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Health as an Investment Commodity: A Theoretical Analysis

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Abstract A healthy and productive workforce is important for both industrial and economic growth. For without health labour cannot transform their stock of knowledge into production of goods and services. Improving the health status of labour has been of increasing interest to employers and stakeholders. However, this concern has received little attention from recent studies. This paper therefore sought to review theoretical literature on health investment, restricting attention to health as an investment commodity, to highlight factors having impact on health investment to enable the study to provide policy measures.

Keywords: *health capital, health investment, employees, stakeholders*

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1. Introduction

A healthy and productive workforce is important for both industrial and economic growth. Poor health either results in loss of days worked, called absenteeism, or reduced work capacity, called presenteeism [1]. Labour represents the number of person-hours required for the production of the desired good or service [2]. The health status of labour is an important factor in the production process because without health labour cannot transform their stock of knowledge and skills, acquired through education and/or experience, into production of the desired goods or services [3]. Individuals with good health are able to work more and earn more than those with poor health [4]. Therefore, the incentive for investing in health is to increase the number of person-hours required for the generation of income [5]. The importance of health capital increases as the production becomes increasingly health intensive. As a person ages his stock of health depreciates which is, of course, "merely one manifestation of the biological process of aging" [[5]; p. 236]. Occupation, however, contributes further to this depreciation [6,7]. The industrial sector happens to be where employees are often exposed to workplace physical and chemical hazards [8,9,10] and among other hazards. For example, a high concentration of aluminium was found in the blood and urine among workers producing aluminium flake powder [11]. It is estimated that two million people around the world die each year as a result of work-related illnesses or injuries and occupational accidents, and 160 million new cases of work-related illness each year [7]. It is reported that a substantial part of the general morbidity of the population is related to work. But one wonders how many employees know that their ill-health is work related. Disposable income of employees depends on the state of heath; hence, a very poor state of health is associated with a zero income and consequently with zero consumption [12]. Reference [13] two-period overlapping generations model acknowledges the impact of health on longevity and investment in health capital, along with education, having positive effects on labour productivity. The model points out that investment in health improves the probability of an individual surviving from the first period of life to the next. The authors argue that absenteeism (and presenteeism) and premature retirement due to ill-health can be reduced and avoided by investment in health. Ill-health can retire employees before the retirement age of the economy. Any ill-health and chronic incapacitation that forces employees to retirement is a loss of productivity to the society and firms and loss of income to the employees. The rate of retirement due to ill-health may vary between organisations and may even vary within the same organisation because of different tasks performed by the employees. However, recent studies have not given much attention to investment in health for investment purposes. The necessity of this study arises to review theoretical literature on health investment, restricting attention to health as an investment commodity, to highlight factors that affect investment in health to enable the study to provide policy measures to stakeholders when designing and reviewing programmes that have influence on health investment.

2. Investment in Health Capital

2.1. Inputs for Health Production

Reference [5] developed a health investment model in which health is viewed as a capital stock which yields an output of "healthy days" and the incentive for a person to invest in his health is to increase the amount of time available for producing goods or services. By definition, net investment in the stock of health equals gross investment minus depreciation, expressed as follows:

$$I_t - \delta H_t = H_{t+1} - H_t \quad (1)$$

where I_t is gross investment and δ is the rate of depreciation. The rates of depreciation are assumed by the model to be exogenous, and may vary with the age of the individual. H_t is the health stock at time t. Also, according to the model, individuals produce investment according to a set of household production functions:

$$I_t = I_t(M_t, TH_t; E) \quad (2)$$

$$Z_t = Z_t(X_t, T_t; E) \quad (3)$$

where M_t is the vector of inputs such as medical care or exercise, for example, used to contribute to the gross investment in health; TH_t is time input for health; E is stock of knowledge which is exogenous. Z_t is the consumption of other commodities; T_t is the time input and X_t is vector of inputs for the production of Z_t. The model considers health as a durable good that depreciates. However, by means of investment the stock of health capital can be accumulated by combining medical services and one's own time, for example, to produce new health which counters the effect of the depreciation of health stock. According to Grossman, health is both demanded and produced by individuals and it is defined to include longevity and illness-free days in a given year. Health is demanded for two reasons: as a consumption commodity because individuals derive utility from healthy days and as an investment commodity – which this study restricted attention to – determines the total amount of time available for producing goods or services. The latter implies health is an output of inputs and as one of inputs of output. Thus, inputs such as medical services and one's own time are used to produce (good) health, I_t; time, which in turn serves as one of many inputs such as computer and one's skills to produce goods or services, Z_t. The demand for health as consumption and investment commodities makes it seem reasonable to assume that the rich will spend most of their time on consumption of goods and services like watching football match in a stadium, visiting a museum, or having fun at the beach, with the poor, on the other hand, spend most of their time working to earn more income. That is, the poor will tend to demand more health for investment purposes while the rich demand more health for consumption purposes. Investment in health implies either pre-illness investment or post-illness investment. For a pre-illness investment in health, when the individual is not yet ill, the time he takes off from work to visit a physician or for taking medication can be referred to as time input. Here, combining own time and medical care is meant to reduce the probability of illness. With post-illness investment, thus when or after illness strikes, the time taken off from work to seek treatment from a physician or relaxing at home to recuperate is both sick time and time input. Here, combining own time and medical care or recreation is meant to restore to good health. In this case, sick time and time input are indistinctively separated. The premise of the Grossman's model is based on age as the only factor causing depreciation of health, which can be viewed as natural depreciation of health. However, occupation and lifestyle also cause depreciation of health, which can be viewed as artificial depreciation of health. Individuals in occupations that expose them to a high level of pollution, for example, experience a faster depreciation of health than their colleagues in healthy occupations; also, those who engage in wild lifestyle such as smoking or drinking will have their health depreciating faster than that of those who do not engage in such activities; all other things held constant.

2.2. The Relationship between Investment and Health Capital

Reference [14] developed two models of investment in health where in the first model individuals invest in health capital when the motive for investing in health is to decrease the probability of illness and in the second model individuals invest in health through their choice of occupation. The first model assumes that an individual receives an income of Y and divides it between expenditure on consumption goods, C, and investment in health capital, I. With a constant marginal cost of c and consumption good price of v per unit, the instantaneous budget constraint of the individual is expressed as follows:

$$Y = cI + vC \quad (4)$$

According to the model, expenditure on consumption increases the individual's utility provided that he is well, while investment in health increases the health capital stock according to the relation

$$H = I_t - \delta H \quad (5)$$

The equation (5) indicates that the health stock decays over time as the individual ages. The model assumes that initially the rate of decay, δ, is constant throughout the individual's lifetime, however there is a possibility that δ increases over time. Cropper's model is an investment in health under uncertainty in which the health capital stock is deterministic with the stochastic element entering as an illness threshold. The model views the relation between illness and health capital as random rather than as deterministic. The model assumes that whether a person is well or ill depends on events such as changes in climate, exposure to germs and viruses as well as the size of the health stock, which Cropper refers to as random events. The model assumes that illness strikes whenever the health stock, H, falls below a critical sickness level, H_t, which can also be called illness threshold, represented by the individual's exposure to germs or pollutants. Differently put, the individual is sick if at any given time the value taken on by the illness threshold is above his health stock while if it falls below his health stock he is healthy. Therefore one increases his chances of being well by maintaining a high health capital stock or to reduce the probability of illness as long as the illness threshold remains constant over time or the health stock should always be above the illness threshold should the two rise or fall. Cropper treated the relationship between health capital and illness as random rather than as deterministic.

That is, the individual, according to Cropper, cannot guarantee that illness will not occur for at every point in time, she explains, one of two states – ill or not ill – will occur. But she continues that the probability of either state occurring depends on the health stock which is determined by investment. This latter statement suggests that illness is as well deterministic since the health stock, which is determined by investment, determines the probability of whether or not illness will occur. This therefore means illness is partly deterministic and partly random with events such as industrial accidents constituting the random aspect.

