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Relation between Education, Cognitive Abilities and Wages in the Informal Sector in Greater Khartoum (Sudan)

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Acknowledgements

Abstract/ Summary

Many studies have focused on the effect of education and economic growth on wages in the developed and developing economics countries. This thesis examined the effect of education and cognitive ability on the wages of educated people living in Khartoum-Sudan and working in the informal sector. The reaserch showed a correlation between education and wages in the informal sector in Khartoum ($p= 0.012$). Indeed other detectable and undetectable factors, e.g. country economic growth, social norms and corruption, do affect the relation between education and wages.

Key terms: **Khartoum informal sector; Education; Wages**

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1. Introduction:

Education has been for since the industrial revolution the main power driving the economic growth. The state investment in education in industrialized countries helped people to increase their income. In these healthy economics there are strong links between education and productivity, education and wages, wages and productivity, and as a result between productivity and economic growth (scheme 1).

Education ⟶ Wages

Productivity
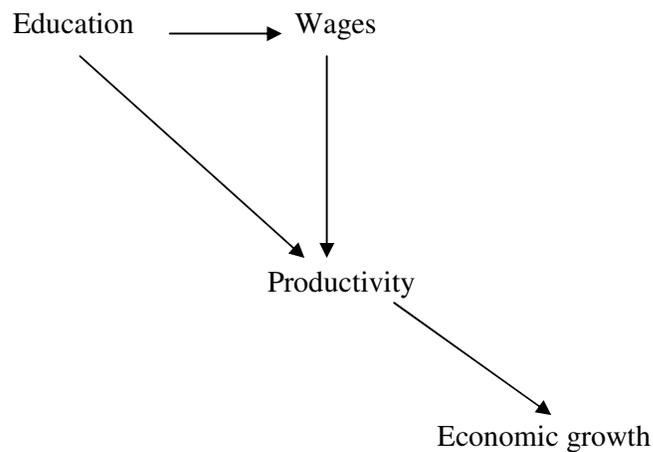
Economic growth

Scheme (1): A Schematic representation of the links between education and productivity, education and wages, wages and productivity, and as a result between productivity and economic growth.

The differences between countries and regions in the human capital potential have been related to differences in cognitive skills and quality of education. Good quality of education supports people with cognitive skills. It is indeed difficult to measure education quality or school quality as there are many factors that need to be taken into account, including student abilities, teachers, skills, books, class room, facilities and so on. There is an agreement between the economists that education has a correlation with economic growth, some of them their main focus is in the quality of education. The education system, instead of focusing on producing for example civil servants, might need to be able to create skilled labor, to increase productivity. "Education is both the seed and the flower of economic development" (page 1131 of Alan B. and Mikael. 2001).

1.1. Objectives of the Study

The thesis aims to study the extent to which wages in Khartoum, the capital of Sudan, have been fulfilled through education and cognitive skills. This knowledge is needed in order to assist the Government, education institutions and organisations to develop the informal sector strategies in an orderly and effective way. Through literature studies and interviews, some light will be shed on the socio-economic situation of Sudanese men and women 30- 45 years old, who worked in the informal sector and lived in the Greater Khartoum in the beginning of 2007. We mainly focus on the cognitive skills of the people working in the informal sector in Khartoum in the first months of 2007.

The thesis provides a background to the education and wages of the informal sector in Khartoum.
It also presents the theories and concepts related to productivity and economic growth in the informal sector and their relation with education and wages leading to disappointment or success.

1.2. Structure of the Research

In addition to the general introduction about education and economic growth, this study consists of seven chapters:

Chapter 2 provides a background to the relation between education and economic growth, from the point of view, through the production function, micro and macro evidence.

Chapter 3 presents the relation between; education and wages, wages and productivity and finally the informal sector.

Chapter 4 shows education and wages in Khartoum - Sudan.

Chapter 5 contains the data presentation, research methodology and some analysis.

Chapter 6 presents the study results and discussion

Chapter 7 offers the conclusion and some guidelines for further research.

2. Education and growth

2.1. Production function

For a long time economists have paid attention on factors that would lead, in the long term, to economic growth and how these factors will help the poor countries to grow faster. Some scholars believe that technology is the key factor for high economic productivity, and production of new and/or better innovations. Solow (1956) considers technological development as the main source for growth in the long run. Since the relation between technology and human capital is strong (Nelson and Phelps 1996), human capital has a high influence on the economic growth. Multiple factors are involved in the efficiency of the human capital including poverty, health and education. The new growth theory models see human capital as an important input in the creation of new ideas, and education as a determinant of growth rates.

There are two approaches to frame the relation between education and growth. One is that growth in countries could be different according to the levels of their human capital accumulation over time. Alternatively the human capital stocks are considered as leading to growth by helping the poor countries to catch up the leading countries by adapting more innovations (Nelson and Phelps 1966). Lucas (1988) points out from the endogenous growth theory, that the human capital is a vital drive for sustainable growth and emphasizes the importance of education "*educated people appear as human capital*". Nelson and Phelps (1966) supported the argument that human capital stocks lead to growth and pointed out the importance of technology and innovations. According to their hypothesis, different nations have different human capital stocks leading to differences in economical growth rates.

Since the time of Adam Smith, it was clear to the economists that economic growth and development are the nature and causes of the wealth of nations. Some scientists, 1950s and 1960s, pointed out the role that education play in economics. Since then the economists linked the role of education on the economic growth (Robert Lucas 1988; Robert Barro 1991; N. Gregory Mankiw, David Romer, and David Weil 1992) believing that a higher level of education promotes economic growth. The growth theory does not identify a role for higher education as a factor of long - term growth. On the other hand, if more education will be linked to increased growth rate, then this economy will be better - off than the one with

similar economy but with less education. Thus, education might have level effects and growth effects (scheme 2). Education in level effects does not take long time to make changes in the GDP and can easily to be identified while education in the growth effects takes longer time.
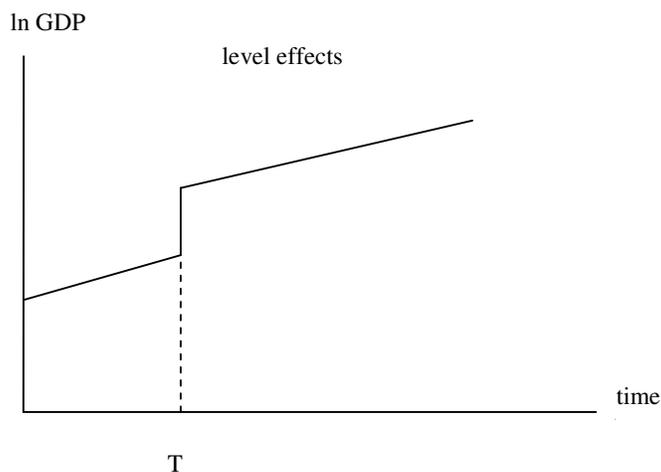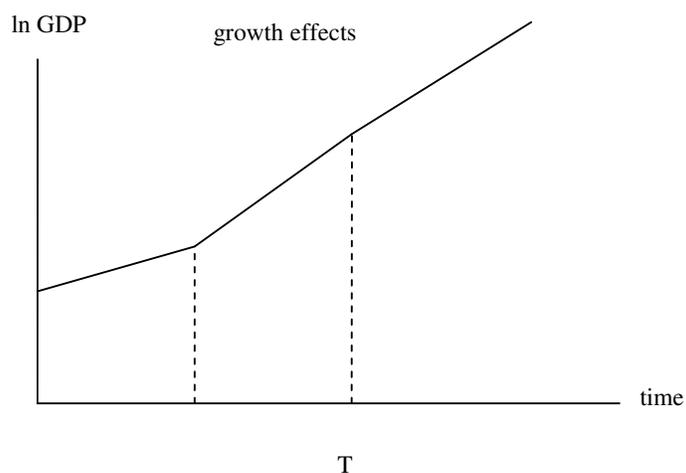
Scheme (2): Schematics representation of the growth effects and the level effects.

