Infectious Diseases and Labour Force Productivity in Industries: A Challenge to Growth- A Study of the Nasco Group, Jos

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ABSTRACT
A major hindrance to effective labour force participation in the process of productivity is the state of its health. Ill health in the labour force increases disease burden and reduces the capacity, vigor and capabilities which it needs to effectively engage in productive activities while increased absenteeism due to ill health reduces overall workplace productivity. This study evaluates the impact of health on workforce productivity in industry in the growth process using data obtained from a field study and analysized through admixture of statistical methods. Given that Nigeria is a highly labour-intensive economy, importance must be accorded to having a healthier workforce in order to maximize productivity. Another essential finding in the study lies in the statistical significance of the education-labour and health capital-labour interaction terms

INTRODUCTION

Health remains an important form of human capital which enhances workers' productivity by increasing their physical capabilities, such as strength and endurance, as well as their mental capacities. Indeed, there substantial revealed evidence of this link is increasing at the microeconomic level from studies by scholars such as Savedoff and Schultz 2000; Schultz 1999a, 1999b, 2002; Schultz and Tansel 1992; Strauss and Thomas 1998. A link also exists between health and income at the macroeconomic level where there are strong cross-country correlations between measures of aggregate health, such as life expectancy, mortality and morbidity, and per capita income as established (Preston 1975; World Bank 1993). Such aggregate health will result in increased savings, investments and consumption that can impact on growth through increased productivity. Social scientists commonly regard these correlations as reflective of a causal link running from income to health such as McKeown 1976; Pritchett and Summers 1996. There are plausible pathways through which health improvements can influence the pace of income growth via their effects on labor market participation, worker productivity, investments in human capital, savings, fertility, and population age structure as revealed by Bloom and Canning 2000; Bloom, Canning, and Sevilla 2002a; Bloom, Canning, and Graham 2003; Commission on Macroeconomics and Health 2001; Easterlin 1999; Hamoudi and Sachs 1999..Through higher productivity, incomes can increased that leads to improved access to many of the goods and services believed to produce health and longevity, such as a nutritious diet, safe water and sanitation, and good health care. This standard view has though been challenged in recent years in the belief that there is a possibility that the income-health correlation is also explained by a causal link that runs the other way, from health to income.

Disease conditions affect economic outcomes through different channels (Weil 2008), who believes that the simplest channel is the effect of disease on the productivity of workers, thereby reducing their marginal productivity and the number of hours worked. Grossman

(1972) substantiates this by indicating that when the health condition of an individual worsens, they will devote more time to getting health care and less time to work. If the reward system is through marginal contribution, then such workers are likely to earn less in wages. Regarding productivity, Chirikos (1993) indicates that poor health conditions can affect the productivity of workers via the number of years spent on the labor productivity thus making retirement more attractive suggesting that unhealthy workers spend less time in productive engagement. Physical disability can directly limit the capacities sought by employers and consequently reduce incapacitated employees' productivity at work. Studies by Dumont (2000) shows that people confronted with health issues have low productivity because they are penalized in terms of access to the labour market through lower demand for their services. These disabled people are generally inactive, and when they carry on an activity it is often in low-productivity sectors. The correlation between health and productivity or income largely results from the selection process associated with considering individuals in good health relative to employment status and rejecting those with poor health (Reppeti et al 1989; Waldron, 1991). Because healthy workers will contribute more to total product through reduced absenteeism and higher marginal productivity. The implication is that those workers that participate more in the process of productivity will earn higher wages if the reward system is tied to marginal productivity especially in market driven economies. At the other extreme, high health costs can push workers to suffer bad health conditions, or to make others work more in order to increase income to finance health expenses. In addition, to improve or maintain their health condition, individuals need to invest in their health which requires huge financial resources and time especially in developing regions where health conditions are generally poor and income levels low, though some activities undertaken in the labour market could also have a direct negative impact on their health through the stress generated by work.