2.3. Health and Occupational Choice

In the second model of reference [14], an individual invests in his health through his choice of occupation. In order to focus on the problem of occupational choice, the model assumes that at each time, *t*, an individual has *L* of labour which he divides between a "healthy" occupation and an "unhealthy" occupation which pays a higher wage but exposes him to a potentially lethal pollutant. If L_t denotes the number of hours worked in the unhealthy occupation, then the individual's income at *t* according to the model, is written

$$Y_r = L + wL_t \quad (6)$$

where *w* represents the wage differential between the two occupations, and the wage in the healthy occupation is taken without loss of generality to be one. The extent of exposure to pollutants determines and increases the probability of death. The model predicts how workers tend to respond to information about occupational dangers. The problem faced by the employee is trading higher wages for an increase in the probability of death. If an employee is faced with a choice between, for example, a job at the brewery which is found to be potential to destroy the immunological status and a safer but lower-paying occupation, how should he optimally behave? Or should an employee who has worked for many years in an occupation which is found to be deleterious to his health continue working in that occupation assuming that he has already accumulated a large stock of the pollutant or should he change his occupation and allow the pollutant to decay? To answer these questions, according to Cropper, if an individual should choose to work in an unhealthy occupation, he should work in such occupations when he is young and switch to a healthier occupation as he grows older to decrease his pollution stock. Also, to the question of what the individual would do when he discovers that his occupation is dangerous to his health, Cropper says the employee should continue to work in that occupation to further increase the stock of the pollutant rather than leaving for a healthier job. Cropper admits that these answers are "somewhat surprising" (p. 1275), but the only explanation she gives to the somewhat surprising answers is that "these conclusions are based on a model" (p. 1276). According to cropper, a person will not fall sick even when illness strikes as long as the health stock is above the illness threshold, which implies a very high health stock aims at reducing the probability of illness. Occupational health and safety practices and healthy lifestyle, on the other hand, aim at non-occurrence of illness in the first place [15,16]. Occupational health and safety practices such as clean air at the workplace or healthy lifestyle such as avoidance of smoking is one of many health inputs for production of health; hence illness is partly deterministic, but not wholly stochastic. According to the model, a period of illness is not followed by a period of recovery as long as the illness threshold is above the individual's health stock, nor could illness have a permanent effect since the illness threshold can fall below the health stock. Thus, prolonged illness does not have long term consequences in the form of reduced health in the future, since there is the probability that the illness threshold will fall below the same health stock. She therefore suggests that the model is best represents mild illnesses, such as colds, whose impact on the health stock is likely to be minor, but not representing severe or serious illnesses.

2.4. Health Investment Decisions

Reference [17] model is restricted to the employed individuals and their behaviour in the period of acute illnesses such as colds, but not chronic illnesses, with regard to demand for medical services and absenteeism. According to Gilleskie, absenteeism can be an important complement to or substitute for medical care. Thus according to the model, with the expected utility maximization, the individual chooses whether or not to resort to medical services and whether or not to miss work. He argues that individuals do not decide at one time the number of visits they will make to a physician within a year, but medical services consumption decisions are sequential and contingent, thus, decisions today is dependent on what happened yesterday. According to the model, given income, sick leave coverage, and health insurance; a person decides upon becoming ill, whether or not to seek medical care and whether or not to be absent from work. Gilleskie argues that by seeking medical treatment or staying home from work, one may improve his chances of recovery from the acute illness. Given the numerous illnesses and different groups of individuals, according to Gilleskie, could lead to wrong estimation of the parameter in modelling demand for health. Therefore he restricted attention to specific class of illnesses and a particular group of people: employees. The model ignores preventive care so an individual who feels he is not ill will not make any medical visits. However, illnesses may not be diagnosed and treated, hence may develop into serious illness if the health investment decision does not include preventive care [18]. The model assumes a zero probability of moving from one type of illness to another within an illness period as well as a zero probability of an acute illness developing into a chronic illness. But it is when the individual seeks preventive care that has a higher probability that a particular illness does not develop into another one [19].

2.5. Downward and Upward Shocks to Health Capital

Reference [20] introduced uncertainty into a static model of reference [5] demand for health. Reference [20] point out that illness affects the health stock by causing a reduction of it. According to this model, severe or serious illnesses have impact on the health stock of the individual and are considered as random walks. The authors define