The idea that increased human capital should give increased production seems very reasonable as discussed by Mankiw (1992) and Pritchett (2001) while estimating the component of human capital in the aggregate production function. Mankiw (1992) and Lucas (1988) discussed Solow model by taking into consideration the growth rate, the population growth and the saving rate, which argue that if the population is high the saving rate is low. If the determinations of the production function are changing, they will cause changes the

growth rate balanced path, which is called the growth effects. If the changes takes the balanced growth path up or down without changing the slope, then it is level effects. Solow (1956) concluded that the changes in the saving rates are level effects.

Mankiw (1992) had made a connection between physical and human capital. Countries save more physical capital grow faster. Those countries with higher saving rate in the physical capital have higher income in steady state, which it leads to a higher level of human capital. Since the factor productivity is determined by the physical and human capital, then the total factor productivity raises by the higher saving rate (Mankiw 92). In the theoretical literature human capital accumulation is often included as a variable at the microeconomic level, as in Mankiw (1997). In the empirical literature, however, only a weak link can be found between such accumulation and growth.

The link between education and growth starts with a theoretical examination based on the production function of Mankiw et al (1992). The link between education and aggregate production can be investigated using Solow's production function:

$$Y = AK^{\alpha_K} L^{\alpha_L} \tag{1}$$
$$(\alpha_K + \alpha_L = 1)$$

And Mankiw's model:
$$Y = AK^{\alpha_K} L^{\alpha_L} H^{\alpha_H} \tag{2}$$

Y is aggregate production, A is total factor productivity (the level of technology in the economy), K is capital, H is human capital, and L is labor. Finally, $\alpha_K, \alpha_L, \alpha_H$ are parameters, and $\alpha_K + \alpha_L + \alpha_H = 1$; that is, there are constant returns to scale.

If we divide through by L and take logs, and adopt the notation that small letters indicate values per capital ($y = \dfrac{Y}{L}$, etc.), then we can write

$$\frac{Y}{L} = \frac{AK^{\alpha_K} H^{\alpha_H}}{L^{\alpha_K + \alpha_H}} \tag{3}$$

$$\frac{Y}{L} = A\left(\frac{K}{L}\right)^{\alpha_K} \left(\frac{H}{L}\right)^{\alpha_H} \tag{4}$$

$$y = Ak^{\alpha_K} h^{\alpha_H}$$

$$\ln y = \ln A + \ln k^{\alpha_K} + \ln h^{\alpha_H}$$

$$\ln y = \ln A + \alpha_K \ln k + \alpha_H \ln h$$

Taking derivatives with respect to time (w.r.t.) we obtain the growth rate of log-linear production,

$$\frac{\partial \ln y}{\partial t} = \frac{\partial \ln A}{\partial t} + \alpha_K \frac{\partial \ln k}{\partial t} + \alpha_H \frac{\partial \ln h}{\partial t} \tag{5}$$

$$\hat{y} = \hat{A} + \alpha_K \hat{k} + \alpha_H \hat{h}$$

So the growth rate of production is equal to the growth rate of technology plus α_K times the growth rate of capital plus α_H times the growth rate of human capital.

Equations (1 - 5) show that a one-off increase in human capital should give a one-off increase in production, and that constant growth in human capital should give constant (although lower) growth in production. So the level of human capital affects the level of production, but not the economic growth. If the human capital affects the growth rate of production, there must be a link between $\hat{A}$ and h. That is, $\hat{A}$ is an increasing function of h. That is, the more human capital there is in an economy, the faster the level of technology should increase.

Looking to our production function equation, we could see how the relation between human capital and production look like:

$$\hat{y} = \hat{A} + \alpha_K \hat{k} + \alpha_H \hat{h} \tag{6}$$

In fact, considerable efforts have been spent to increase the human capital (h) in "Africa" through education (Pritchett 2001, Easterly 2002). This means that (h) increases similarly to $\hat{h} > 0$, then $\hat{y}$ should be greater than zero (positive), thus y must go up i.e. growth. This macro evidence shows that the relation between growth and education is weak.

It is not obvious whether the increase in human capital has a positive effect on the growth rate of technology. However, possible mechanisms were discussed already by Nelson and Phelps (1966), who speculated that more educated individuals might tend to take up new technologies more rapidly, thus leading to a higher growth rate.

$$\hat{y} = \hat{A}(h) + \alpha_K \hat{k} + \alpha_H \hat{h} \tag{7}$$

The growth of A is a function of h. Nelson and Phelips (1966), see that h has to be effective to create technology, and education attainment strongly improve the technological progress. Which it means from our model; improve of A depends upon h. in words "the economy grow by more technological progress depends on more education attainments".

Nelson and Phelps (1966) showed education as the economic corner stone. For helping economic to grow, we need effective labor, to master, understand, and effectively perform the given job. This could happen by training that needs certain type of education, to have ability that the labor could perform many jobs. In our life to day, we need to have a technological back ground to be able to function most of the jobs. They see that education has a big role in the economic growth theory, since the theory would like to estimate how much output should be through the production function, which measure how the output depends on the capital goods, the number of labors, and education of those performed the job. Putting it on other words, effective labor based on education attainments generates the output for the production function. From the model Nelson and Phelps (1966) emphasized the positive payoff of the

education if the technology has been continually improving. In other word, education as a key factor for the technological diffusion, which it helps for more innovations that lead cycle of economics rolling. A good manager needs to be educated to adapt new techniques. The educated farmers in the United States they adapted new innovation to increase their productivity before the farmers with less or no education.

To link education to economic growth, we need to look at the Solow model (1965) in the output in a function of factor inputs. Solow model assumes only two inputs, labor (L), and capital (K), for only one output (Y). If we suppose that the labor different level of education could be identified by L with respect to time, and then here the labor input has different output, it differs between country to country for example. Then we could find that the share of labor depends on the level of labor which could be equivalent to the education attainments.

If the average number of education's years for the workforce increases by one year in a country, and if the educated and uneducated once substitute each other, so the labor supply will increase by one, it dose not matter if every one's education increased by one and or some others less than one year. This increase in the effective labor will increase the output. Countries have high education level will have more capital per labor; this fact could be clear if the capital per these effective labor has the same amount before get more education and after getting more education (Stevens, and Weale 2003). It is still difficult to know the extent by which education effects economic growth. On the other hand there are strong supports that education will help countries to make good use of technology to increase the labor productivity.

Easterly made a comparison in the per capita income and found it higher in the United States is higher than in India being similar in unskilled wages. According to Mankiw model, if India is poor because it lacks skilled labor, then the skilled labor should have very high wages. In the production function down here; we could see that education has a week effect on the total factor productivity (TFP) and $\frac{\partial y}{\partial h}$ is high as shows in this equation.

$$y = Ak^{\alpha_K} h^{\alpha_H}$$

$$\frac{\partial y}{\partial h} = \alpha_H \left(Ak^{\alpha_K} h^{\alpha_H} \right) \Big/ h$$

$$\frac{\partial y}{\partial h} = \alpha_H y \Big/ h$$

2.2. Simple Micro and Macro Evidence

Empirical work on education and growth at best shows, that the link between education and growth is weak. At worst, it is non-existent. On the other hand, there is clear empirical evidence of a link between education and wages. This appears to be a contradiction, which Pritchett (2001) tries to resolve by suggesting that education might have a negative effect on TFP, i.e. the level of technology in the economy.