According to Fox et al. (2004), disease burden explains a large percentage of avoidable mortality of the poor as such disease burden forms a basic health risk that is very much severe, confronting poor households. The burden cripples the poor households" earning capacity as such sick individuals often lack the capability to contribute to productivity growth. Both chronic diseases such as malaria, tuberculosis, diarrhea and acute seasonal epidemic of other infectious diseases exert a big burden on the health of Nigerians making them less productive. Huge sums are also spent on treatment while savings are lost, investments opportunities are lost and public funds are diverted towards health care provision rather than for productive engagement and all these lead to lower economic growth. A common empirical approach toward studying the effect of health on economic growth has focused on data for a cross-section of countries and regressed on the rate of growth of income per capita on the initial level of health and this is typically measured by life expectancy. These studies are either largely absent in Nigeria due to data paucity or unreliability or over aggregation and generalization at the national level and even less so for specific sectors of the economy. In specific terms, they are absent in industry where activities are conducted in obvious disregard to the health implication on the workers. This study attempts to fill this void by focusing on the impact on health outcome on

worker productivity and is intended to stimulate interest on research into the health-productivity nexus for developing nations or regions where there are increased incidence of diseases.

Literature

In the theory of human capital, more educated and healthy people are more productive indicating that the productivity of the labour force is driven by her status of health capital and education. Kalemli-Ozcan et al. (2000). Obviously a healthy and educated work force is expected to contribute positively to the effectiveness and efficiency of the production process hence the productivity of a nation. Healthy workers and family members contribute more to output by reducing the rate of absenteeism while ill health reduces hourly wages. At the other extreme, lower expenditure on health care by households frees up resources for other productive activities like food and education and contributes to development by stimulating investments through increased consumption. Lower infant and child mortality in households lowers the family size and deepens productive investment on each child that results in higher skills while ill-health generates poverty through lower incomes and less education which are key determinants of health [Gupta (2006)]. The micro links logically translate into macro links between health and productivity and growth through lower savings, investments and overall productivity. Barro and Sala-i-Martin (1995) have documented that the elasticity of productivity growth with respect to the log of life expectancy range between 0.046-0.082 for 134 countries using panel data. This means that a one per cent rise in the health index of labour will positively impact on productivity by between 0.046-0.08 per cent and if aggregated over a large number of people, this can be substantial. Using the log of GDP growth rate per capita as a productivity measure, Bhargava et al. (2001), studied the empirical link between labour productivity and health capital for 125 countries and world Development Indicators between 1965-1990, and found that a 1 percent change in adult survival rate is associated with a 0.05 percent increase in GDP growth rate and this is also dependent on the population of such nations and disease prevalence. Where the incidence of disease is sever and prone, such growth rate could be less or even worsen over time.

Given that productivity growth effects cumulates over time, an economy with endemic malaria ends up with a per capita income that is approximately half the per-capita income of the non-malaria endemic economy if we control for other determinants of growth (Gallup and Sachs, 2000). A high disease burden creates a high turn-over of the labour force and lowers the extent of individual worker productivity. This has been the case in South Africa where firms have reportedly slashed back on investments for the reason that high prevalence rates of AIDS exacerbates expectations of very high worker turnover (Adeyi et al. 2006). This is in accord with the remark made in the CMH Report (2001) that a high incidence of disease among a firm's labour force engenders a high rate of turnover due to absenteeism. On the average, well to do firms or nations must hire and train more than one laborer for each position to balance for the high turnover occasioned by the incidence of ill health of any worker. The implication is that only rich firms or nations have on average healthier workforce or hire them and such healthiness of the firm or the

country's labour force determines importantly her level of productivity and hence economic growth. Labour productivity is measured as the ratio of a volume measure of output to a volume measure of input according to Pelkowski and Berger (2004). By intuition, labour productivity will vary as a function of the health capital of the firm or economy amongst other factors of production and the efficiency with which these inputs are utilized. This provides the basis for diversity in labour productivity growth across regions, with production levels showing life-size split between advanced and developing countries. For example, GDP per capita has been shown to grow fastest in East Europe, followed by Asia, than North America, and Western Europe but lowest in Latin America and Africa according to Iverson (2006) largely due to the health situation in these regions of the world.

