting this form of sectoral segmentation as opposed to a geographical one I introduce a dummy variable for public sector employment (Table 12). In addition, I allow interaction between the dummy variable (Public) and regional dummies.[3] A public-sector worker earns 11 percent less in Lower Egypt and 19 percent less in Upper Egypt than in Greater Cairo. Compared to a public sector worker in Greater Cairo, a public sector worker in urban areas earns 17 percent less, while one in rural areas earns 27 percent less. This is another indication in support of the hypothesis that there is geographical segmentation in the Egyptian labour market. Also, Table 12 shows the interaction between public sector employment and the education dummies (columns 4-6). The estimates

suggest that public sector employees earn more than private sector workers at all educational

levels except for the university level, where they earn more in the private sector.

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[3] To interpret the coefficient of interaction dummies see Johnston (1987).

Table 12. Public Sector Employment and Estimates of Male Earnings Function

	1	2	3	4	5	6
Constant	5.252	5.227	5.240	5.293	5.250	5.273
	(139.12)	(130.23)	(131.36)	(132.88)	(124.44)	(125.67)
Experience	0.100	0.100	0.100	0.099	0.099	0.098
	(48.77)	(48.47)	(48.38)	(47.57)	(47.40)	(47.28)
Experience Squared	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-36.51)	(-36.68)	(-36.40)	(-35.74)	(-36.01)	(-35.70)
Union	0.169	0.181	0.173	0.166	0.179	0.170
	(6.95)	(7.38)	(7.09)	(6.84)	(7.28)	(6.98)
Educational dummies[a]						
Read	0.125	0.149	0.130	0.122	0.153	0.126
	(4.87)	(5.79)	(5.05)	(3.93)	(4.90)	(4.06)
Primary	0.173	0.193	0.177	0.092	0.125	0.103
	(5.90)	(6.53)	(6.03)	(2.65)	(3.57)	(2.95)
Preparatory	0.618	0.623	0.620	0.580	0.607	0.596
	(19.26)	(19.26)	(19.24)	(13.21)	(13.67)	(13.53)
Secondary	0.744	0.748	0.740	0.538	0.594	0.549
	(13.86)	(13.88)	(13.75)	(5.57)	(6.12)	(5.69)
University & Higher	1.222	1.221	1.210	1.326	1.369	1.343
	(31.46)	(31.08)	(31.05)	(19.86)	(20.36)	(20.10)
Regional dummies[b]						
Alex. & Canal Cities	-----	-----	0.076	-----	-----	0.080
			(1.61)			(1.68)
Urban Lower	-----	-----	-0.165	-----	-----	-0.161
			(-3.82)			(-3.72)
Urban Upper	-----	-----	-0.321	-----	-----	-0.322
			(-6.44)			(-6.41)
Rural Lower	-----	-----	0.024	-----	-----	0.024
			(0.75)			(0.71)
Rural Upper	-----	-----	-0.253	-----	-----	-0.257
			(-7.26)			(-7.19)
Geographical dummies[b]						
Urban	-----	-0.131	-----	-----	-0.126	-----
		(-3.88)			(-3.71)	
Rural	-----	-0.085	-----	-----	-0.083	-----
		(-2.84)			(-2.67)	
Lower	-0.044	-----	-----	-0.049	-----	-----
	(-1.59)			(-1.72)		
Upper	-0.294	-----	-----	-0.302	-----	-----
	(-9.70)			(-9.75)		

Table 12. Public Sector Employment and Estimates of Male Earnings Function (continued)

	1	2	3	4	5	6
Public Sector dummies						
Public Sector (Dummy = 1)	-0.133	-0.073	-0.068	-0.215	-0.111	-0.131
	(-4.03)	(-1.91)	(-1.79)	(-4.40)	(-2.07)	(-2.46)
Public * Urban	-----	-0.107	-----	-----	-0.107	-----
		(-2.25)			(-2.22)	
Public * Rural	-----	-0.250	-----	-----	-0.248	-----
		(-5.35)			(-5.18)	
Public * Lower	-0.230	-----	-----	-0.222	-----	-----
	(-5.53)			(-5.53)		
Public * Upper	0.023	-----	-----	0.035	-----	-----
	(0.50)			(0.74)		
Public * Alex & Canal	-----	-----	-0.205	-----	-----	-0.203
			(-3.10)			(-3.07)
Public * Lower Urban	-----	-----	-0.119	-----	-----	-0.116
			(-1.94)			(-1.88)
Public * Upper Urban	-----	-----	0.025	-----	-----	0.030
			(0.37)			(0.44)
Public * Lower Rural	-----	-----	-0.365	-----	-----	-0.358
			(-7.13)			(-6.84)
Public * Upper Rural	-----	-----	-0.075	-----	-----	-0.067
			(-1.25)			(-1.10)
Public * Read	-----	-----	-----	0.050	0.014	0.043
				(0.89)	(0.24)	(0.76)
Public * Primary	-----	-----	-----	0.255	0.204	0.231
				(4.17)	(3.30)	(3.76)
Public * Preparatory	-----	-----	-----	0.105	0.046	0.072
				(1.71)	(0.74)	(1.17)
Public * Secondary	-----	-----	-----	0.324	0.229	0.289
				(2.82)	(1.98)	(2.52)
Public * University & Higher	-----	-----	-----	-0.078	-0.160	-0.120
				(-0.99)	(-2.01)	(-1.52)
R^2	0.379	0.371	0.381	0.381	0.373	0.383
Adj.R^2	0.378	0.370	0.380	0.380	0.372	0.382
F-statistics	410	396	283	298	288	226
N	8741	8741	8741	8741	8741	8741

t-statistics are in parentheses.
[a]Illiterate is the reference group.
[b]Greater Cairo is the reference group.