Education quality was pointed by Abdel Gadir and Elbadawi, for all countries especially the developing countries, they better to focus on the quality more than in quantity of education. The cross-country data show a negative relation between education and growth in some countries. Sudan has been one of these countries. Table (1) shows this relation. (AbdelGadir, A. and Elbadawi, A. 2002)

Table (1): Human Capital and Growth in Sudan 1980-2000

Period	Growth Rate of Human Capital per Worker (%)	Growth Rate of Per Capita GDP (%)
1960-1965	4.56	-1.25
1965-1970	4.39	-0.61
1970-1975	6.01	-1.85
1975-1980	6.55	4.09
1980-1985	3.29	-0.34
1985-1990	3.87	-0.45
1990-1995	3.31	0.33
1995-2000	2.09	2.94

Source: AbdelGadir, A. and Elbadawi, A. (2002).

Table (1) shows a negative and positive relationship in some years between the growth in the stock of human capital per worker and per capita GDP. Since the output elasticity in whole

period is less the one unit, this shows there is no matching relationship between the growth rate of human capital stock per worker and per capita GDP growth.

The finding of AbdelGadir, and Elbadawi (2002) matched Easterly is relation between education and growth. Easterly (2002) noted that many studies could not find strong or even any response between education and economic growth, even with the entire education explosion. The lack of growth in Africa despite the education explosion made Easterly to question "where has all education gone?" The relation between growth in human capital in terms of education and growth of output per worker was negative. Figure (1) shows the negative relationship between growth in Education and growth of out put per worker, in a comparison between Africa and East Asia.

Barro and Sala-i-Martin (1995) also found a significant relation between education and growth while other literature mentions that primary education might have insignificant relation. Some time the relation between growth and education is like a mystery or as a puzzle (Temple 1999). Some foundations found that economic growth has a weak relation to the increase in educational achievements.

Temple (1999) presented different argument in the relation between economic growth and education achievement. Temple considers the inconsistency in the relation as a puzzle, he built his argument upon micro econometric evidence. The increase in human capital and economic growth has a hidden correlation explaining the hidden unclear observations.

Percent per Annum
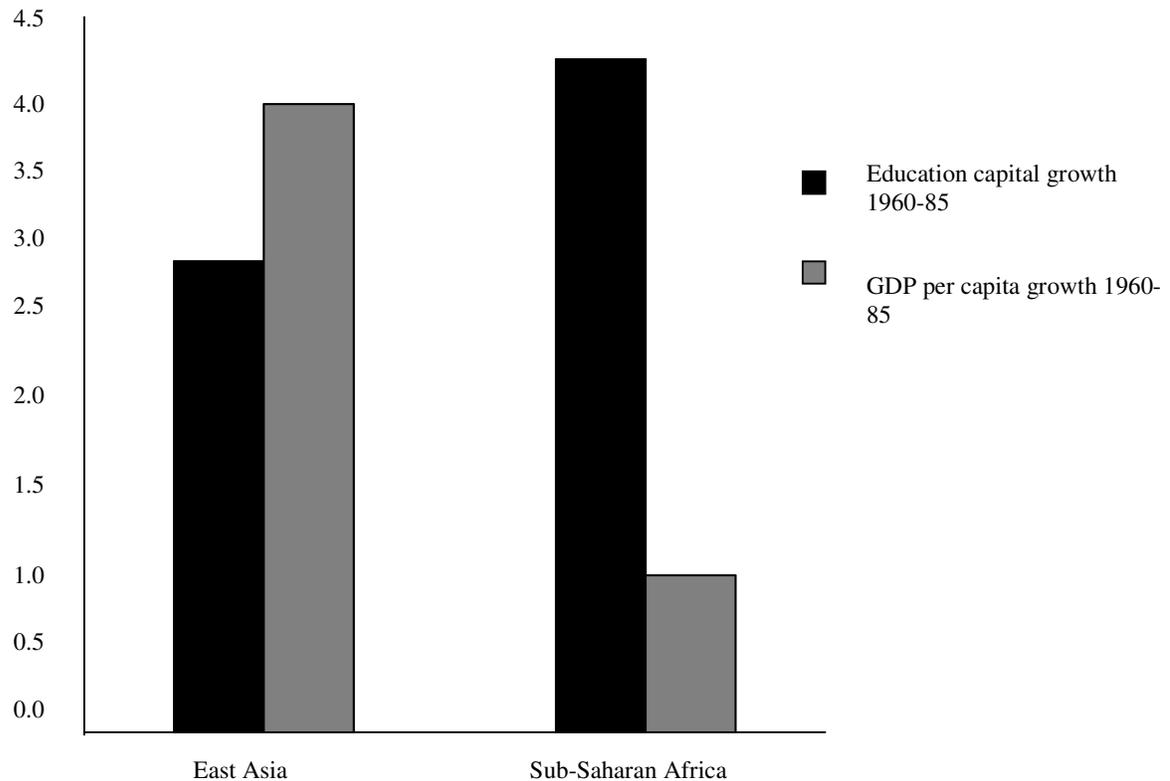
Figure (1): The relationship between Education and growth.
Source: Easterly, W. (2001).

Temple (1999) cites others who highlighted the weak correlation between education attainment and growth (Benhabib and Spiegel 1994, Pritchett 1997). Temple indicates that the correlation is not weak. By using the cross-country growth regressions, he showed a fairly strong relation between increases in human capital and output growth in 64 countries. Countries with little human capital accumulation might have insignificant effect of their human capital. Temple discussed that the ordinary least squares (OLS) regression is not always the best way to estimate cross-country growth regression and might mislead the relation between the importance of the human capital and out put per worker. An important aspect of his investigations relates to the sensitivity of using the reverse regression for the measurement error. The measurement error could be caused by the wide human capital coefficient, especially in samples from the developing countries.

Education has a positive correlation with income. Many scholars highlight strong evidences of a substantial payoff to investment in education. The findings of Alan B. and Mikael (2001)

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show that earning increases with the number of the years in school, e.g. in United States. Some literatures talk about inherited ability and its correlation to earning. The micro evidence has not been clear about the social return and the private return to schooling. Alan and Mikael (2001) came out with different analysis of micro and macro literatures on education compared with Benhabib and Spiegel's (1994) and Barro and Sala-i-Martin's (1995). They highlighted the conclusion that the "measurement error", accounted in education while the years of schooling are correctly counted, explains the cross-country regressions showing that education correlated to economic growth. Benhabib and Spiegel (1994) show no correlation between the change in education and the economic growth. Alan and Mikael (2001) also came by some evidences that the finding by Benhabib and Spiegel's (1994) are not correct because the data used did not show any relation between education and economic growth.

Pritchett (2001) found some conflicts between the micro and macro evidence. The micro evidence supports the idea that wages increase for each additional year of schooling. On the other hand, the macro evidence from the entirely standard growth accounting shows a growth negative impact on education. Pritchett (2001) observes that the impact is varies across countries, and he is wondering about the reasons for this variation? Pritchett has more than one answer that will be mentioned latter. Nevertheless, there is still no single argument to reduce the investment in the basic education, no one thinks that basic education is not needed. We can not deny that education has other benefits; e.g. by lowering the child mortality rate (educated mothers) in a way that effects the economic growth. Education helps to create cognitive skills even if its level is low (Pritchett 1996 and 2001).

2.3. Macroeconomic Models "Where has all the education gone?"

The relation between education, wages and growth has been always a puzzle. Surrounded by disagreement between the micro and the macro evidences. According to the micro evidence, the relation between wages and schooling is strong. Accordingly, this evidence means that the wages increases with additional schooling attainment which leads to growth. Thus, on the other hand, the macroeconomic do not see any impact of education on growth. Temple (1999) concludes that the impact of education on growth is different between countries, while Pritchett (2001) asks the questions "why are these differences" and "where has all the education gone?". In the Sub-Saharan African countries, it has been witnessed that there is enormous improvement in the education attainment, but still the wages are not high and the

economic growth is slow (Easterly 2002). Pritchett answers were not similar for every country, suggesting other differences between countries:

1. Education might not lead to socially productive activities. Education is, sometimes, not a strong economic component. For example in Saudi Arabia in 1988 half of the university students were studying social sciences as culture and humanitarian subjects, which play only small role in the economic output (Pritchett 1996 and 2001).