Results from several studies indicate that health, in the form of physical abilities and adult survival rates, makes a positive and statistically significant contribution to aggregate output. The implication that can be drawn from this is that where diseases incidence such as malaria and tuberculosis or other infectious diseases are absent in the population, productivity can be enhanced significantly. A cross-sectional study of the effects of adult mortality on small farmers engaged in cotton and maize production in Zambia found that an adult death resulted in a decline in crop output of roughly 15 percent as revealed by Larson, Hamazakaza et al. (2004). Yamano and Jayne (2004) on the other hand, find that an adult death and associated funeral expenses reduce purchases of agricultural inputs, such as farm animals and fertilizer, and jeopardize agricultural production. In addition, these studies find that the effect of adult mortality is greatest on households that were relatively poor to begin with, in part because they are less able to cope with unanticipated shocks (Beegle 2005).

Other studies have shown that adult mortality has a deterrent effect on the acquisition of human capital as individuals may be less willing to get a higher education or make investments that pay off in the longer term, especially those that cannot be transferred to future generations in the same way as financial investments, if there is a greater risk that they may not be around to enjoy the returns of that investment. Another key route by which mortality affects growth is through fertility where there is lower precautionary demand for children and greater investment in children's human capital, both of which have a beneficial impact on growth of per capita GDP. Some studies have estimated the growth effect of adult mortality ranges from 0.8 to 1.4 percentage points associated with a one standard deviation increase in mortality, which implies that adult mortality can explain the drastic growth shortfall that has occurred in Africa between 1960 and 2000. On a macroeconomic scale, Mwabu & Fosu (2007) find that the economic toll of malaria in Africa amounts to at least 10 per cent less of gross domestic product per year. Gallup & Sachs (2001) corroborate these finding by indicating that per capita GDP of malaria-endemic countries in tropical Africa in the 1990s was 30 per cent of per capita GDP of countries that had been free of malaria three decades earlier. On the microeconomic front, using household data for 1994, Mwabu (2007) shows that malaria morbidity in Kenya is associated with a 15-16 per cent reduction in wages, with a 10-12 per cent decline in farm

output during the long rains, and with a much higher reduction in household income. Kamgnia (2007) finds that in Cameroon, malaria accounts for nearly 75 per cent of working days lost due to illness, and for about 40 per cent of annual household expenditure on health. Bawah and Binka (2005) in a study in Ghana found that the absence of malaria in the labour force (meaning healthy labour) could cause average life expectancy of the population to rise from 48.8 years to 54.9 years. In another study, Bonnel (2000) reveals that given a healthy Africa- free from HIV/AIDS, income per capita could rise or grow at 1.1 per cent a year compared to 0.4 per cent in a HIV/AIDS scenario. In a another study, Angbas (2015) finds that HIV positive workers earn 1 per cent less wages while contributing 1.2 per cent less labour to the process of productivity and save less than those who are not infected.

Studies have also revealed that communicable and infectious diseases cause 59 percent of deaths and 64 percent of disability-adjusted life-years (DALY) loss among the 20 percent of the global population living in countries with the lowest per capita incomes, compared with 34 percent of deaths and 44 percent of such loss among the entire global population. These diseases are also responsible for 77 percent of the mortality gap and 79 percent of the DALY gap between the world's poorest and richest 20 percent, compared with 15 percent and 9 percent attributable to non-communicable diseases. Its impact of productivity can be clearly seen when we consider that an accelerated overall decline in communicable diseases would benefit the world's poor more than a faster global reduction in non-communicable disorders. A faster reduction in deaths from communicable diseases would also benefit the poor much more than it would the rich, and would thereby reduce global poor-rich differences in longevity. According to the WHO World Malaria report in 2014, there were an estimated 584 000 deaths (90 per cent of all malaria deaths occur in Africa), of which an estimated 437 000 were African children who died before their fifth birthday due to malaria. Every 40 seconds a child dies of malaria, resulting in a daily loss of more than 2,000 young lives worldwide. These estimates render malaria the pre-eminent tropical parasitic disease in most of the developing countries. Malaria mortality rate is substantially higher in African countries and its impact on childhood mortality is even worse. The implication of this huge number of infections on children is that future labour force will be significantly reduced resulting in huge production costs for firms, industries and declining overall growth for these malaria endemic economies.

