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Policy Failure in Achieving Universal Basic Education: A Theoretical Analysis

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Universal attainment of basic education is recognised as a key development goal; whereas early-age work is considered as a barrier to achieving this goal. The literature suggests that returns to education are larger than those of early-age work, and that child-labour results in long term social loss that reduces human capital. This study evaluates the argument that early-age work can itself lead to accumulation of human capital when it takes the form of apprenticeship career path. The paper develops a model that allows a rational agent (parent) to compare the early-age work as apprenticeship career path with the formal education career and shows that the parents' career choice for their child will depend on the lifetime earnings of both careers. The theoretical model is further extended and empirically tested to check whether benefits of education are higher for all levels of education. The simulation analysis suggests that for lower level of education up to Grade-12, the benefits of apprenticeship exceed the net benefits of education whereas, at Grade-12 and beyond, the net benefits of education in terms of earnings outstrip the apprenticeship career. The study implies that early-age work may not necessarily be inefficient when compared with low levels of schooling and that any intervention should ensure universal education for all without compromising skill development of resource poor children. This can be achieved through making skill development complementary to education.

JEL Classifications: H44, H52, I26, J24
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1. INTRODUCTION

The prevalence of early age work in less developed countries is generally attributed to mass poverty. In this backdrop, the policy either incentivises parents by offering conditional cash transfers to ensure that they send children to school, or takes coercive action to control child-labour. The economic theory views child-labour as a source of inefficiency because returns to education are large and early-age work results in reduced stock of human capital thus lowering lifetime earnings of the child [Basu and Van (1998); Basu and Ray (2001)]. Resultantly, policy-makers attempt to address all forms of child-labour through same regulatory measures such as banning the child-labour and incentive mechanisms. The incentive mechanism, in the prevailing policy framework is designed to compensate the direct and indirect costs of education with the presumption that these measures would essentially motivate parents to send their children to school.

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Another dominant concept of early-age work views it as an outcome of parents' selfishness. The parents have two options, either to invest in future of their children by equipping them with marketable skills mainly through education or to borrow from the future by choosing early age work for their children. The early-age work can be distinguished between the two kinds of work that a child can take up. First is the type of work that results in skill development over time such as working with motor mechanic, electrician, plumber, or tailor. There is generally no arrangement to impart useful indigenous skills in the formal educational or vocational institutions. We term apprenticeship career path for this kind of skill developing work in the informal sector. Second is the unskilled work that does not develop any specific marketable skills for instance, dish washing in hotels, household servants. It is a fairly justifiable assumption that the choice of parents to employ their children into this kind of non-skill developing work is the household strategy for subsistence and survival whereas the choice of an apprenticeship career path represents a futuristic career building strategy.

The literature suggests that human capital development depends on the level of education acquired by an agent. Empirical studies generally rely on the presumption that a relatively higher level of education always produces higher future earnings. Such studies use years of schooling as a proxy for education where each additional year of schooling raises the income level. This treatment of years of schooling seems less suitable to study the schooling choice of parents in the less developed countries. At lower levels of education, job and income prospects are usually lower as compared to the higher levels. If a household has a perception that the child is likely to attain a certain higher level of education where returns to education would exceed those of apprenticeship career path, the agent would be likely to send children to school. However, if the agent believes that the child would not be able to complete a higher level of education primarily due to his circumstances, then he may contemplate a choice between formal education and apprenticeship career path. This implies that the agents perceive education and skill-oriented work as competing career paths and they take into account of the relative gain from the two while making their rational choices. Most of the past studies conclude that early-age labour is necessarily inefficient and ignore the fact that some parents consider early-age work as a source of human capital development.

This paper develops a cost-benefit model that incorporates apprenticeship as an alternative career path to analyse its implications for the rational choice of an economic agent. In this context, the policy framework aiming at universal basic education cannot fully take into account the incentives required by the agent who chooses apprenticeship career path instead of formal education. The model shows that the prevailing policy instruments are unlikely to alter the choices of the agent and hence economies will fail to materialise the goal of universal education through these policy interventions. The model demonstrates that early-age work may not necessarily be inefficient as compared to different levels of education. The model suggests that in order to achieve the goal of universal education an overarching policy intervention is required that may educate the children by not compromising the skill and earnings development. Using the theoretical framework of the study, we conduct a simulation analysis to determine the level of education where benefits of education equal the benefits of apprenticeship. The analysis shows that at a lower level of education, the lifetime benefits of apprenticeship are higher

than that of formal education. For higher levels of education, the simulation analysis suggests that the net income earnings of education career path outstrip the earnings of early age work career. The simulation results are in agreement with the theoretical cost benefit analysis. The results imply that the goal of universal education can be achieved by improving quality of education as well as by banning the early age-work through regulatory measures.

The rest of the paper is organised as follows. Section 2 briefly reviews the theoretical frameworks within which the supply side determinants of early-age work are analysed. The section also discusses how the issue of early-age work is placed within human capital formation framework and identifies the missing link in the literature. Section 3 highlights evidence of early-age work in less developed countries and regions. The proposed cost-benefit model of early-age work-education choice is presented in Section 4. The section also discusses the failure of existing policy of universal attainment of basic education. Section 5 presents the results of the simulation analysis conducted using available data. Finally, Section 6 concludes the paper and highlights the modifications required in the existing policy regime.

2. EARLY-AGE WORK AND EDUCATION: EVIDENCE FROM LITERATURE

Economics and development literature considers education as the main source of human capital. In his seminal work, Schultz (1961) viewed human capital as capacity to adapt and respond to dis-equilibrium situations. Becker (1962) asserted that human capital is embedded in the stock of knowledge and skills that contribute directly to worker's productivity. Human capital not only affects productivity through direct effect on output and income but also has indirect effect on labour allocation. That is why the provision of basic education to children is considered a major public sector activity around the world. Earlier studies such as, Brown, *et al.* (2002) and Amin, *et al.* (2004) view the incidence of child-labour as households' struggle to survive and to make livelihood. Some other studies develop models taking insights from household production model [see, Rosenzweig and Evanson (1977); Becker (1981); Pörtner (2001a)]. In these models, the household maximises utility from different factors including, number of children, schooling, leisure and composite consumption good that are produced using time endowment of family members. Households earn money either by selling goods they produce or by working for wages.

Some recent studies influenced by Mincer (1974) focus on education and its impact on determination of wages. In these models, the household head allocates his time between leisure and paid work. The mother allocates her time among child-rearing and home production while children allocate their time endowment in leisure, education, paid work and household production. These models suggest that if income of husband increases, child education would increase and a rise in mother's income would reduce size of the family since opportunity cost of child rearing activity would increase. Also, it may result in more investment in the child. An increase in expected wage of the child increases the opportunity cost of schooling and hence may decrease attainment of education. An increase in asset holding increases the household income and hence educational attainment of the child also increases.

The demand for education in these models is a function of household income—the lower is parent's income, the higher will be the child-labour. The literature also considers income inequality as a source of child-labour [Ranjan (2001)]. Rogers and Swinnerton (2001) assume an economy that cannot support its entire population without child-labour. In this case, if everyone in the family enjoys equal share in family income then child-labour will prevail. However, the high-income families would not send children to work. Patrinos and Psacharopoulos (1997) highlight the role of family size on the incidence of child-labour and show that the age structure of children in their school going age in a household is important such that more siblings imply less schooling and more child-labour.