2. The educated labours have not been demanded in the labour market. Pritchett sees the economic mystery as a reason behind the puzzle of the education and growth, and that is why the private rate of return to education is differing. The educated labour used to be hired by the government, but what do they do there? and are they productive or not? The story of the Western Africa countries provide evidences that governments might not be able to employ all universities graduates. The government guarantee to employ the educated people, leads to great confusion in the labour market and might lead to overstaff.

Mincer (1974) first estimated that the marginal return to more years of schooling can be totally different and diverse between countries and time from the average returns. The return to schooling can be rising, falling, or stable in different countries. The wage of the educated labor could rise or fall in the labor market with the demand and supply respectively. According to Mincer coefficients, there has been a rise in the United States in the 1980s while there was a falling in the return to schooling in Egypt and some sort of stabilization in some Central American countries. In the African countries, the expansion of the educated labor often goes beyond the wage expansion, and leads to fall in the return to education.

Some economist thoughts to built on technological progress to raise the returns to education. Pritchett thinks that returns to education might need a continuous technology adoption. When India adopted technology, the education correlated to economic growth. Thus, the technological progress gave higher returns both in economic growth and schooling, which lead to more education expansion. Good policies are needed to create higher returns to schooling and growth. Pritchett thinks that if open trade policies are established in the developing countries they might lead them to catch up higher returns to education and adoption of new technologies.

3. The education system has not been able to produce highly or even unskilled labor. In the developing countries, schooling quality might be a bit laid back compare to OECD and some of the Asian countries.

3. Education and wages

Many studies show that an individual's level of education is positively correlated with their level of wages. Indeed, Pritchett (2001) claims that this is one of the most well-established facts in economics. However, establishing causality is difficult as it is not clear whether high education and high wages are caused by a third independent factor. Furthermore, even if higher levels of education do lead to higher wages, this need not imply that a more educated population is more productive. In this section I will investigate some of these questions.

For some years ago, the belief was that expansion of education will lead to economic growth. The Solow model shows that the impact of education on the economic is less than the expectations (Pritchett 1997). Interestingly, Moll (1998) highlighted that education through increasing the cognitive skills has significant role in determining the distribution of wages in South Africa.

3.1. Causality and the link between education and wages

Jacob Mincer's (1974) formulation of the log-linear relationship between earnings-education has been used by Alan and Mikael (2001). In the United States, the earnings increased by each extra year of schooling even though the education rate of return differ over time across countries. There are some hidden variables that might be correlated with earnings and education, e.g. inherited abilities. Each additional year of schooling provides other skills that lead to higher earnings, irrespective of the education level.

Mincer's idea is that if earnings increase by additional year of schooling, then we find a linear relation between the log of earnings and individuals' years of schooling. Mincer's estimated in his model that the time spent in school could determine the earnings. Mincer's wages equation has been used for some countries (United States, Sweden, West Germany, and East Germany) by OLS. The log-linear relationship between education and wages has been illustrated by the plots in Figure (2).
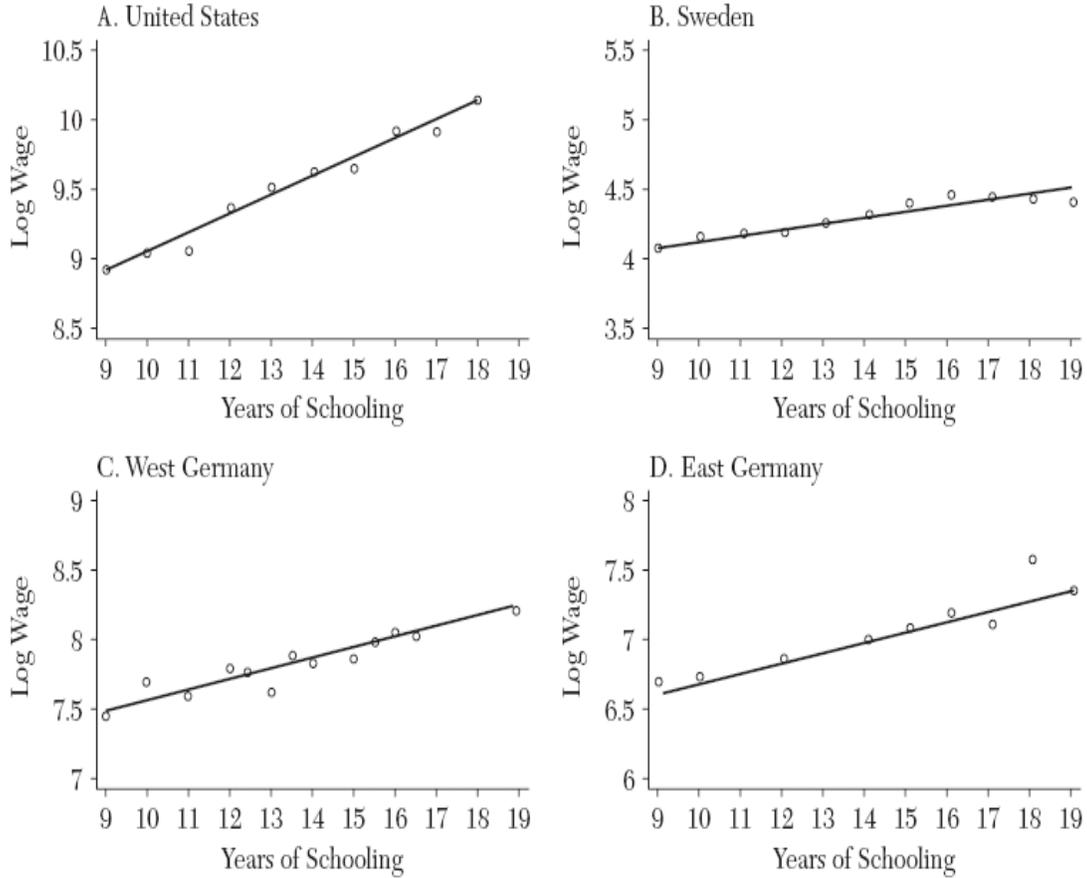
Figure (2): Schooling-Log Wage Relationship and Mincer Earnings Specification
 Source: B. Krueger (2001).

Mankiw's forecast about wages of skilled people in the poor countries has been criticized. The scarcity of skilled people in poor countries should raise their wages compared to the unskilled ones. Eastery (2002) in his example about India and United States argued that if, according to Mankiw, the skilled workers should have much higher wages in India compared to the unskilled ones, than skilled workers from rich countries like United States showed to India, and the unskilled workers should move from India to United States. However, the opposite happens in reality and the skilled workers move from India to United States. Even we find people from poor countries with higher education tend to move to United States. A specialist in India earns very little per year compared to his peer in United States.

3.2. The link between wages and productivity

Many economists defined wage as a compensation of a service produced by a worker. This compensation could be cash or commodities. It is measured by the amount of the produced service, and the demand and supply of that service. Therefore, wage has strong relation with productivity in the sense that as much as the worker increases her/his productivity, the wage will increase as well. In addition, there is a large difference in income between poor and rich countries.

There are two reasons why highly educated people earn higher incomes. First, people with higher education tend to be compensated for the time spent in school. Second the educated people demonstrate their ability to use the resources economically. In other words, a highly educated person has a higher income and tends to have high productivity level (Omer S. Ertur, William J. House 1994).

3.3. Could education lead to higher wages at the expense of others?

Easterly (2002) asked a question about, what the educated people do with their skills. Here government's policies play a significant role. Skilled people take advantages of the wrong policies, which creates high profit opportunities for individuals. For example, if a government controls the market, this policy immediately creates a black market and the skilled people will make high incomes by working in this black market. This does not lead to higher GDP because the money will be flowing only in individuals pockets.