Infectious diseases such as malaria, for instance, result in recurrent debilitating bouts of illness, which prevents individuals from supplying their labour productively. Human capital accumulation may also be adversely affected by poor health due to the higher levels of school absenteeism amongst those suffering from illness. A high disease burden within a country can also have implications for foreign and domestic investment, tourism, the internal mobility of labour and land use. As the WHO (2011) claims, returns to investment in agriculture, mining, manufacturing and tourism, as well as investment in major infrastructure projects, are likely to be depressed by a high incidence of illness and disease especially in the labour force. Murray and Lopez (1996: 259) estimate the per capita disability-adjusted life years (DALYs) lost in various regions of the world in 1990

due to premature mortality and years lived with disability, adjusted for severity. The estimated figures are lowest in developed countries at about 0.17 DALYs per capita, they range from 0.2 to 0.4 DALYs per capita in various regions of the developing world, and reach close to 0.6 DALYs per capita in Sub-Saharan due to the low and high incidence of diseases respectively in these regions. This means that individuals in developed regions can loose up to two years of productive engagements over a life cycle while the incidence is as high as xix years in developing regions. The cumulative impact on productive and growth for these regions will be measured by the number of enfeebled individuals and severity of the disease condition which is significantly higher in poor regions and this will reduce the rate of growth in proportion to the burden over time. A great deal of the literature on economic growth has been devoted to studying the impact of education on aggregate economic performance and comparing the results with the rate of return to education identified by the Mincer (1974) log wage equation. This study is unique as it compares the estimates of the macroeconomic effect of health on output with the microeconomic estimates of the effect of health on wages now available and specifically targeted at industry.

Methodology

This study provides results based on a field survey conducted on five (5) industries actively engaged in the production of various products over a period of three years between 2015 and 2018 June. The Nasco group is composed of: The Fibre Company, Nasco Biscuits, The Households Product, and The Nasco Pack each engaged in producing different products. Its workforce is made up of individuals with different skills, educational attainment and socioeconomic status. A random sample of one hundred and twenty (120) respondents was drawn from the total workforce of the five companies designed to achieve the study objective which is to evaluate the impact of ill health on worker productivity. The variables of interest include incidence of absenteeism, income and total productivity of the five companies. The theoretical foundation of this study is based on the aggregate production function as espoused by Cobb-Douglas and cast as follows which is premised on the fact that the aggregate product of a firm or nation is determined by factor inputs such as capital, labour and the human capital component of its labour force as generally revealed by neoclassical scholars.

$$Y = A\,K^{\alpha}H^{\delta}Lv^{\beta} \quad \text{.....1}$$

Where $0 < \alpha < 1$, $0 < \delta < 1$ and $0 < \beta < 1$

Y denotes real GDP, A represents an index of total factor productivity, K represents the total physical capital stock, H represents human capital and L denotes the total labour force. We take v to be the level of human capital in per capita terms and define $L = Lv$ as effective labor input. The wage w earned by a unit of composite labor V is its marginal product which defines the marginal contribution of such labour unit based on its capacity that is influenced by its state of health. A worker with v_j units of human capital will therefore earn a wage of: $w_j = wv_j$

The study first estimates the total factor productivity (TFP) through the following function: $\ln Y = a + \alpha \ln K + \delta (\ln L + \beta + \delta - 1) \ln$ 2

For ease of estimation, the model is cast in natural logarithms to reflect the divergence in the measure of the variables.

$$lny_{it} = \varphi_i + \alpha lnk_{it} + \delta lnl_{it} + (\alpha + \beta + \delta - 1) lnh_{it} + \varepsilon_{it} \quad \text{.....3}$$