Economic shocks may affect parents' choice between work and education for their children. Some studies have viewed child-labour as a strategy to minimise the risk of unpredictable changes in family income due to job loss or bad harvest [Cain and Mozumder (1980)]. Pörtner (2001b) suggests that parents' motivation to see children as insurance increases in an economy where actuarially fair price insurance is not available. The child-labour as a form of risk minimising insurance implies that child-labour can prevail even during times when household may not require income of child for subsistence in normal time periods. Ejrnæ and Pörtner (2002) argue that children are perceived by the household as a tool of insurance to reduce future uncertainty. Parents invest in the number and quality of their children to maximise the 'value of family'. Land holding is the most attractive alternative source of earning in economies having less developed financial markets. Thus, if the return on education is low as compared to that of land, then the maximisation of family value takes the form of a large number of child farm workers. Such models highlight the importance of parents' education in determining the supply of child-labour. Parents with higher education are expected to have higher future income and hence have less need to insure themselves through child-labour. Mother's education is even more important in determining the educational attainments of children. These models also provide insights into the determinants of optimal family size which in turn determines the human capital development. Families lacking access to credit are more likely to withdraw children from school when faced with downturn in economic activity [see, Duryea (1998); Behrman, *et al.* (1999); Skoufias and Parker (2001)].

Theoretical models generally assume perfect land and labour markets which in reality is not the case. Skoufias (1995) highlights several types of land and labour market imperfections that may affect the optimising decision of the household. One of such imperfections relates to the difficulties in employing labour or leasing out land primarily due to principal-agent issues. This market imperfection implies that as land ownership increases, the tendency to employ family children increases. This relationship may be reversed in the case of competitive markets due to the income effect of large landholdings. Laitner (1997), Parsons and Goldin (1989), and Jacoby and Skoufias (1997) analyse how capital market inefficiencies can lead to inefficient decisions by parents regarding child-labour. When parents do not have access to capital markets, they cannot borrow against their expected future earnings when children are young in the current time period. In this scenario, they rely on internal resources of the family. Child-labour today, instead of investment in human capital formation through education, is then a kind of borrowing from future. Because returns to extra hour of schooling are expected

to be higher than that of work, the decision to send child to work is inefficient in dynamic setting but the agent finds it optimal in the constrained situation. These studies highlight the importance of parents' access to financial markets.

Basu and Van (1998) model another structural issue of labour market to analyse the phenomenon of child-labour. The study proposes that the supply of child-labour is positive when wage of parents is less than a critical level such that once their wage reaches that critical level, they withdraw their children from labour force. This implies that the aggregate labour supply both from parents and children has a backward bending curve. When child-labour reaches the zero level, the supply curve becomes positively sloped. The above formulation implies two stable equilibriums in labour market. The market clearing wage would be low in the presence of child-labour. Once child-labour is banned, the market wage rate will rise and in effect, parents do not need to send children to work. Hence, the study suggests that the economy may be stuck in low-wage trap and recommends a complete ban on child-labour. Basu (2000) shows that labour market with adult unemployment can lead to child-labour. The study analyses the effect on child-labour of minimum-wage law that is expected to create unemployed adults and these parents may use the child's earning to minimise the effects of loss in their earning.

Becker (1974) explains child-labour in terms of parents' selfishness and assumes that parents will have children only when they expect to earn positive return from them. Cigno and Rosati (2000) also developed a model of non-altruistic parents where each family is supposed to pay an amount to the parents when they become adult. The size of the payment by itself is a function of child's human capital formation activities and consumption. In this setting, parents maximise the value of their children because it maximises their old-age returns. Basu and Ray (2001) asserted that child-labour phenomenon is also affected by the balance of power between parents such that the more the decision making power is equally distributed among the father and mother, the less likely is the child-labour.

The past studies while explaining the phenomenon of child-labour, ignore the altruistic role of parents who choose apprenticeship career path for their children because the literature on human capital usually views early-age work as a source of deterioration of human capital. Labour can be reallocated from farming and other low skilled works to those nonfarm sectors where more skills are required [Fafchamps and Quisumbing (1999)]. Mincer (1974) proposed a methodology to estimate the returns to human capital, where human capital is measured through the level of education and work experience. The process of accumulation of human capital is used by economists to understand the choice between early-age work and education. The relationship between human capital and child-labour is usually viewed as of substitutes where child-labour decreases human capital by forcing the child away from education. Since returns to education are greater than returns to child labour, hence child-labour is dynamically inefficient.

Baland and Robison (2000) use maximisation of family value type model to analyse human capital formation through education. The model has an intertemporal aspect in decision making where, altruistic parents, having ability to leave bequest and having access to capital markets invest efficiently in education to their children. The optimal investment decision regarding child-labour and child education in this setup is based on comparing the value of a child's labour earning with the present value of earnings to the family due to child's human capital acquisition in school.

Emerson and Shawn (2007) model the role of parents' expectations for child-labour, fertility and education decisions and show that there is a range of income where the child is expected to receive incomplete education if parents have the belief that the return to education is low. Because child participation in labour market reduces his ability to accumulate human capital, the act of sending the child to labour market fulfils the pessimistic expectations of the child. Contrarily, if parents expect that the return to education is high, then the child completes his education, hence there is no child-labour. The paper has the implication that onetime regulatory measures, such as banning of child-labour and compulsory education, can take an economy out of child-labour equilibrium to no child-labour equilibrium because this would remove child-labour from the choice set of the agent. However, the model shows that the welfare effects of such a policy intervention depend upon the stage of development process.

The above models make a questionable implicit assumption that returns to education are always greater than returns to early-age training at workplace. This is so because these models see education as the primary source of human capital formation without realising that early-age apprenticeship can also be a source of acquiring valuable productive skills. Also these models ignore the role of parent's perception about the likelihood of their child completing some appropriate level of education (termed *critical level* in this paper). Emerson and Shawn (2007) incorporated parent's expectations about returns to education for explaining the choice between education and child-labour, but it misses the point that expected returns to education depend upon the expected level of education that a child would attain. The proposed model captures this missing link of the literature and investigates its implications for policies aimed at universal basic education.

3. EVIDENCE FROM LESS DEVELOPED REGIONS

Universal attainment of basic education is recognised as a desirable development goal included in the Millennium Development Goals (MDGs). It essentially requires that all children should be attending school in their school going age. Therefore, the issue of out-of-school children has been a primary concern for policy-makers. Although, there has been an impressive progress towards this goal, yet fully achieving this goal in some developing countries remains a challenge. It requires that all the school going age children are enrolled in school, and schools have the capacity to retain them and their successful completion of primary education. In less developed countries, the enrolment is low due to insufficient public provision of education and quality of education is low in the schools that result in dropouts. Resultantly, the primary completion rates are well below 100 percent as almost 60 million children are out of school in their school going age worldwide as of 2012 (Table 1).

