CHAPTER IV

LIFE EXPECTANCY: ARE MEN CATCHING UP OR WOMEN FALLING BEHIND?

4.1. Introduction

A recent study of women in Sweden (Kuper et al., 2007) revealed that women employed full-time who experienced job strains had higher risk of developing breast cancer. According to the National Institute for Occupational Safety and Health (NIOSH 2001), 60% of women cited stress at work as their most important problem and that women were almost twice as prone to stress-related illnesses compared to men. International statistics reveal that between 1980 and 2006 male labor force participation rate decreased by 3.48% while female labor force participation rate increased by 2.52% (WDI, 2008). Could the redistribution of responsibility between men and women explain some of the narrowing gap between the life expectancy of men and women? Specifically, are men really catching up or are women lagging behind because they are experiencing increasing stress levels due to their more active involvement in non-domestic work. This paper is an analysis of the link between increased female labor force participation and the narrowing gap between the life expectancy of men and women.

The rest of this paper is divided into five sections. Section II discusses previous literature related to labor force participation, life expectancy/mortality and gender. Section III presents the data used in the paper. Section IV presents the estimation model

expressing life expectancy as a function of health related factors, economic factors and demographic factors. This section also includes model estimates and analysis. Section V concludes the paper, summarizing the findings and indicating areas for possible future research.

4.2. Literature Review

This section discusses previous literature divided into the four sections. The first section discusses previous literature on determinants mortality. The second section discusses previous literature on gender differences in life expectancy (mortality). Previous literature on work and stress as determinants of mortality are discussed in the third section; the fourth section discussed previous literature on gender differences in labor force participation rates and the fifth section concludes the literature review, summarizing the relevance of studies discussed with regard to the effect of labor force participation on life expectancy and gender differences in life expectancy.

4.2.1. Determinants of Mortality

Raleigh and Kiri (1997) give insight to the possibility of societal problems such as income inequality resulting in mortality increase. Wolfson et al. (1999) examine the relationship between income inequality and mortality using the 1990 census data for the 50 U.S. states and Washington, DC. They find that less income equality is positively related to decline in mortality. Wolfson et al. (1999) also find that there is a stronger association between income inequality and mortality at the state level of analysis

compared to the individual level of analysis. As such, they suggest that social environmental factors should also be considered in the explanation of the causes of morality as they are also determinants of health.

Also in support of the contribution societal problems make to the increase in mortality, Marmot (2005) identifies societal determinants of health including poverty, inequality and 'causes of the causes'. Poverty results in poor nutrition, diseases and illnesses, poor or no medical care and violence all of which lead to higher mortality rates. However, Marmot (2005) explains that social inequalities make attempts to solve the problems of poverty or material deprivation futile.

While the effect of income inequality on mortality has been examined from a geographical perspective, the effect of income inequality on mortality from a gender perspective is yet to be explained. Many studies such as Rice et al. (1967) support the notion that gender difference in wages exist. Using data from several sources including the Bureau of Labor Statistics and the National Center for Health Statistics, Rice et al. (1967) seek to estimate the present value of lifetime earnings with regard to educational level and sex, among other demographic factors such as age and color. They find that the peak life time earnings of men are almost twice as high as that of women. Using data from the 1967 Survey of Economic Opportunity, Oaxaca (1973) investigates gender based wage differentials and the extent of discrimination against female workers in the U.S. Oaxaca (1973) finds that wage differentials between males and females are large. However, the differentials are caused by differences in the kinds of jobs males and females hold not differences in the pay they receive for doing equal amount of work. In particular, compared to males, females are concentrated in lower paying jobs and as such,

the wage deferential results. Lower paying jobs are often of lower quality in terms of benefits and they are also likely to involve a lot of stress.

Alcohol consumption is sometimes perceived as a way to distress and relax; however excess alcohol consumption has been found by several studies, to influence individual health and even mortality of others through accidents and homicides. Pridemore (2002) investigates the co-variation of drinking and lethal violence in 78 regions of Russia. Using estimates of regional homicide mortality from the Registry of Acts of Civil Status (Zapis Aktov Grazhdanskogo Sostoyaniya - ZAGS) and data on deaths due to alcohol poising as a proxy for alcohol consumption from the Ministry of Public Health's pubilcation Smertnost' naseleniya Rossiiskoi Federatsii. , Pridemore (2002) finds that alcohol consumption is positively and significantly related to the differences in regional homicide mortalities.

Stallard and Tolley (1991) also find that changes in life style such as the elimination of substance abuse such as tobacco, alcohol and narcotics, as well as improved diet and exercise, can by themselves – without medical intervention lead to increase in life expectancy by about 15 to 20 years. Vollset (2008) support the findings of Stallard and Tolley (1991). Vollset (2008) investigates the trends in middle age death risks in Europe over the past half century (1952 to 2001) with regard to life style changes, and improvements in medical techniques, and prevention. Using data from the World Health Organization data base, he finds that in addition to improvements in medical techniques changes in life style such as non-smoking, moderate alcohol consumption, exercise, high fruit diet have resulted in the decrease in death risk estimated to be about 50%. Similar factors such as improved nutrition, medical care, etc. affect mortality at the

macro level of analysis. Cutler et al. (2006) identify some of the factors that determine decreases in morality over time, including improved nutrition, urbanization, public health, vaccination, medical treatment/care, and the long-term reach of early factors.