The aggregate production function in equation 1 with the measure of human capital in equation 3 is consistent with the form of the wage equation found at the microeconomic level. The study deliberately excludes the workers' experience from the measure of human capital. It assumes that although worker experience and squared vary a great deal across individuals but are highly correlated and vary little across these firms. The study also assumes that higher average ages in the various firms that vary with longer life expectancies tend to be offset by high levels of schooling and later entry to the workforce. This makes estimating the effect of experience in macroeconomic models difficult according to Bloom, Canning and Sevilla (2004.The primary concern of the study is the impact of poor health on TFP and overall productivity in an industrial setting and utilizes data on three of the most common causes of ill health in developing regions. The first is tuberculosis, the second indicator is the incidence of malaria, while the third indicator is the incidence of diarrhea which draws from the study by Gallup *et al.* (1999) using the records obtained of workers in Nasco group over five years. This follows that of Gallup *et al* who used World Health Organization (WHO) data to calculate the fraction of a country's land area subject to malaria. The equation for estimation of the determinants of TFP is as follows: $\ln tfp_{it} = \gamma_i + \delta_t + \theta_1 \ln X_{it} + \theta_2 \ln K_{it} + \theta_3 \ln L_{it} + \theta_4 \ln H_{it} + \varepsilon_{it}$

In the analysis, the study uses adult survival rates as the measure of population health. Conceptually, this measure may be more closely related to adult health and worker productivity than to life expectancy, a measure that is highly sensitive to infant mortality rates. However, the adult survival rates act only as a proxy for the health of the workforce, because they measure mortality rates rather than morbidity. The main reason for using adult survival rates is that it allows the study to compare the results directly with those of Weil (2001) and Shastry and Weil (2003). Overall raw data on rate of absenteeism, rate of participation of the workers in the process of production and adult survival rates were obtained from the records of the workers at the different factories. This was to generate variables to be tested for the study in line with the overall study objective and based on the a priori expectation developed for the study.

RESULTS

The first part of the result of study is the estimation of the total factor productivity from the sample drawn for the study using an aggregate production function as indicated. The import is to evaluate how each of the adopted variable has been affected by the incidence of health ill, this result is presented in the table below. This result is based on a sample of one hundred and twenty respondents drawn for the study form the records of these workers.

Table 1. Production Function Estimates (Fixed Effects)

Dependent variable: income per worker (ln y)

ln *k*	*0.37* * * *
	(0.022)
ln *L*	*0.013*
	(0.060)
ln *h*	*0.20* * * *
	(0.029)
R^2	*0.85*
N	*120*
Hausman	*9.12*
(FE v. RE)	*(0.03)*

Standard errors in parentheses (p-value for the Hausman test).
Note: * * * denotes significance at 95% confidence level.

The table above provides results of the estimated production function as described by equation (3) that is stated above and based on the data used for the study. The coefficient of ln*L* indicates that the production function exhibits close to constant returns to scale because the coefficient of 0.013 is close to zero. The elasticity of output with respect to the capital stock is 0.37, whilst the equivalent elasticity for human capital is 0.20. Since the coefficient of ln*L* represents $(\alpha + \beta + \delta - 1)$, the implied elasticity of output with respect to the labour force (β) is 0.44. The study then uses the estimates from table 1 as our measure of total factor productivity (TFP), towards estimating its impact on output and the determinants of TFP and the role of health therein. The primary concern is evaluate the impact of poor health on TFP in industry by using data on three common disease types that are most prevalent in the study area-malaria, tuberculosis and diarrhea. The most direct economic impact of malaria is in terms of reduced labour productivity through absenteeism of the worker. Hempel and Najera (1996) indicate that a bout of non-fatal malaria will typically last for 10-14 days including 4-6 days of total incapacitation with the remainder characterized by headaches, fatigue and nausea. A mild sufferer will experience 1 or 2 bouts per year. The extent to which this lost labour time will reduce output depends on whether it coincides with harvest time in agricultural areas, and whether other family members can compensate. Where the incidence occurs in industry, such workers contribute less labour time thereby reducing the total output of the firm and may earn less wages if they are based on marginal productivity. Malaria results in frequent absenteeism, particularly amongst effective labour force and school children, resulting in the reduced accumulation of human capital and associated lost productivity in adult life. However, the economic impact of malaria extends beyond the direct impact on labour productivity. A high malaria burden is likely to increase labour turnover resulting in increased hiring and training costs and reduced profitability for enterprises.