It is interesting to examine whether regional earnings differentials can be explained by different endowments, among the regions, of productivity-related characteristics such as education and

work experience. If workers are paid according to the same wage structure, endowment differences will account for all the observed earnings differentials. I use the Oaxaca (1973) wage decomposition, which is the standard methodology for analysing observed earnings differentials and is based on the idea that earnings are determined according to given earnings structures.

We wish to decompose the observed wage differential into two parts, one that can be attributed to observed characteristics of the region, called the endowment differential, and another unexplained differential that is a manifestation of the segmentation of the regional markets. In the labour literature this is called discrimination. We begin the relation between the differential in sample mean wages expressed as a function of mean observed characteristics. From estimated regressions for each region we obtain the following relations for mean wages:

$$W_c = Z_c \, b_c \tag{2}$$

$$W_o = Z_o \, b_o \tag{3}$$

where $\mathbf{W}_c$ and $\mathbf{W}_o$ are the mean logs of earnings, b_c and b_o are vectors of the estimated regression coefficients, and $\mathbf{Z}_c$ and $\mathbf{Z}_o$ are the mean values of the corresponding explanatory variables for Greater Cairo and the "other region", respectively. The gross difference in mean earnings between the two regions can then be expressed as:

$$\mathbf{W}_c - \mathbf{W}_o = \mathbf{Z}_c \, b_c - \mathbf{Z}_o \, b_o \tag{4}$$

By adding and subtracting $\mathbf{Z}_o \, b_c,$ this difference can be written as the sum of two terms:

$$\mathbf{W}_c - \mathbf{W}_o = (\mathbf{Z}_c - \mathbf{Z}_o) \, b_c + \mathbf{Z}_o \, (b_c - b_o) \tag{5}$$

The first term on the right hand side is the mean Cairo wage minus the predicted wage for the other region if the market rewards there were the same as in Cairo. This term is usually known as the difference in wages between the two regions due to differences in observable characteristics, **Z**, or the part of the regional wage differential due to difference in endowments. The second term is the wage difference arising from different rewards in the two regions, $b_c - b_o$, evaluated at the mean of characteristics of the other region. This is the unexplained difference, or the residual, of the wage gap, which we can attribute to a number of factors that cause segmentation of the labour markets in the two regions.

Table 13 summarises the results of the regional wage decomposition in Egypt computed using coefficient estimates from Table 9. An important finding is that a large percentage (between 45 percent to 63 percent) of observed earnings differential is due to differences in regional endowments. In other words, around half the regional earnings differentials in Egypt can be explained by different productivity-related characteristics, such as education and experience, among the various regions.

Table 13. Decomposition of Regional Wage Differentials in Egypt

	Endowment Difference	Residual Difference	Overall Differential
Alexandria & Canal Cities			
Log	0.363	0.212	0.575
percent	63.3	36.7	100
Lower Urban			
Log	0.396	0.452	0.848
percent	46.7	5.3.3	100
Upper Urban			
Log	0.354	0.384	0.738
percent	48.0	52.0	100
Lower Rural			
Log	0.485	0.330	0.815
percent	59.5	40.5	100
Upper Rural			
Log	0.393	0.487	0.880
percent	55.3	44.7	100

N.B. Based on Earnings structure of Greater Cairo
Endowment difference is $(\mathbf{Z}_c - \mathbf{Z}_o) \, b_c$, residual difference is $\mathbf{Z}_o (b_c - b_o)$.
The overall differential is Endowment + Residual Difference.

6. Conclusion

This paper presents an empirical investigation of the determinants of labour market earnings and of earnings inequality in the Egyptian labour market. Using a human capital model, the determinants of regional earnings are examined. The relative importance of personal and regional effects on earnings inequality is assessed.

The analysis has produced these main findings. First, the estimated rates of return to education increase with rising educational levels. This is different than the common pattern found in most countries. According to Psacharopoulos (1994), who surveys over 60 countries, the highest returns tend to be for primary education. In the case of Egypt, the rates of returns to educational qualifications are highest for university & higher education. Second, there are

variations in returns to education across regions. A university graduate earns at least one and a half times more than a worker with no schooling in Urban Lower Egypt and twice as much in Greater Cairo. Also, around half the regional earnings differentials in Egypt can be explained by different productivity-related characteristics, such as education and experience, among the various regions.

This study also points to the importance of credentialism in the Egyptian labour market. Educational degrees provide a signal and serve as a convenient screen rather than improve workers' productivity. This is especially true in the case of university degrees mainly due to the public sector hiring practices. Also, there is an indication to support the view that the Egyptian labour market is segmented geographically. However, future tests are needed to have more conclusive evidence.

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