Table 1

Gender-wise Differences in Educational Attainments in 2012

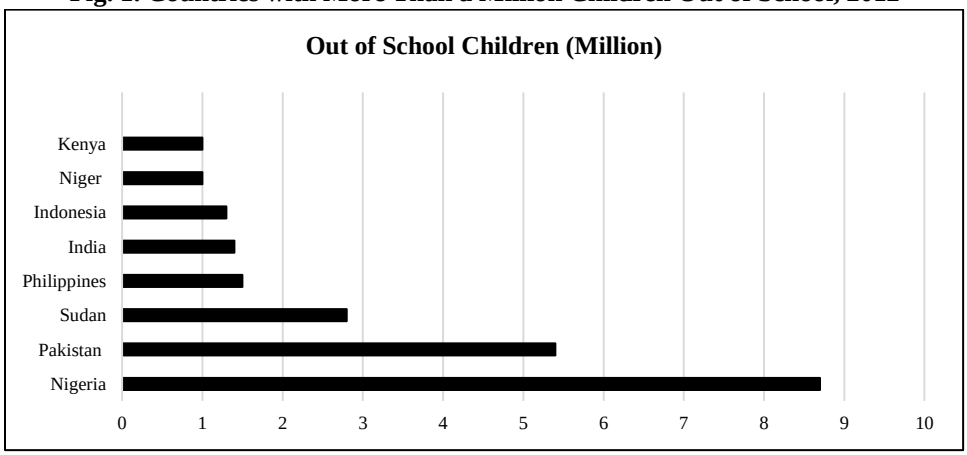
	Children Out of School (Million)		Survival Rate to the Last Primary Grade (%)	
Region	Male	Female	Male	Female
South Asia	5.5	4.8	60.0	65.0
East Asia (Developing)	3.4	3.1	91.2	93.5
Latin America	2.1	1.8	78.0	82.0
World	28.4	30.9	73.5	76.1

Source: http://data.worldbank.org/indicator

The data revealed another aspect in attainment of education in these countries that the boys underperform as compared to the girls. It is surprising since a typical perception prevails that in the less developed countries, gender discrimination in educational opportunities favours the boys. The girl's education is presumably undervalued due to various socioeconomic factors. Paradoxically, the evidence suggests that the extent of education deprivation is sufficiently high among boys as compared to girls in most of the developing regions. The primary completion rate is higher for girls than boys and more boys are out of school in their school going age. In most of the developing countries, a part of population or certain groups experience some sort of disadvantage in education.

The conditions have shown slight improvement as the number of children out of school slashed from over a hundred million in 2000 to less than 60 million in 2015. The situation has improved in almost all the countries except the countries affected by conflicts or social upheavals, where the number of children out-of-school have increased over the last decade for example, Pakistan, Iraq, Haiti, Nepal etc. The UNESCO finds that in the developing regions, children in the poorest households are four times as likely to be out-of-school as those in the richest households.[1] It is also alarming since it reflects social deprivation of the group as a disadvantage in education causes marginalisation and this deprivation effect is transmitted across generations.

Fig. 1. Countries with More Than a Million Children Out of School, 2012



Source: UNESCO Institute of Statistics (2012).

The extent of educational attainment among boys lower than girls can partly be explained by parents' opportunity to engage the boys in skill developing works during their school going age. This skill developing work choice of the parents emanates out of rationality depending on their circumstance set. The global efforts based on the existing view towards the early age work cover the cost of education either through public provision and/or cash transfer. The segment of target population that does not choose formal education a source of skill development can be persuaded through improving the quality of education and skill development through it especially for those households that cannot afford to educate their children to higher levels due to constraints imposed by the

[1]http://www.un.org/millenniumgoals/education.shtml.

circumstance set. Kazi (2006) spells out the historical evolution of laws preventing child-labour in India since 1938 and identifies the defects in the legislation and enforcement system, which fail to prevent child-labour especially in family-owned industries. However, the study does not recognise the role of apprenticeship career path in this failure.

4. THE MODEL OF EDUCATION-APPRENTICESHIP CHOICE

Our model assumes that parents have two choices regarding the career path of their children. They can either send their child to school or to workplace for apprenticeship. This study follows Basu and Van (1998) with some modifications. The parents are assumed to be rational and altruistic and choose the best option in favour of the child. Therefore, it can be assumed that career path choice for the child are made by parents in the earlier years. Basu and Van (1998) argue that child-labour is a result of poverty that forces parents to send children to the work place for subsistence and survival. The framework of our analysis is somewhat different from Basu and Van (1998) as we presume that early age apprenticeship may lead to the development of human capital and the relevant choice facing this agent is between the early-age apprenticeship and education. The agent makes his choice among the two alternatives comparing their expected benefits and costs.

4.1. Modelling Education as Career Path

Most of the monetary rewards of education are realised after the completion of a certain level of education while, the cost of the child's education is borne by the agent before joining the job market. Both the cost and benefits of education depend upon the level of education. Higher and more professional education is usually costly with high earning prospects corresponding to that level of education. Suppose education starts paying wage w_j at time period $T^* = t_j$ where j is the number of years of schooling to complete that level of education. But this optimal level of education of the child is not certain to the parents. The educational expenditures are sort of negative wage during the study period as shown in Figure 2. We assume for simplicity that the cost of education is a constant function of the level of education. The cost of education increases as the level of education j increases. Let 'j' be the maximum level of formal education that the child can attain.

Given this description, the agent forms expectations regarding the likelihood of his child continuing from a lower level to the higher level of education. The higher is the probability that the child moves to the higher education level, the higher will be the expected net benefit of education. The probability in turn is determined by socio-economic vector O that captures the circumstances of the household including elements related to demographic features, asset holding and opportunities available to the household. Given that T^* is the time when the child enters the job market after completing certain education level, then $P_j = P(T^* = t_j)$ is the probability of completing j years of schooling. The better are the circumstances of the household (vector O), the higher is the probability of T^* implying that the child continues to higher education level. With this formulation, $P_j(T^* = t_j)$ is conditional upon O; that is $P_j = P\left(T^* = j \middle| O\right)$.

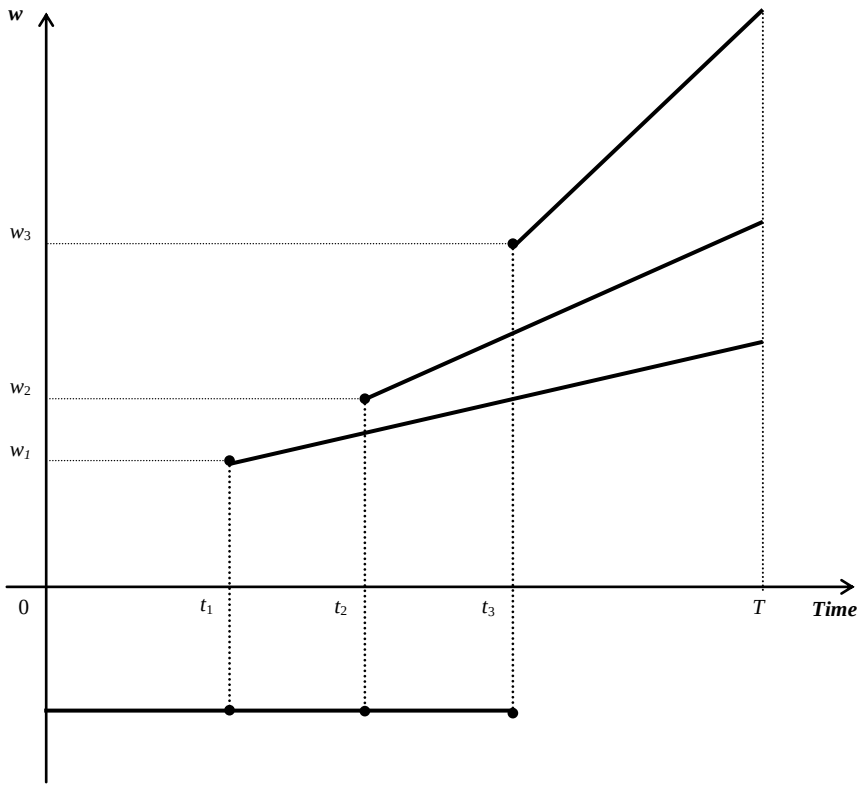
Let *C* be the annual cost of education, Δ_c be constant annual increase in this annual cost and *j* be the number of years of education. A constant annual increment in cost is assumed to specify a linear model. The present value of expected cost of education is then given by the sum of the arithmetic gradient series:

$$PV_E^C = \frac{P_1 C}{(1+r)} + \frac{P_2(C+\Delta_c)}{(1+r)^2} + \frac{P_3(C+2\Delta_c)}{(1+r)^3} + \cdots + \frac{P_{j'}(C+(j-1)\Delta_c)}{(1+r)^{j'}}$$

$$PV_E^C = \sum_{k=1}^{j'} \frac{P_k(C+(k-1)\Delta_c)}{(1+r)^k} \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad (1)$$

The benefits of education can take two forms, direct monetary rewards and indirect non pecuniary benefits.

Fig. 2. Earning Path in Case of Education Career Choice



(a) Direct Expected Monetary Returns are based on human capital earning function of Mincer (1974), where monetary returns to education occur due to productivity enhancement, skill development, and knowledge. Higher education and professional skills are associated with higher wages. Earnings associated with any education level can be viewed as consisting of two components: a base amount (w_j) and a constant increment (Δ_{wj}). Figure 2 shows that if the level of education completed happens to be j_1, then starting wage is w_1 and this wage grows every year at some constant amount Δ_{w1} till

retirement denoted by *T*. On the other hand, if the child completes j_2 years of schooling where $j_2 > j_1$, then his starting wage is w_2 that grows at Δ_{w2}, with $w_2 > w_1$ and $\Delta_{w2} > \Delta_{w1}$. The starting point of wage (w_j) and its growth path (Δ_{wj}) depends upon the level of education when the agent enters the job market. The present value of the expected life time earnings of education, PV_E^D, turns out to be the present value of an arithmetic gradient series consisting of a base amount and a constant increment.

$$PV_E^D = P_1\left[w_1\left(\frac{1}{(1+r)^1}+\frac{1}{(1+r)^2}+\cdots+\frac{1}{(1+r)^T}\right)+\Delta_{w1}\left(\frac{1}{(1+r)^2}+\frac{2}{(1+r)^3}+\cdots+\frac{T-1}{(1+r)^T}\right)\right]$$
$$+P_2\left[w_2\left(\frac{1}{(1+r)^2}+\frac{1}{(1+r)^3}+\cdots+\frac{1}{(1+r)^T}\right)+\Delta_{w2}\left(\frac{1}{(1+r)^3}+\frac{2}{(1+r)^4}+\cdots+\frac{T-2}{(1+r)^T}\right)\right]$$
$$+P_{j'}\left[w_j\left(\frac{1}{(1+r)^{j'}}+\frac{1}{(1+r)^{j'+1}}+\cdots+\frac{1}{(1+r)^{j'+m}}\right)+\Delta_{wj}\left(\frac{1}{(1+r)^{j'+1}}+\frac{2}{(1+r)^{j'+2}}+\cdots+\frac{T-j'}{(1+r)^{j'+m}}\right)\right]$$

Where $j' + m = T$. This reduces to:

$$PV_E^D = \left[P_1 w_1\left(\frac{(1+r)^{T-1}-1}{r(1+r)^T}\right)+P_2 w_2\left(\frac{(1+r)^{T-2}-1}{r(1+r)^T}\right)+\cdots+P_{j'}w_{j'}\left(\frac{(1+r)^{T-j'}-1}{r(1+r)^T}\right)\right]$$
$$+\left[P_1\Delta_{w1}\left(\frac{(1+r)^{T-1}-r(1)-1}{r^2(1+r)^T}\right)+P_1\Delta_{w1}\left(\frac{(1+r)^{T-2}-r(2)-1}{r^2(1+r)^T}\right)+\cdots+P_{j'}\Delta_{wj'}\left(\frac{(1+r)^{T-j'}-r(j')-1}{r^2(1+r)^T}\right)\right] \quad (2)$$

This equation gives the present value of direct benefits of education.

(b) Indirect External Benefits: Indirect benefits of education can be divided into two components: positive social externalities and non-pecuniary personal benefits. Several past studies assess the direct external impact of education and find that education results in increased political awareness and likelihood of participation in political process [Milligan, Moretti, and Oreopoulos (2004); Dee (2004)], lower level of criminal activity [Lochner and Moretti (2004)], improved health of household [Currie and Moretti (2004); Chou, *et al.* (2007)], increased probability of higher education of the next generation [Oreopoulos, Page, and Stevens (2003)] and higher rates of productivity of workers [Moretti (2004)]. Suppose *b* measures the indirect benefits of one year of education which accrue to the society in the lifetime of the child assumed to be *T* years. It includes psychological benefit associated with the tag of being 'literate' in society whereas carrying the stigma of illiterate in society gives disutility to uneducated people. This can also be viewed through screening argument of Stiglitz (1975), where education works as a signaling device for discriminating between high and low ability people. Let it be represented by *S* (a function of factors such as overall awareness about the importance of education in the society captured by the literacy rate). As this awareness increases in society, the stigma associated with illiteracy increases which leads to the higher magnitude of *S*. In this formulation, *v* can represent the vector of variables that affect *S* positively (for example, an increase in the literacy rate in an area where the child lives increases the level of stigma if there is a high tendency in the family of child to do work) Adding this psychological benefit with the above ones gives indirect benefits:

$$PV_E^{ID} = (b + S)T = B \quad [2] \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Adding Equations (2) and (3) gives total benefits of education career path. Subtracting cost (1) from total benefits of education gives net gains of education career path.

[2]Present value of these indirect benefits may be discounted at some subjective rate.

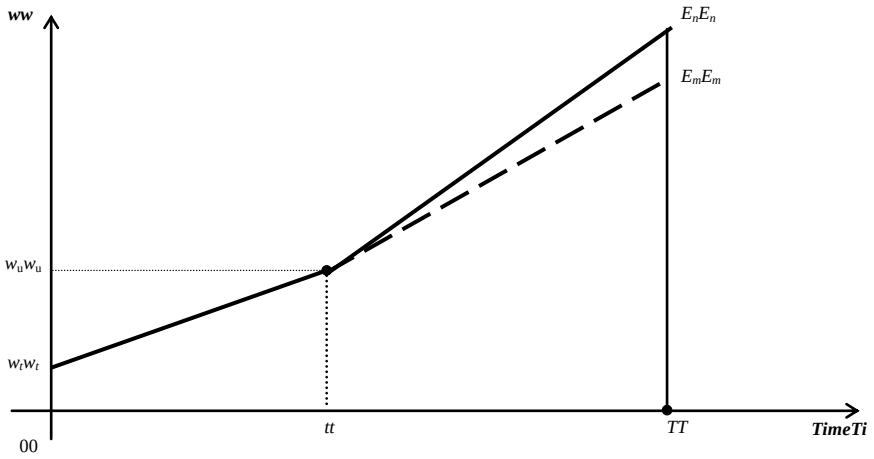
4.2. Modelling Apprenticeship Career Path

The benefit and cost corresponding to the choice of apprenticeship career path are given as follows.