When people get low salaries, they tend to abuse their positions; corruption being the right word to use. Easterly showed some examples from different countries. In Malawi, the government offer free note books, pens, and other requirements to students for free during their schooling. As teachers receive low salaries, they end up selling these tools.

Some countries produce highly skilled educated people, but there is no demand for them in the country labor market because of some wrong policies. All these skills do not go to the right places, educated people working as buss drivers, selling cloth in the streets, or emigrate to rich countries, for example, the skilled Indians emigrating to United States looking for jobs (Easterly 2002).

3.4. The informal sector

The informal sector is criticized for lower wages compared to the formal sector. It is difficult to determinate the size of the informal sector, which is important as income and productivity could be identified by the size of service. Some other factors might involve as well, e.g. education, and experiences and inherited activity. That is why the informal sectors employees tend to work more hours than those in the formal sector in order to produce more services and earn more.

Contacts in all of the informal sector activities are important, as employment, job seeking and hiring. When an employer requires new workers, the practical way to employ them is asking the employees of bringing relatives or friends (Cohen B. and W. J. House 1993).

4. Study of education and wages in Khartoum, Sudan

In this thesis I explore and describe the apparent relation between education and informal sector productivity and economic growth in Greater Khartoum. Earlier in Sudan, when the wages became low at the agricultural sector, many farmers migrated to towns to work as unskilled laborers in other sectors which were economically more attractive. People were also displaced during the 1980's because of war, drought, famine or other catastrophes to the cities. The newcomers suffered most because of their economic situation, and most of them worked in the informal sector.

Over the last decades, the Sudan government put a lot of emphasis on education to be part of the national planning. The government set a plan to the education sector to create efficient human capital for economic growth. The education sector is rolled by the government; even the private education is supervised by the government. It provides education as a public service, for all people, all age categories, sex, ethnics and regions. The main core of the education is producing skilled workers. Even so, the literacy increased but still there are some children at the primary school age have not been able to attend school (Omer and William 1994). Education is almost free in Sudan, parents have to cover some basic needs like books, uniform, etc., but it was still hard for some families to afford these basic needs, and it is enough reason for not sending their children to school.

In the 1970's, the education system was built in this way; six years in the primary school, three years in secondary (intermediate) school, three years in the high secondary school, and then tertiary education, i.e. college education. Similar to other sub-Saharan countries, Sudan expanded the education system but this expansion was not balanced between the different levels of education. The expansion in the high school and tertiary education during the 1990's was rapid compared with the expansion the primary level. In general, African education system especially the primary education enrolment rates have declined. One reason for poor education could be the reduction in the public expenditures on education. The students get very little from their governments for the school materials. Khartoum is one example; the returns to education is very low (Cohen B. and W. J. House 1994).

Sudan, as most of the African countries, have faced economic crisis in the 1970's. The growth in GNP per capita has been very low and the productivity was declined in most of the sectors (agriculture, industry). Sudan also had other problems including a long civil war and

famine/drought, which contributed to lower the wages in Sudan. These lead many Sudanese especially skilled ones to look for work abroad.

The Informal sector develops naturally when the conditions of income are temporary or permanent changing. In Sudan, the informal sector is driven by educated and uneducated, immigrant or dwellers in the cities. The Sudanese especially the males preferred to move from formal sector to informal sector for better income. International Labor Organization (ILO) identified the informal sector in Sudan as a private sector with 10 to 20 workers, and is divided into three levels (high, middle, and low). The high level looks almost as the formal sector only differing in size. In middle level, the income per worker

Source: author field work 1999

could be compared to the formal sector income, and the low level includes individual seller and so on. In this level, the participants take low percent from the informal sector employment total percent according to ILO. The first two levels are providing various different activities, and their income is varied from time to time and from person to person due to differences skills and physical capital. The income in these two levels might not be less than the other sectors. The participants in the third level at the time of ILO study might not be high; one reason could be that the rural- urban migration phenomenon did not exist so much (Omer S and William J 1994).

Most of those in the informal sector belong to the third level, e.g. the rural -urban migrants taking a big percentage in this level. Mostly females selling tea, food, and snacks, etc. males shoe polishing, selling vegetable, and fruits, etc. Mostly this level uses local resources as the other levels as well, and it does not need licenses or capital assets as shows in the picture.

The informal sector was ignored by the governments for some time. Since it started to grow recently, it turns some attention from the governments and the scientists. The economists found that this sector could play a significant role in developing the economics.

5. Field Study

5.1. The Study Area

This thesis is based on a small empirical study of the Sudanese informal sector in Greater Khartoum, conducted in the spring of 2007. The study will investigate the education and income of the Sudanese who work in the informal sector in Khartoum.

Three study areas (map 1), Khartoum, Omdurman, and Khartoum North were selected for the study. These places were chosen because they are the main centers for the Sudanese who live and work in Khartoum. Khartoum is the capital of the province, where most of the offices are and the center as well for the state. Omdurman is the old town in the state it has a lot of tradition markets. Khartoum North is the industry area as it is known like this.
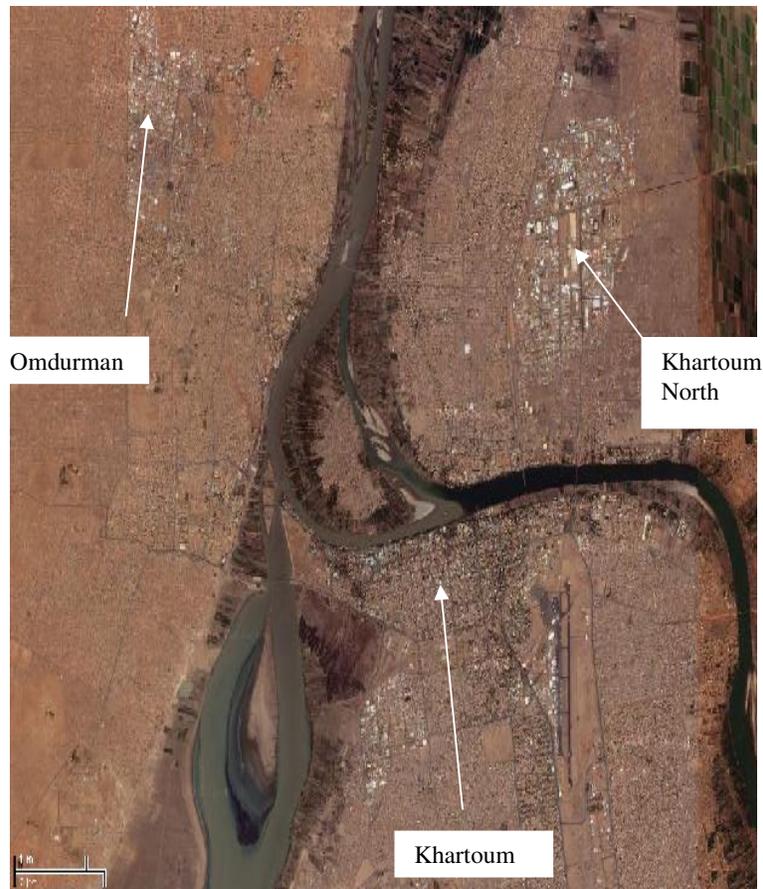
Map (1) Map of Khartoum

Source: http://maps.google.com/

The respondents were equally and randomly chosen as the target population of the study. The communication system in Sudan is different than here, to send out questionnaire or chose random samples it does not work via phone or mails. This was the reason why the questionnaire was handed, and supervised. The assistant had to supervise the questionnaire to be sure it is done in time and take them. The samples mainly were met at the buss stops in the center of the three study areas. Some samples were visited home or work place, and/or in a coffee shops.

The following criteria were used to select respondents:

1. The respondents were those who identified themselves as they have some education and working in the informal sector. This does not mean that they are the high educated people.