serious illness as one which permanently reduces the individual's stock of health capital. That someone who experiences a severe illness does not necessarily bounce back to full health – which they define as a high level of health capital. The model assumes health stock of the individual and how healthy she feels to be same. The model looks at two kinds of illness: one that reduces the health stock of the individual by a certain proportion, *a*, and another which reduces the individual's health stock to a certain level, H_s. In the first case, the amount of health stock the individual is left with after the illness strikes depends on how much she had before the illness. This implies that the greater the pre-illness health stock of the individual, through investment, the greater her post-illness health stock. The pre-illness health stock determines the rate of recovery after the individual is hit by a certain proportion, *a*, of illness and puts her at the position of reducing the probability of contracting another illness. In the second case, because the health stock of the individual falls to a fixed predetermined level, the pre-illness health stock has no influence on the post-illness health stock. This implies pre-illness investment should aim at preventing illness but not also to increase the rate of recovery after illness strikes or reduce the probability of contracting another illness. This is because irrespective of the amount of investment the individual makes if she is hit by illness her health stock falls to the fixed predetermined level. This model is considered as a health stochastic variable whose variation over time is determined partly by a deterministic factor and partly by a random factor. Increase of health stock through deliberate private investment is the deterministic factor. The random factor has to do with car accident, gas explosion and the likes. The random factor, argue by the authors, tend to always cause downsize of the health stock with no upward shock to the health stock, but upward shocks to health capital are hardly observed. Laporte and Ferguson argue that downward shocks, called illness, are easy to observe, whiles unexpected recuperation from illness are seen as upward shocks, but the probability of upward shocks is low for a person already in a very good health, exhibiting diminishing returns. Thus, the model postulates that there is diminishing returns on the return on investment when the individual has reached the upper limit of full health. A case in point is if an employee falls sick in the course of work she may resort to, for example, medication to be restored to good health to enable her to continue with the work or will be able to return to work the following day. The initial return on investment will be high, according to the model, but falls when she recovers from the illness. But this diminishing returns on the return on investment could be due to the consumption technology of medication but not the attainment of full health as put forward by Laporte and Ferguson. With an increasing consumption technology of a drug, subsequent dosages are more effective than the initial ones, thus the more of a drug is consumed the more effective the drug becomes; while with a decreasing consumption technology, initial dosage is more effective than subsequent ones. With a linear consumption technology of a drug, subsequent dosage is as effective as the initial dosage. This suggests that the type of medication would rather exhibit diminishing returns, but not the attainment of full health. This is because even when the individual has attained full health she may have to continue be on medication, for example, to maintain that level of health stock even if not to improve upon it.

3. Conclusion

This paper reviewed theoretical literature on investment in health – restricting attention to health as an investment commodity. The study concludes that investment in health increases the total amount of time available for the production of goods and services. Reference [21] point out that the health state of the individual is influenced by prices, income, and tastes which are factors influencing the demand for health inputs. These factors have impact upon the consumption decisions individuals make about health inputs which determine the health state. Thus, the extent to which individuals choose to alter the consumption of health inputs depends on factors such as prices, income, and preferences. For example, those with higher income are able to afford quality healthcare than persons with lower income; also, the lower the price of health inputs the higher the demand for them [19]. Individuals will invest in their health if they have access to the available health inputs. Stakeholders should make facilities available and accessible to employees for health investment: Governments should introduce pro poor health programmes to make healthcare accessible to also the low income employees, firms should establish clinics at their workplaces to provide primary healthcare services to their employees since primary care provides greater access to needed services, greater focus on prevention, and early management of health problems [18]. Medical bills payment coverage policies by firms should give priority to blue-collar workers who are most likely to be exposed to high health risks, such as pollutants, by virtue of the nature of their work and also are most likely to be low income earners.

The proverb "Health is not everything in life, but without health, life is nothing" points to the dual property of health: Health is not everything, but without it life is nothing. Without health labour cannot transform his or her knowledge and skills into production of goods and services. Individuals in their search for jobs, with regard to health investment, should consider working in firms with health policies or facilities that provide the employees access to medical care. Employees, especially the low income earners, should subscribe to pro poor health programmes such as National Health Insurance Schemes to provide them 'free' access to medical care. Illnesses may not be diagnosed, hence treated, if preventive care does not form part of the health investment decision. Therefore individuals should include preventive care in their health investment decisions. Also, stakeholders should consider as well preventive care when introducing or reviewing health programmes that have influence on health investment decisions of employees. Countries should adopt a comprehensive national policy on Occupational Health and Safety (OHS) practices and periodically review the policy to ensure that employees are not exposed to hazards that would lead to work related illnesses, injuries, or death. Finally, medical expenditures should be categorised into preventive medical expenditure, which is a pre-illness medical expenditure; and curative

medical expenditure, which is incurred at the event of illness to enable informed policies to be made towards preventive and curative treatments.

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