Tuberculosis is not only a disease with social implications due to the stigma attached to it which is evident from the lower scores of cases in psychological and social domains but is has catasphrophic impact resulting in death. The implication is that such workers lost must be replaced and involves hiring cost and waiting time for training of the new entrants. Nigeria is reported to have the second highest incidence of tuberculosis in the world only after India. Khan *et al.* (1998) had found in a study conducted in Pakistan on socio-cultural constraints in treatment that while both male and female TB patients face social and economic problems, female patients are more affected and they provide the largest and most reliable labour force for industry. A single incidence of tuberculosis could last for nine months for an effective treatment and often removes the patient completely from his work place and even where treatment is completed, the patient requires time total rehabilitation. Such long spell of time is means lost productivity for the individual or the firm as the case may be.

Lack of access to sanitation and particularly to safe drinking water remains a great risk to health in developing countries. It is a strong determinant of waterborne diarrhoeal and other diseases such as amoebiasis, cholera, dysentery, schistosomiasis and typhoid fever as well as roundworm and guinea worm infections. It is estimated that diarrhoeal diseases alone (including dysentery) annually kill over 2 million children under the age of five (Warner, 1997). Furthermore, like malnutrition and malaria, lack of access to safe water and sanitation is most common in the poorest regions of the world. Indeed, it often exacerbates the incidence and effects of malnutrition and malaria as diarrhoeal and other diseases make it more difficult for individuals to retain consumed food and poor water conditions foster the spread of malaria contaminated mosquitoes. Access to safe drinking water has become an expensive commodity for the majority of rural dwellers who draw either from ponds or stagnant water bodies often polluted by animals and industrial waste. Only those who can afford to drill boreholes or tap from the public water system are slightly sure of safe water, and even then the regular incidence of burst pipes and exposure of treatment sources creates additional hazards for water safety..

Overall, this result reveals that health plays a huge and significant role in explaining differences in productivity and in the level of income per worker between firms, industry and nations, a role roughly as important as education. This explains why regions that have less disease burden are more productive than regions where such disease burden is higher. Specific examples can be drawn from HIV/AIDS endemic regions of the world where studies have shown that in the absence of such infectious, GDP per capita will be significantly higher over the long run. Other studies have indicated that tuberculosis incidence in Ethiopia has lead to drastic reduction in the number of workers hence productivity. As a general check on the robustness of this result, to see whether it is driven by outliers for example, model used replaces the incidence of malaria, tuberculosis and diarrhea with a dummy variable. This variable is set equal to one for the one-third of the sample with the highest proportion of population suffering from these disease condition.

Table 1-

	Coefficient	SE
Dependent Variable (Y)	*0.090* ***	*/0.035/*
Health Variable		
Malaria	-0.22**	*/0.027/*
Tuberculosis	-0.75***	*/0.025/*
Diarrhea	-0.13**	*/0.034/*

Standard errors in parentheses

***, ** and * denote significance at 99%, 95% and 90% confidence levels, respectively.

The implication of the result presented above is that these health indicators all have negative impact on the total factor productivity (TFP) of the sampled workers and these variables are highly significant considering the values of the standard errors. The result from the table above and data from records of the firms drawn from their records are used to compute their health impact on the productivity of the industry and the result is given in the table below.