2. The minimum and maximum age limits were set between 30 and 45 years.

The assistant met some difficulties to find the match samples, sometime s/he met with answers like; no I have no time to answer your questionnaire, sometime people run away and might give a nice smile of sorry.

5.2. Research Methodology

The study is mainly based on a questionnaire. Samples of one hundred educated persons from the informal sector (referred to as respondents) were interviewed through a supervised questionnaire (Appendix 1) for information related to (i) education, (ii) work and income, and (iii) cognitive skills tests.

Since some of the respondents their education is low, the questionnaire supervised. The checklist consisted of 27 questions aiming at gathering information on the informal workers and economic growth.

The data collection was based on the following guidelines:

1. all data to be collected by assistant/s to the researcher

2. the time limit for the interview should not exceed, on average, an hour.

5.3. Cognitive Ability

Different methods were used in the study. Cognitive ability tests were used to describe the effectiveness of the education. Through the questionnaire the respondents were asked to do cognitive ability tests, the tests mainly focused on mathematics tests in three levels, and languages tests, mainly comprehension for Arabic (as a native language), English, and if the respondents has any knowledge about other languages. The total points could be achieved are 10 points. The cognitive ability test (appendix 1) examined participant's knowledge in basic mathematics, Arabic language, English language and knowledge of other languages.

5.4. Data Analysis and Presentation

The questionnaires information has been sorted, tabulated and presented in the form of tables, Excel program has been used. SHAZAM software used for the econometric analysis.

6. Results and Discussion

6.1. Outcome of the Questionnaire

Spread of Wages

The 100 samples included in the study, their monthly wages are spread as shown in table (2), the exchange rate (1 Euro= 280 SD. Dinnar). 2% of the total number their income between 11.000 - 20.000, 23 % between 21.000 - 30.000, 11 % between 31.000 - 40.000, 28% between 41.000 - 60.000, 23% between 61.000 - 100.000, 10% between 101.000 - 200.000 and 3% more than 201.000. Most of the respondents their income between 41.000 - 60.000.

Table (2) Spread of wages.

Wage	Number
0 - 10.000	0
11.000 - 20.000	2
21.000 - 30.000	23
31.000 - 40.000	11
41.000 - 60.000	28
61.000 - 100.000	23
101.000 - 200.000	10
More than 201.000	3
Total	**100**

Spread of education levels

Table (3) shows the spread of education between the respondents, 11% have Khalwa (religious school) education, 13% with primary education, 17% with secondary education, 18% with high education, 38% with tertiary education and 3% they indicate other education (could in other country). One reason for the high percentage of tertiary education is the government policy of education, the expansion in the high school level was rapid compare with the expansion the primary level (Cohen B. and W. J. House 1994).

Table (3) Spread of education levels

Education Level	Number
Khalwa (religious school)	11
Primary (6 years in school)	13
Secondary (9 years in school)	17
High (12 years in school)	18
Tertiary (university education)	38
Others	3
Total	**100**

Parent Education

In our sample table (4), 50% of the mothers were without education, compared to 21% of the fathers. In the questionnaire, we did not focus on parent's background, e.g. whether the respondent lives in a single-parent family, number of siblings and so on.

Table (4): Parents Education

Education Level*	Father's Education	Mother's Education
No education	21	50
Khalwa	27	19
Primary	26	19
Secondary	5	5
High	8	2
Tertiary	13	5
Total	**100**	**100**

* See table (3)

Experience:

The data shows that 42% of the respondents have between 3 to 5 years of experience, this is the biggest number of the respondents have only experience between 3 to 5 years (figure 2). From the data collection the assistant comment about this number; which is that many of the respondents they have changed type of work either once or many times, since it informal sector. As it is characterize by free moving in the sector.
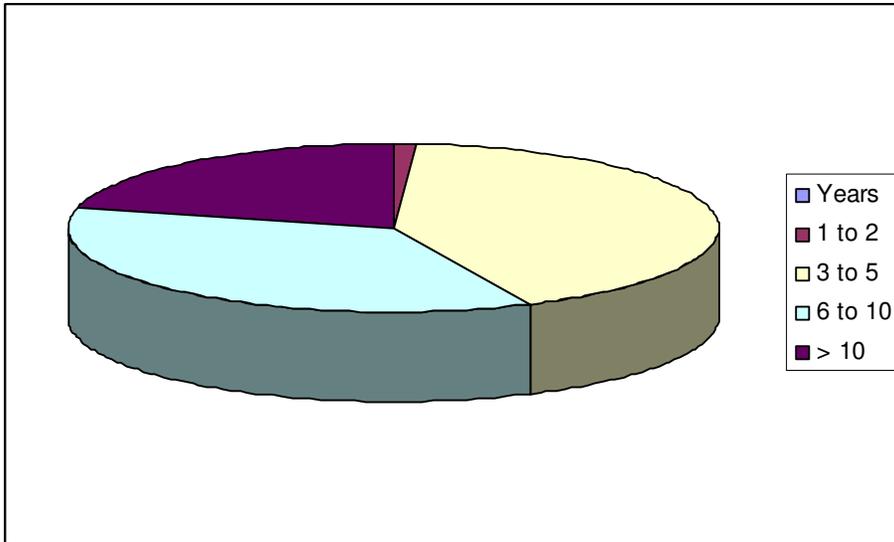
Figure (2): Experience per year.

Cognitive Ability Test

The score range between 0 - 10 points, low is zero and high is ten. The findings from the data shows that the highest number of the respondents (34%) scored 5 points out of total points 10, and that 85% of the respondents scored 5 - 10 points, while only 15% scored less than five points (table 5).

Table (5) Cognitive Ability

Points	Respondents
0	0
1	4
2	0
3	3
4	8
5	34
6	16
7	8
8	8
9	16
10	3
Total	**100**

6.2. Determinants of Wages

6.2.1. Determinants of Wages from Ordinary Least Squares (OLS)

Table (6) presented estimated regression coefficient and the significance for the relation between wages and education, experience, cognitive ability. The table also presents parent's education and sex. The Ordinary least squares (OLS) estimation has been used to map the relation between the variables that affects the wages. We begin with OLS of wages on the level of education, sex, parental education, years of experience and cognitive ability.

Our OLS wage function,
Wage = f (education level, sex, mum education, dad education, experience and total cognitive ability) has an R-square of 0.4104 and an adjusted R- square of 0.3723.

Table (6): OLS correlation between wages with education, experience and cognitive ability

Variable Name	Estimated Coefficient	P-Value	Elasticity at Means
Constant	-82705.	0.000	-1.2763
Experience	6397.1	0.000	0.7004
Total Cognitive Ability	7707.9	0.002	0.7196
Education Level	9416.5	0.012	0.5348
Sex	15961.	0.100	0.1749
Dad Education	8837.6	0.010	0.2605
Mum Education	-7028.0	0.086	-0.1139

We find (Table 6) that wages are strongly positively correlated to the level of education, experience, and cognitive ability (estimated coefficient, p-value and Elasticity at means). The three variables (level of education, experience, and cognitive ability) have strong and direct effects on wages. Furthermore, there is a significant positive correlation to the father's education, but a (non-significant) negative correlation to the mother's education. This latter result is rather surprising. Finally, the sex dummy shows that males have higher expected wages than females. From the OLS estimation, we conclude that education has a direct relation to wages.

When we dropped mother's education from the wage function, the R- Square and adjusted R-Square went down, even made the other variables with a little weak relation to wages. This finding, showing Mum education as a kind of a mystery, needs some more work.

Table (6) showed parent education as related to wages, there is strong and direct relation between father's education and wages, but the relation between mother's education and wages is very weak. The reason could be that fathers are more educated than the mothers (table 4).