(a) Apprenticeship career path enables the agent to earn wage w_o during training time which starts at time $t_o = 0$, and this w_o is also expected to increase overtime, say, at an amount Δ_t until the child becomes expert in his work after t years.

(b) The on-the-job training imparts valuable skills that eventually set his career path and earn him higher wage (w_u) in future when the training is complete and he turns into an expert (expert). The earning path after becoming an expert depends on whether he turns into an entrepreneur by setting his own enterprise and earns E_n or remains employee and earns E_m till time T. Let p be the probability that he would become an entrepreneur and earn Δ_{en} growth rate in w_u and $(1 - p)$ be the probability that he remains employee and obtains Δ_{em} growth rate in wage w_u till time T. Intuitively, Δ_{en} would be greater than Δ_{em}. For simplicity, we assume that w_t, w_u and their increments Δ_t, Δ_{en} and Δ_{em} are applicable to all apprenticeship professions that impart valuable skills. The probability of becoming an entrepreneur is dependent upon socio-economic opportunities (q) available to the agent. This earning schedule of apprenticeship career path is shown in Figure 3. The earning path in the case of establishing an enterprise is higher than in the case where an expert remains employee in the informal sector.

Fig. 3. Earning Path in Case of Apprenticeship Choice



The present value of expected lifetime earning in apprenticeship career path is given as follows:

PV_A = PV of earning during training time
+ p(PV of earning as entrepreneur after training)
+ $(1 - p)$ (PV of earning as employee after training)

This is given by the sum of present values of arithmetic gradient series:

$$PV_A^B = \left[w_t\left(\frac{(1+r)^t-1}{r(1+r)^t}\right) + \Delta_t\left(\frac{(1+r)^t-rt-1}{r^2(1+r)^t}\right)\right] + p\left[w_u\left(\frac{(1+r)^{T-t}-1}{r(1+r)^T}\right) + \Delta_{en}\left(\frac{(1+r)^{T-t}-r(T-t)-1}{r^2(1+r)^T}\right)\right] + (1-p)\left[w_u\left(\frac{(1+r)^{T-t}-1}{r(1+r)^T}\right) + \Delta_{em}\left(\frac{(1+r)^{T-t}-r(T-t)-1}{r^2(1+r)^T}\right)\right] \quad \ldots \quad \ldots \quad (4)$$

4.3. The Decision Criterion

The choice to send the child to school depends upon the above two *PV* expressions given in Equations (2) and (4). The objective is to examine how the factors that determine the choice of education career path play a role in schooling decision of the child. We analyse net benefits of both career paths for that critical education level (j^*) that equates the present values of the two career paths. Note that j^* is expected to lie between 0 and the highest level of education, i.e. $0 < j^* < j'$. Writing the direct benefits of education for j^* level of education and solving the total benefits of education with those of apprenticeship career we obtain,

$$PV_E^{NB(j^*)} = PV_A^B \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

$$j^* = \frac{ln\left(\frac{\alpha}{\gamma}\right)}{ln(1+r)-\left(\frac{\beta}{\alpha}\right)-\left(\frac{\gamma}{\tau}\right)} = \frac{\alpha\tau\ \ln\left(\frac{\alpha}{\gamma}\right)}{r\alpha-\beta\tau-\gamma\alpha}\ ^{3} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

Equation (6) gives the critical level of education (j^*) which equates the present values of the expected net benefits of education and informal apprenticeship career paths. The critical level of education (j^*) can also be interpreted as perceived pay-back period of the agent, that is how long will it take for return on education to become equal to the return yielded by apprenticeship career path. In other words, it is the number of years of education that the agent believes should leave him indifferent about the two career paths such that j^* is the breakeven point that would equate the net benefits of education with those of apprenticeship. Therefore, j^* can be seen as appropriate wait-time of the agent to enter the job market. This interpretation of j^* has two implications for rational decision making.

(1) It is evident from the solution that higher is the j^* required to equate PVs of both career paths, the more is the number of years a child must continue to study to out-perform the expected earnings of apprenticeship career. Also, the higher is the j^*, the higher is the initial wealth/income an agent must be endowed with to finance the cost of education. As the pay-back period of the agent increases, his willingness to go for education career would decline.

(2) Choosing the education career path is not necessarily superior for all levels of educational attainments. It depends upon the level of education (j) for which we are comparing the two choices. For all $j<j^*$, expected returns on education are less than those in apprenticeship career, hence choosing education would be inefficient for such an agent at these lower education levels. This important

[3]See Appendix for solution.

result shows why education policies that seek to 'ensure minimum education for all children' may fail under certain conditions (such as adverse poverty and family education background etc.). If education policies target a minimum education level j_t that is less than j^*, then agent would not be motivated. This is shown in detail in Section 4.5 below.

4.4. Some Comparative Statics of the Model

Equation (6) can be used to analyse the response of j^* to a set of exogenous and policy variables. We examine some of these here.

(1) Cost of Education (C): Differentiating (6) with respect to *C* gives:

$$\frac{\partial j^*}{\partial C} = \frac{\left(\frac{1}{\alpha}(ln(1+r)) - \frac{\beta}{\alpha} - \frac{\gamma}{\tau}\right) + ln\frac{\gamma}{\alpha}\left(\frac{\beta}{\alpha^2} + \frac{\gamma}{\tau^2}\right) r(1+r)^T}{\left(ln(1+r) - \frac{\beta}{\alpha} - \frac{\gamma}{\tau}\right)^2} < 0 \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

The above sign holds because $\gamma < \alpha$ (therefore $\frac{\gamma}{\alpha} < 1$) and $ln(1+r) < \beta + \frac{\alpha\gamma}{\tau}$. When the annual price of education increases, it decreases the net benefits of education and j^* would decrease in the mind of agent. This means that parents' willingness to spare the child for schooling would decrease. Thus, (7) says that the critical level of education (j^*) in the economy is required to decrease for motivating the agent to choose education career path after a rise in the cost of education. But if j^* does not change in the economy or the agent believes that it has not changed; then he would be discouraged to send the child to school after increase in *C*. Because j^* is determined by the interaction of several factors and market forces in the economy, it can't be altered (say by government intervention) in response to an increase in price of education. Hence, we have the proposition:

Proposition 1: Everything held constant, an increase in the price of education would decrease the number of years spent on education by the child.

It is interesting to note that the rate at which this perceived j^* changes due to a change in *C* depends not merely on the growth rate of the cost of education (Δ_c) but on several other variables.

$$j_c^* = f(r, w, \Delta_w, C, \Delta_c, P, A, B) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

The policy implication of the above result is that the cost of education should be subsidised because that would increase the likelihood of the child going to school by increasing the net-benefits of education and hence increasing the wait-time of the agent. It can be shown that $\frac{\partial j^*}{\partial \Delta_c} < 0$ which implies that annual increment in the cost of education also decreases *j**.