Table II-

Explanatory Variable	**Coefficients**			
	Total Labour Productivity	**Malaria**	**Tuberculosis**	**Dirahhea**
Output (X) Dependent Variable	0.415** (0.057)	-0.421** (0.0456)	*--0.17*** */0.025/*	*-0.18*** */0.022/*
Capital (K)	**0.634^^ (0.432)**	*-0.046** */0.021*	*-0.039* */0.020/*	*0.25** /0.12/*
Labour Productivity (L)	0.591** (0.068)	*-0.40*** */0.050/*	-0.527** */0.10/*	*-0.046** */0.021/*
Adult Survival Rate	0.030** (0.009)	*-0.087** */0.041/*	-0.331** */0.054/*	*-0.040** */0.018/*
Institutional Quality	0.022* (0.026)	*-0.062* */0.034/*	*-0.036* */0.021/*	*-0.066* */0.035/*

Source: Authors' computation 2018

Standard errors in parentheses

***, ** and * denote significance at 99%, 95% and 90% confidence levels, respectively.

The import of the result from the table above indicate that all of output, capital, labour productivity, adult survival rate and institutional quality are positively related as a rise in any of these variable will stimulate output either in the short or long run. This agrees with the functional aggregate production function where the various factor inputs have positive impact on the level of out of the firm and all these variables are statistically significant given the values of the standard errors. The implication is that where labour is health and actively participate in the process of productivity, it will have a significant positive impact on the level of total product of the firm. This generally agrees with theoretical postulations of both classical and neoclassical scholars in developing the aggregate production function. At the other extreme, the incidence of malaria, tuberculosis and diarhhrae all have significant negative effect on the level of productivity as indicated by

the values of the coefficient and their standard errors given. These variables also have negative effect on the institutional quality provided at the industry either through time devoted to managing these disease conditions or the resources that are diverted towards providing health care for these workers instead of adding to the capital stock, purchasing raw material or other technical services that can raise output of the industry. Where a large proportion of the labour force is infected with either of these diseases, the industry will lose productive labour resulting in declining output, profits and in the long run can lead to sever negative impact on industrial and manufacturing contribution to the nation's gross domestic product. The study finds that all variables to be signed and statistically significant in accordance with our prior expectations in almost all cases.

In specific terms, the incidence of tuberculosis has the highest negative impact on the productivity of the workers. According to the World Health Organization (WHO) 2014, almost half of the global tuberculosis deaths occurred in African Region and approximately 21.5 epr cent of the 6 060 742 TB cases (new and relapse) reported to the WHO in 2014 were in the African Region and that the 0.753 million tuberculosis deaths that occurred in the African Region in 2014 led to a decrease in the future non-health GDP by International Dollars of about (Int$) 50.4 billion, while the average total non-health GDP loss was Int$66 872 per tuberculosis death. There is no doubt that tuberculosis exerts a sizeable economic burden on the economies of the most endemic nations that suffer its highest burden. The study results suggest that poor health can indeed reduce aggregate productivity. It would therefore appear that poor health is a key factor in explaining the existence of persistent underdevelopment in many regions of the world. It has long been known that poverty and underdevelopment play a significant role in the prevalence of malnutrition, the lack of access to safe water and sanitation and the resultant profusion of waterborne diseases, and the general lack of medical services and preventative medicine. However, a reversal of this relationship, with poor health itself contributing to poverty and underdevelopment, has generally not been quantified at a macroeconomic level until relatively recently. This study has tried to improve on the existing literature by looking at three specific aspects of poor health rather than the aggregate measure of life expectancy and by directly estimating the effect of health on total factor productivity, rather than economic growth. The recent creation of the World Health Organization's (WHO), suggests that interest in the macroeconomic implications of poor health is increasing. The Commission's report, published in December 2001 (WHO, 2001), firmly states that poor health within a nation can have severe implications for that nation's productivity and macroeconomic performance. With a clear link between health and productivity emerging, the report calls for a global commitment to tackle health issues. This commitment must come from low income countries themselves, but also increased financial commitments from donor countries will be needed. It would appear that only increased and re-prioritized investment in health care, on a global scale, will release the developing world from the vicious cycle that links poor health and poverty as these results suggest that poor health can indeed reduce aggregate productivity. The result from this study aggress with several other empirical researches that have indicated clearly that- the lower the overall level of mortality in a

society, the greater the importance of non-communicable diseases relative to communicable ailments

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