Adding or reducing one or some variables might make some changes in the results. Therefore, these results need to be treated with great caution as there is obvious potential for the explanatory variables to be correlated with one another. We now investigate these potential correlations and other effects in more detail.

6.2.2. Determinants of Wages from Two-Stage Least Squares (2SLS)

From the literatures discussed earlier, cognitive ability are important contribution to wages. In order to understand the role cognitive ability on wages, we need to ask "are wages driven directly by education, or is it via the effect of education on cognitive ability?". To investigate this question, we performed a two-stage least squares (2SLS) analysis of wages, in which cognitive ability is treated as a function of the level of education, age, and mother's education. The other explanatory variables are the level of education, sex, and experience.

Our 2SLS wage function,
Wage = f (sex, experience, education level and total cognitive ability (sex, experience, education level, age, parent's education and rural)) has an R-square of 0.2325 and an adjusted R- square of 0.2002, which are lower than those of the OLS wage function.

Our findings (table 7) show that when the level of education is permitted to affect cognitive ability, the direct effect of education on wages almost disappears.

Table (7): 2SLS correlation wage as independent variable with sex, experience, education and cognitive ability.

Variable Name	Estimated Coefficient	P-Value	Elasticity at Means
Constant	-0.10434E+06	0.001	-1.7978
Experience	7420.7	0.000	0.8125
Cognitive Ability	18919.	0.026	1.7663
Education Level	1831.2	0.806	0.1040
Sex	10491.	0.343	0.1149

When we consider the results from the 2SLS, we find the contribution of cognitive ability to wages is raised, while the contribution of experience stayed constant. The relationship between these variables and wages are summarized in scheme (3). The relationship between experience and cognitive ability and their interactions in determining wages can not be deduced from this sample but it is important to investigate.

The total cognitive ability impact on the wages is direct and strong (table 6). We did not in the analysis focus on the impact of the cognitive ability variables (mathematics, Arabic, English and knowledge of other languages) on wages by single variable, we focused on the total sum of the variable points.
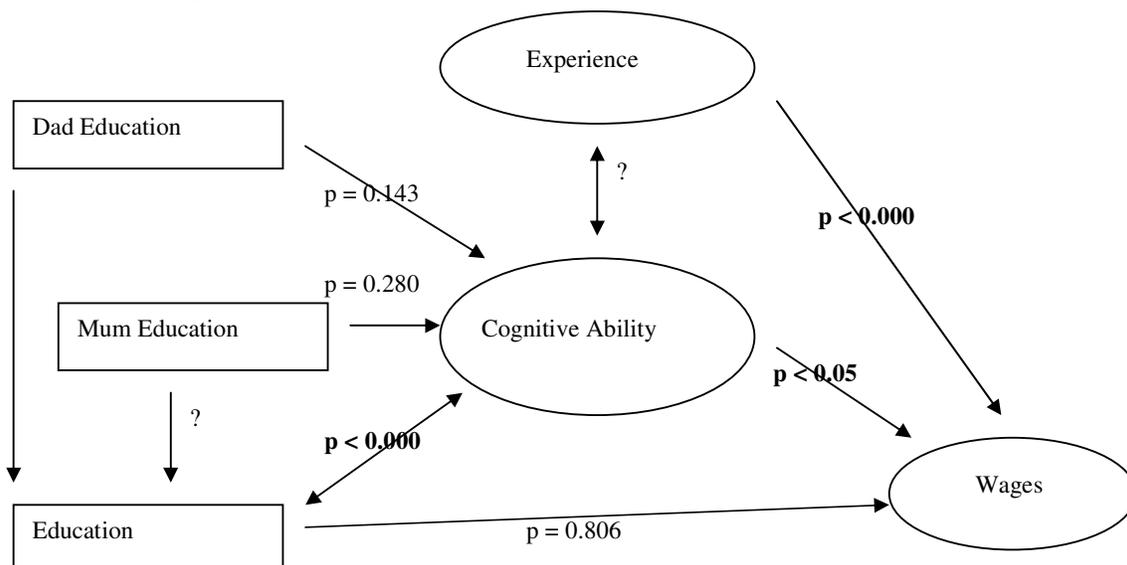
Scheme (3): A Schematic representation of the link between different variables and wages as shown by the results of this study.

6.3. Determinants of Cognitive Ability

6.3.1. Determinants of Cognitive Ability from Ordinary Least Squares (OLS)

To further investigate the effects shown in scheme (3), we looked in more detail at the production function for cognitive ability. We used the OLS and 2SLS to estimate the effect of some variables on cognitive ability. We started here by the OLS,

Total cognitive ability = f (education level, sex, age, mum education, dad education). This relation has R-square of 0.3701 and an adjusted R- square of 0.3366.

We found that education has strong and direct effect on cognitive ability (table 8) while sex, age and parents education are not effective or have not direct relation on cognitive ability. The results point attention to the effect of age on cognitive ability. They have a negative relation, i.e. when we look at age it seems that the older one are, the cognitive ability goes down.

Table (8): Determinants of Cognitive Ability from Ordinary least squares (OLS)

Variable Name	Estimated Coefficient	P-Value	Elasticity at Means
Education Level	0.61159	0.000	0.3720
Constant	4.8280	0.014	0.7980
Dad Education	0.21121	0.143	0.0667
Mum Education	0.18986	0.280	0.0330
Age	-0.45192E-01	0.306	-0.2891
Sex	0.16553	0.692	0.0194

6.3.2. Determinants of Cognitive Ability from Two-Stage Least Squares (2SLS)

We used a two-stage least squares (2sls) analysis of cognitive ability, education is used as a function of the length of parent's education, age and rural. The other variables are the length of parent's education and age. Our 2SLS cognitive ability function,

cognitive ability = f (parents education, age, education (parents education, age, rural)) has an R-square of 0.3690 and an adjusted R- square of 0.3425.

Our findings show in table (9), the three variables (parent's education and age) have not strong direct effect on cognitive ability. While the relation takes indirect shape through

education. The results show education almost very significant (p-value and elasticity at means). Age shows negative correlation to cognitive ability, either people use to forgetting, or school quality differences. The contribution of education level to cognitive ability decreased in this 2SLS

Table (9): Determinants of Cognitive Ability from two-stage least squares (2SLS)

| Variable Name	Estimated Coefficient	P-Value	Elasticity at Means
Constant	5.1348	0.007	0.8487
Education Level	0.59416	0.023	0.3614
Dad Education	0.20654	0.166	0.0652
Age	-0.48224E-01	0.265	-0.3085
Mum Education	0.19092	0.313	0.0331

7. Conclusions

Many studies have focused on the effect of education and economic growth and wages in the developed and developing economics countries. This thesis examined the effect of education and cognitive ability on the wages of educated people living in Khartoum-Sudan and working in the informal sector. Interviews were conducted with randomly selected samples of 100 persons. A Cognitive ability test (appendix 1) was used to provide good information quality.

Despite of many difficulties related to the respondents work and the time required for answering all questions, they were helpful during the study. The respondents were happy to do the cognitive tests, even if some of them had some difficulties especially with the Mathematic and English language tests.

In this study, education was strongly positively correlated to wages ($p = 0.012$, table 6). In our study we did not investigate which education level is more effective than the others. As mentioned before, the expansion in education was more in the high school than primary school. Moreover, since the rates of return to primary school education are generally low (Cohen B. and W. J. House 1994), we expect high schooling to be is more effective. Although education in Africa has a poor reputation, our results still show a positive effect on wages in Khartoum.

The results clearly show that education, although still poor, has a significant relation to wages in the informal sector in Khartoum. Indeed other detectable and undetectable factors, e.g. countries economic growth, social norms and corruption, do affect the relation between education and wages. The relationship between education and cognitive ability and their interactions on wages are indeed complex and warrant further investigations including the impacts of productivity and economic growth (scheme 4).