(2) Probability of Becoming Entrepreneur (p): If the agent has a higher probability that the child would turn into an entrepreneur in apprenticeship career, then the pay-back period (length of time for which agent is required to spare child for education) would increase:

$$\frac{\partial j^*}{\partial p} = \frac{rln\left(\frac{\gamma}{\alpha}\right)}{\left(r - \frac{\beta}{\alpha} - \frac{\gamma}{\tau}\right)^2}\left(\frac{(\Delta_{en} - \Delta_{em})(1+r)^{T-t} - rt - 1}{P}\right) < 0 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

because $\Delta_{en} > \Delta_{em}$ and $\gamma < \alpha$. If parents have higher expectations that the child would be able to become an entrepreneur, then their willingness to send the child to school would decrease as their wait-time decreases. This is because with higher *p*, the PV of net benefits of apprenticeship increases.

Proposition 2: If the agent has a higher likelihood of his child becoming entrepreneur in the apprenticeship career, his willingness to send the child for education would decrease.

Some more interesting results can also be derived using Equation (6). We move onto analyse the policy of minimum basic education using insights of the above model.

4.5. Failure of Minimum Basic Education Policies

We now discuss the implications of a policy that aims at some minimum education level j_T. Figure 4 plots the *PV* of benefits from both career paths. The dotted line is cumulative present value of benefits from apprenticeship career from time zero to *T*. It is positively sloped because w_t as well as $w_u > 0$ and is plotted convex because we have assumed Δ_c such that the rate of increase in wage is greater than *r* (the discount rate). Solid curves plot cumulative present values of net-benefits from education path at different levels of education. The curve labeled PV^1 is *PV* of education net benefits for education level 1 (say primary). The curve is drawn below throughout PV_A curve indicating the fact that *PV* of life-time net-benefits of education are less than PV_A at this education level. This curve shifts up as education level increases (say to education level 2) and at j^* level of education, *PVs* of both career paths are just equal. At all educations levels beyond j^* (such as j^{*+}) PV_E of education net benefits exceeds that of PV_A.

Fig. 4. Earning Path in Case of Education Career Choice

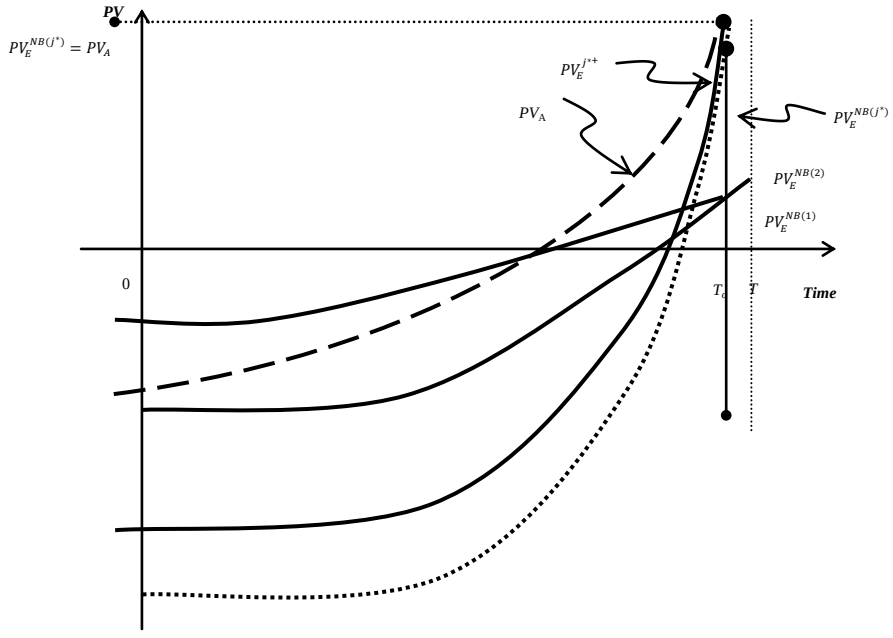
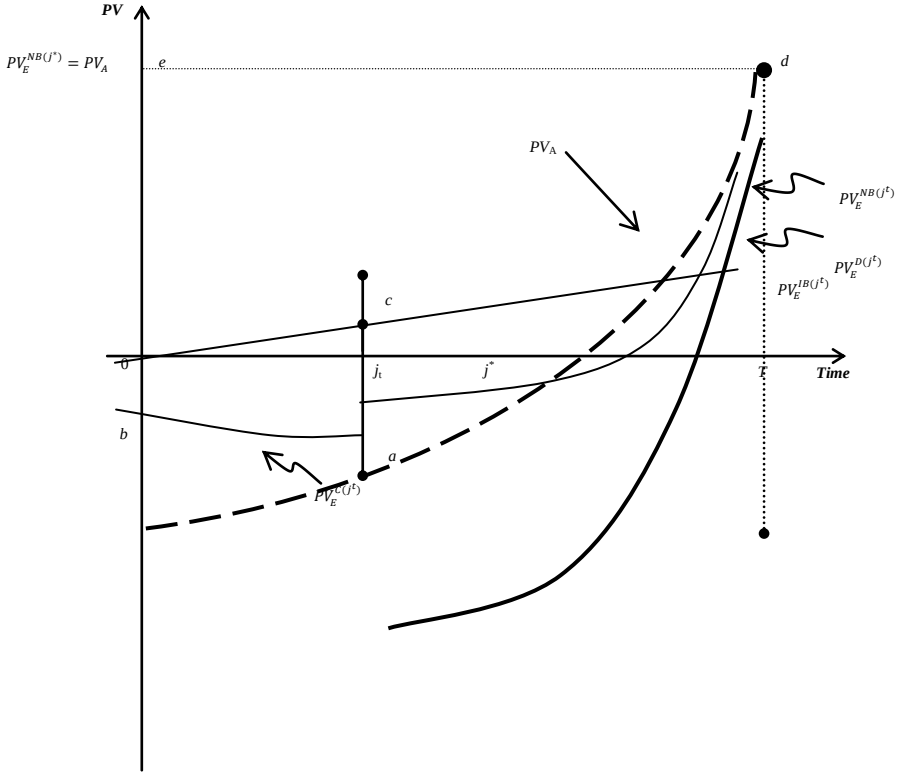


Figure 5 plots *PV* of education benefits for j^* level along with PV_A. The thinner lines are depicting the components of net benefits of education (i.e. *PV* of direct and indirect benefits and cost). Consider an agent who is poor and has low expectations of his child reaching j^* education level. He would send his child to school only if he expects the attainment of j^* level of education. In other words, his demand for education would be zero below j^* level. Suppose that the policy maker is targeting universal attainment of some education level j_t, say primary, such that $j_t<j^*$. Clearly, this agent would not be motivated to send child to school even if explicit cost $ab0j_t$ is waved and additional amount $0cj_t$ is given as conditional cash transfer to compensate implicit cost of sending the child to school till j_t period. Note that the implicit cost of j^* education level is given by area below PV_A curve (*dT0*) while explicit cost would be above cost line up to j^*. This agent would be motivated for child schooling only if the subsidy guarantees j^* (say graduation) level of education and not j_t. The farther is j^* from j_t level, the more is likelihood that the policy would fail in motivating this agent.

Fig. 5. Earning Path in Case of Education Career Choice



It is important to emphasise the reason of failure of this policy design for this specific agent. The policy-maker targets education level j_t (say primary) mainly due to external considerations of education (that it makes children better citizens, inculcates basic skills etc.) but the agent views this policy on the basis of the effects of this j_t education level on career earning path of the child. If the policy maker sets j_t much lower

than j^* of the agent, this is tantamount to leaving the poverty ridden agent far behind in his efforts to reach j^*. Hence, he would refuse to move along with this policy-maker to the point j_t.