Parents/ State and innate ability

Education

Cognitive ability

Job possibilities

Productivity

Economic Growth
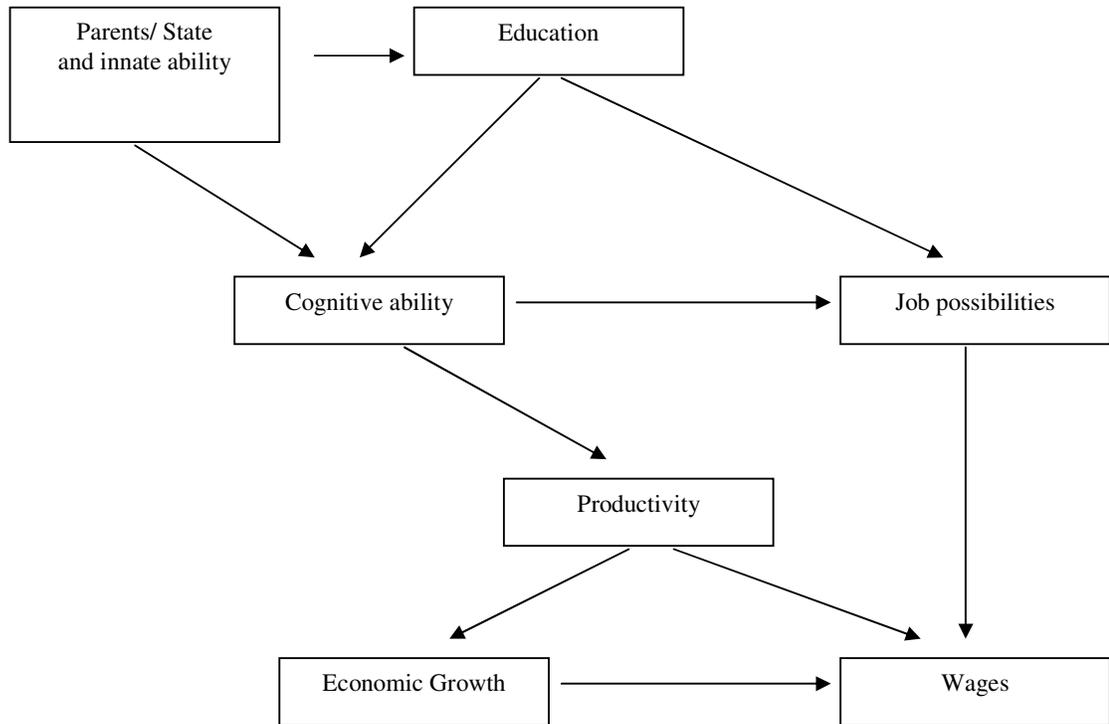
Wages

Scheme (4): A Schematic representation of the relation between education and cognitive ability on wages including other variables.

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Appendix (1):

Questionnaire for the informal sector: Arabic
(Mark the correct number)

1. Sex:

a) Male
b) Female

2. Age:

a) 30 – 35
b) 36 – 40
c) 41 – 45

3. Where do you live?

a) Khartoum
b) Khartoum North
c) Omdurman

4. Where have you got your education?
Khartoum:

a) Khartoum
b) Khartoum North
c) Omdurman
d) Rural
e) Other City. Name the City ……………….

5. Type of Education:

a) Khalwa
b) Primary
c) Secondary
d) High
e) Tertiary
f) Others

6. Years of Schooling:

(I)Khalwa
a) Less than 1 year

b) 1- 2 years
c) 2- 3 years
d) More than 3 years

(II) Primary
a) 1 – 2 years
b) 3 – 4 years
c) 5 – 6 years
d) More

(III) Secondary
a) 1 years
b) 2 years
c) 3 years
d) More

(IV) High
a) 1 years
b) 2 years
c) 3 years
d) More

(IIV) Tertiary
a) 1 – 2 years
b) 3 – 4 years
c) 5 – 6 years
d) More

(IIIV) Others (Please specify type of education and number of years)
…………………….

7. Education of the Parents:

	Mother:	**Father:**
Khalwa	(a)	(a)
Primary	(b)	(b)
Secondary	(c)	(c)
High	(d)	(d)
Tertiary	(e)	(e)
Others	(f)	(f)

8. In which region do you work?

a) Khartoum
b) Khartoum North
c) Omdurman

9. Employment:

a) Self- employment
b) Family firm
c) Large firm

10. Type of work (one type of work or more):

a) Transport
b) Service/ Commerce
c) Manufacturing/ Repairs

11. Work duration per day:
a) Less than 2 hours
b) 2 – 5 hours
c) 5 – 8 hours
d) 8 – 10 hours
e) More than 10 hours

12. Monthly Wage (how much income per SD Dinnar):

a) Less than 10.000
b) 10.000 – 20.000
c) 20.000 – 30.000
d) 30.000 – 40.000
e) 40.000 – 60.000
f) 60.000 – 100.000
g) 100.000 – 200.000
h) More than 200.000

Note if working in family firm and individual income is hard to estimate please answer questions on separate sheet (12*)

12*. Family firm:

I) Firm income
a) Less than 30.000
b) 30.000 – 50.000
c) 50.000 – 100.000
d) 100.000 – 200.000
e) 200.000 – 500.000
f) 500.000 – 1.000.000
g) 1.000.000 – 5.000.000
h) More

II) Number of people working full-time in the firm?
…………….

III) Number of those above educated to following levels:
a) Primary   ( )
b) Secondary   ( )
c) Tertiary   ( )
d) Other   ( )

13. Experience (how many years):

a) Less than 1 years
b) 1 – 2 years
c) 3 – 5 years
e) 6 – 10 years
d) More

14. Cognitive skills tests:

(A) Mathematics problems to solve:

(I) Easy
a) 27 + 40 = ….
b) 68 – 39 =….

(II) Medium
a) 12 * 5 =….
b) 18 * 9 = ….

(III) High
a) 7 * 5(34 – 27) =….
b) 8.5/9(28 + 14) =….

(B) Languages:

(I)Arabic
(Text translated to Arabic)
During the hot summer season, the Nile shrinks in width, exposing small islands in the shallowest spots along its course. The largest of these, the Tumsah and Safsaf islands, can justifiably be called safe-havens from the grueling summer heat. Tumsah, so called because of its crocodile-like shape, is located on the Blue Nile, just a short distance south of Kober Bridge. Safsaf, called after a type of Nile vegetation, is located on the Middle Nile, north of Harnad lands, combining the White Nile Bridge. The Island has white sand beaches are a favorite abode to a variety of birds and fishes too. (http://www.sudan-embassy.co.uk/./infobook/khartoum.php)

(1) How many islands:
a) 3 Islands
b) 5 Islands
c) 4 Islands
d) 2 Islands

(2) Where is the location of the crocodile shape island?
a) White Nile south of Omdurman bridge
b) Blue Nile south of Kober Bridge

(3) Which of the Island has white sand Beaches?
a) Safsaf Island
b) Tumsah Island

(II) English

Omdurman souk (market) is a hive of activity with crowds of people, horses, carts, and donkeys for the majority of the day. It is a very exciting place to visit and has many local shops to be explored, for example, the bead market, where merchants of beads sit in a row on a porch displaying their colorful goods. Don't miss the opportunity to visit this market. (http://khartoum.usembassy.gov/omdurman_souk.html). To walk around the souk; if you are fast walking you might need around five hours to have enough time, if you slow walking you might need a couple of hours more than the fast walking time.

How many hours you need to walk around the souk, if you are slow, medium, or fast walking type:

(1) Slow	**(2) Medium**	**(3) Fast**
a) 5 hours time	a) 2.5 hours time	a) 5 hours time
b) 4 hours time	b) 3.5 hours time	b) 3 hours time
c) 7 hours time	c) 6 hours time	c) 2.5 hours time

(III) Others Languages ………….

Pris: 100:- (exkl moms)

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