The solution to this policy failure requires that j_t should be set as close as possible to j^* to motivate these agents for participating in such minimum education programs. In other words, the minimum is required to be as high as possible. The alternative method of making this policy more effective is to facilitate these children to acquire human capital through both sources simultaneously. This requires changing the existing institutional arrangements that can convert the 'dichotomy' between the two sources of acquiring human capital into 'complementarity'.

5. SIMULATION ANALYSIS

A comprehensive empirical analysis of the propositions developed in the previous section essentially requires data on the variables used in the theoretical framework. Unfortunately, data on these variables do not exist for any country. Alternatively, we carry out simulation analysis of final equations of the model using appropriate prior information and estimates from the literature. Table 2 gives the description of the parameters used in the simulation analysis. The estimates of starting wages for different education levels (W_j) are obtained from Labour Force Survey of Pakistan 2014-15 by using following criteria.

- Employed workers with j years of education are selected.
- Among the selected workers, those with minimum age are identified (e.g., 16 years of age for 8 years of education).
- The average wage of these workers is treated as starting wage after j years of education.

The growth rate of W_j is approximated by real per capita growth rate of 2014-15 with some adjustment for higher j levels. Similarly, cost of education and its increment are approximated keeping in view the expenditures in public sector education institutions. The estimates of data used for simulating equation for apprenticeship career are mostly based on the Survey conducted in three major cities of Pakistan namely Karachi, Lahore and Rawalpindi/Islamabad by Siddique and Ahmad (2018).

Table 3 gives the results of simulation. It shows how the lifetime net benefits of education (NBE) respond to different levels of education (j) acquired by the worker. The benefits of apprenticeship (BA) are assumed to be independent of education level in this calculation. The results clearly show that the net benefits of education are less than the benefits of apprenticeship until the higher secondary level of education (equivalent to Grade 12) is obtained by the individual. However, for all higher levels of education, the net monetary benefits of education are higher than the same for apprenticeship career path. Figure 6 plots the same information and shows that the net benefits of education get closer to the benefits of apprenticeship as j increases and these become equal at approximately 12 years of education. In other words, the present value of benefits from both career path become equal if a child achieves 12 years of education. Our results are based on two caveats. First, we assume for simplicity that there are no benefits other than the wage earned by the worker. Second, the benefits of education are assumed neutral to

Table 2

Definition of Variables Used in the Simulation Analysis

Notations	Description	Based on	Value Used
r	Discount rate	Real discount rate of last five years	3%
j	Number of years of education after which one joins job market	Years of schooling	Years from 8 to 16
P or Pj	Probability of completing j years of education	Intuitive guess values	$P_j(8) = 0.95$ $P_j(10) = 0.85$ $P_j(12) = 0.75$ $P_j(14) = 0.65$ $P_j(16) = 0.55$
S_o	School starting age	Age	5 Years for class one
W_j or W_{j*}	Starting wage rate after j years of education level	Average Wages of employed workers (Labour Force Survey, 2014-15)	$W(8) = 8000$ $W(10) = 11000$ $W(12) = 14500$ $W(14) = 20000$ $W(16) = 24000$
ΔW_j	Annual growth rate of Wj	Equal to real per capita growth	@4% for Grade-8-12 and @6% for Grade-13 onwards
ΔC	Annual growth rate of cost of education C		@3% annually
T	Retirement time (60 years of age)	Age	60 Years
$T - (j + So)$	Work time after completing j years of education	Productive age of a person	Calculated as required
W_o or W_t	Starting wage of trainee when he starts apprenticeship at $t = 0$	Siddique and Ahmad (2018)	Rs 150 daily
ΔW_o	Annual growth rate of W_o	Lump sum annual increase	Rs 500
W_u	Starting wage of Ustad (trainer)	Siddique and Ahmad (2018)	Rs 14,000
ΔW_u or Δ_{en}	Annual growth rate of W_u	Lump sum annual increase	Rs 2,000
W_{em}	Starting wage of trainee who remains employee	Siddique and Ahmad (2018)	Rs 14,000
ΔW_{em}	Annual growth rate of W_{em}	Lump sum annual increase	Rs 1,000
P	Probability of becoming trainer (*Ustad*) after training	Siddique and Ahmad (2018)	0.75
$1 - p$	Probability of remaining employee after training	Siddique and Ahmad (2018)	0.25
AC	Starting age of training in Apprenticeship career path	Age of trainee	10 Years
t	Years it takes to complete training in the apprenticeship career	Average training time	4 Years
$T - (AC + t)$	Working years after the completion of t years of training	Productive age of a person	Calculated as required

Table 3

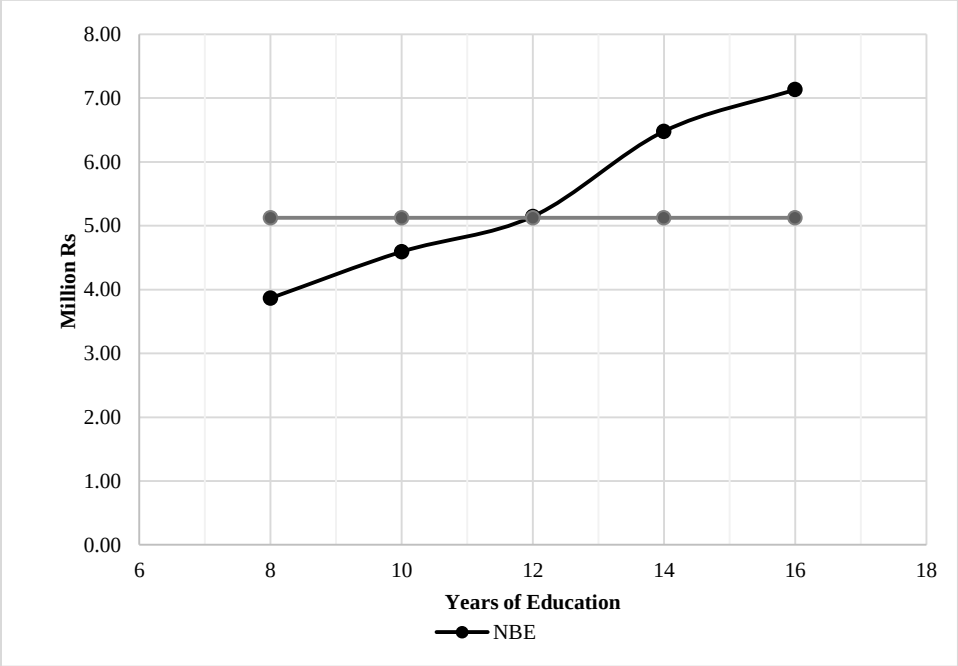
Results of Simulation Analysis

(Million Rupees)

Years of Education	Net Benefits of Education	Benefits of Apprenticeship	Difference
8	3.87	5.12	–1.25
10	4.59	5.12	–0.53
12	5.15	5.12	0.03
14	6.48	5.12	1.36
16	7.13	5.12	2.01

the quality of education. Both these assumptions are quite strong but are opted due to data constraints. Therefore, $j^* = 12$ is the level of education that approximately equalised the benefits of two alternative career paths (at least in the absence of stringent regulation banning the early age work choices). The results suggest that the policy of targeting 10 years of schooling is expected to fail as an incentivising tool. It essentially requires some sanctions for the parents who opt early age work for their children.

Fig. 6. Simulation Results of NPV of Education and Apprenticeship Career Paths



6. CONCLUSION

Child-labour is major cause of nonattainment of universal primary education among school age children. The conventional wisdom views early age work largely as an outcome of poverty whereby the agent seeks to ensure survival. The issue of out-of-school children signifies the important role of factors affecting both the demand for and supply of education. On the one hand, it implies the failure of the government to supply quality education. On the other hand, the benevolent parents may find it worthwhile to equip the child with some marketable skills for ensuring his future earnings. This view about the prevalence of child-labour cannot satisfactorily explain high rates of educational deprivation in Pakistan. A more relevant descriptive model is developed in this paper that can address this paradoxical evidence.

This paper highlights that early-age work can be a source of human capital accumulation when the agent opts it as an apprenticeship career path, mostly in the informal sector of the economy. There is also a general belief that child-labour necessarily compromises the development of human capital. The model takes into account the cost benefit framework for apprenticeship-education choice and reveals that

early-age work may not necessarily be inefficient when compared with different levels of education. The rational choice of parents depends upon the expected returns from education and apprenticeship career paths. If parents have low expectations regarding their child reaching the critical level of education where the expected benefits from education outweigh those from apprenticeship career, they are unlikely to send the child to school. This suggests that policies that aim at universal basic education may fail to achieve the desired outcomes.

The paper carries out the simulation analysis to validate the theoretical model by employing the most relevant available data and compare the benefits in the form of prospective income earned in the two career paths. It finds that at a lower level of education the net benefits of education are lower than the benefits of apprenticeship career path; however, as education level rise above the Grade-12, the net benefits of education are better than those of early age-work for all higher levels of education. The theoretical and empirical analyses clearly indicate the reasons for low educational attainments of education in poor households. The policy of universal education can be achieved by minimising the number of out-of-school children and drop outs. Moreover, the economy relies on the informal sector for a large number of economic activities and services for which no formal institutions exist and informal sector attracts resource poor households for career choices of their children.

To increase the effectiveness of policies, the targeted education level should be set as close as possible to a level whereby marginalised segments of the society can acquire education along with their apprenticeship career path. A limitation of the study is that it assumes a community where parents have discretion to choose between education and early-age work. The study offers a theoretical framework that needs to be empirically tested by using data of individuals choosing both the alternative career paths. This should be an interesting future undertaking for researchers especially in those countries where child-labour is a chronic issue.

APPENDIX

Using:

$$PV_E^{NB(j^*)} = PV_A^B \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \text{(a)}$$

$$P_{j^*}\left(w_{j^*}\left(\frac{(1+r)^{T-j^*}-1}{r(1+r)^T}\right)+\Delta_{wj*}\left(\frac{(1+r)^{T-j^*}-r(T-j^*)-1}{r^2(1+r)^T}\right)\right)+(b+S)T-P_{j^*}\left(C\left(\frac{(1+r)^{j^*}-1}{r(1+r)^{j^*}}\right)+\Delta_c\left(\frac{(1+r)^{j^*}-r(j^*)-1}{r^2(1+r)^{j^*}}\right)\right)$$
$$=\left[w_o\left(\frac{(1+r)^t-1}{r(1+r)^t}\right)+\Delta_t\left(\frac{(1+r)^t-rt-1}{r^2(1+r)^t}\right)\right]+p\left[w_u\left(\frac{(1+r)^{T-t}-1}{r(1+r)^T}\right)+\Delta_{en}\left(\frac{(1+r)^{T-t}-r(T-t)-1}{r^2(1+r)^T}\right)\right]+$$
$$(1-p)\left[w_u\left(\frac{(1+r)^{T-t}-1}{r(1+r)^T}\right)+\Delta_{em}\left(\frac{(1+r)^{T-t}-r(T-t)-1}{r^2(1+r)^T}\right)\right] \quad \dots \quad \dots \quad \dots \quad \text{(b)}$$

or

$$P_{j^*}\left(w_{j^*}\left(\frac{(1+r)^{T-j^*}-1}{r(1+r)^T}\right)+\Delta_{wj}\left(\frac{(1+r)^{T-j^*}-r(T-j^*)-1}{r^2(1+r)^T}\right)\right)-P_{j^*}\left(C\left(\frac{(1+r)^{j^*}-1}{r(1+r)^{j^*}}\right)+\Delta_c\left(\frac{(1+r)^{j^*}-r(j^*)-1}{r^2(1+r)^{j^*}}\right)\right)=A-B$$

Where

$$A=\left[w_o\left(\frac{(1+r)^t-1}{r(1+r)^t}\right)+\Delta_t\left(\frac{(1+r)^t-rt-1}{r^2(1+r)^t}\right)\right]+p\left[w_u\left(\frac{(1+r)^{T-t}-1}{r(1+r)^T}\right)+\Delta_{en}\left(\frac{(1+r)^{T-t}-r(T-t)-1}{r^2(1+r)^T}\right)\right]+(1-p)\left[w_u\left(\frac{(1+r)^{T-t}-1}{r(1+r)^T}\right)+\Delta_{em}\left(\frac{(1+r)^{T-t}-r(T-t)-1}{r^2(1+r)^T}\right)\right]$$

and $B=(b+S)T$. Simplifying and combining *j*-terms on the left hand side:

$$\left(\frac{w}{r}+\frac{\Delta_{wj^*}}{r^2}+\frac{C}{r}+\frac{\Delta_c}{r^2}\right)\frac{1}{(1+r)^{j^*}}+\left(\frac{\Delta_c j}{r(1+r)^{j^*}}+\frac{\Delta_{wj^*}}{r(1+r)^T}\right)=\frac{A-B}{P}+\frac{w_{j^*}}{r(1+r)^T}$$

Multiplying both sides by $r^2(1+r)^{T+j^*}$ we have:

$$\frac{\alpha+\beta j^*}{\tau-\gamma j^*}=(1+r)^{j^*} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \text{(c)}$$

Where:

$$\alpha=\left(rw_{j^*}+\Delta_{wj^*}+rC+\Delta_c\right)(1+r)^T$$
$$\beta=r\Delta_c(1+r)^T$$
$$\gamma=\frac{r\Delta_{wj^*}}{(1+r)^T}$$
$$\tau=\frac{(A-B)r^2}{P}(1+r)^T+rw_{j^*}+r\Delta_{wj^*}T+\Delta_{wj^*}+(Cr+\Delta_c)(1+r)^T$$

Taking logarithm on both sides of (c), the equation can be written as follows:

$$ln\left[\alpha\left(1+\frac{\beta}{\alpha}j^*\right)\right]-ln\left[\tau\left(1-\frac{\gamma}{\tau}j^*\right)\right]=j^*(1+r)$$

Simplifying using logarithm expansion $ln\,(1+x)=x$ for $x<1$:

$$j^*=\frac{ln\left(\frac{\alpha}{\gamma}\right)}{ln(1+r)-\left(\frac{\beta}{\alpha}\right)-\left(\frac{\gamma}{\tau}\right)}=\frac{\alpha\tau\ ln\left(\frac{\alpha}{\gamma}\right)}{r\alpha-\beta\tau-\gamma\alpha}$$

Where $|j^*|<min\left\{\left(\left|\frac{\alpha}{\beta}\right|,\left|\frac{\tau}{\gamma}\right|\right)\right\}$

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