Education is also linked to mortality as studies such as Crimminsa and Saitob (2001) support of the role of education as a determinant of life expectancy. Crimminsa and Saitob (2001), investigate how healthy life expectancy is affected by gender and education for whites and African Americans in the U.S. in 1970, 1980 and 1990. Using decennial life tables of the U.S. for gender race groups in years 1970, 1980, and 1990, they find that the only groups that experienced a decrease in healthy life expectancy between 1980 and 1990 are African Americans of both genders with a grade school education, white females with a grade school education, and African American females with some high school education.

Using data from the National Longitudinal Mortality Study for 1979 – 1985, Rogot et al. (1992) estimate the life expectancy of white men and white women controlling for employment status, education and family income. They find that all three factors influence life expectancy. Employment status was found to be positively related to life expectancy. At age 25, males and females in the labor force had higher life expectancies of 12 additional years and 9 additional years compared to males and females outside the labor force. At age 25, there were also differences in the life expectancy of individuals with the highest and lowest levels of education. The difference in life expectancy between individuals with the highest and lowest levels of education was found to be 6 years for white men and 5 years for white women in favor of higher educated males and females. Similar results were found for family income where individuals with

the highest family income had life expectancy of about 10 years higher for males and 4.3 years higher for females compared to their counterparts in the lowest income groups. However, Cutler et al. (2006) in their analysis of factors influencing mortality find that while the mortality rate is higher for individuals with low income, women with more education and higher incomes are more susceptible to having breast cancer.

4.2.2. Gender Differences in Life Expectancy

Mecele (2006) found that men are beginning to catch up with women in terms of life expectancy. He supports his argument by analyzing data over time for men and women in France, finding that while there is a general decline in mortality, the gap between men and women is closing over time. Mecele (2006) explains that one of the reasons for this narrowing gap is health improvement in middle aged men relative to middle aged women. Mecele (2006) also emphasizes that increased incidence of breast cancer may be one of the most prominent health factors responsible for the narrowing gap in life expectancy.

In order to investigate the future pattern of life expectancy, Meslé and Vallin (2006) examine the trends in female life expectancy at old ages and in particular the reason for the changes in the pattern of female old age mortality in the U.S. compared to other industrialized countries over the past two decades. They explain that women in the U.S. and Netherland are experiencing extensive slow down in their old age life expectancy when compared to women in other industrialized countries like France and Japan. Using data from the World Health Organization they find that the advantage

France and Japan have over the U.S. and Netherland in terms of life expectancy arise as a result of greater success treating and preventing cardiovascular diseases as well as the higher case of mental disorders observed among older women in the U.S. and Netherlands compared to France, where the negative effect of mental disorders is mild, and Japan, where the negative effects are non existing. It is noteworthy that the illnesses, cardiovascular diseases and mental disorders, found to influence differences in life expectancy by Meslé and Vallin (2006) are very often stress related.

DesMeules et al. (2004) examine the effects of preventable mortality on life expectancy as a means to explore gender differences in life expectancy. They also examine the gender differences in life expectancy that may result for biological reasons. Using annual Canadian mortality data (1959 - 1999) and census data for their analysis, they find that most of the gender gap in life expectancy is explained by preventable causes such as smoking and accidents and that biological difference seemed to have no effect on life expectancy. They also found that when preventable causes are excluded, women have shorter health adjusted life expectancy when compared to men. Women were found to have higher mortality resulting from biological and sex-specific causes such as breast cancer. They explain that the higher mortality observed among men compared to women are mostly the result of health care choices or behaviors that can be prevented.

Using mortality data for English health authorities from 1984 – 1994, compiled by the Office for National Statistics, Raleigh and Kiri (1997) examine differences in trends in life expectancy in English district health authorities in relation to gender. They find that the gap in life expectancy of deprived areas compared to prosperous areas increased over

the time frame. In addition they also find that the most deprived areas had the highest gender gap in life expectancy. They use Jarman score, an index of general medical practice work load, to determine deprivation levels.

4.2.3. *Work and Stress as Determinants of Mortality*

Work is usually rewarded by wages which can be spent on health care, healthier environment and better nutrition, etc. all of which will likely have a positive effect on health. However, lower paying jobs are more likely to be jobs of low quality and resulting high stress levels which can be detrimental to health. Strazdins, Shipley, and Broom (2007) investigate the effect of job quality on wellbeing using a sample 2,164 mothers and 2,614 fathers from the Longitudinal Study of Australian Children (LSAC). Strazdins, Shipley, and Broom (2007) characterize high-quality jobs as those with significant job security and control, those for which employees exhibit a great deal of schedule flexibility, and those that offer paid family-related leave. They find that high-quality jobs were related to better parent well-being and improved mental health, coping and self-rated health. Mothers were however found to have lower quality jobs compared to fathers. Furthermore, part-time jobs were usually of low quality compared to full-time jobs and mothers were more likely to work in part-time. Bohle et al. (2004) analyze results of a survey of 39 employees of two five-star hotels between 19 and 61 years of age. Work hours for the sample ranged from 0 hours a week to 73 hours per week. Bohle et al. (2004) find that casual employees tended to work more and irregular work hours as they had little control over their work schedule. The causal employees also reported greater work-life conflict and more health complaints compared to full time employees. Thus job

quality and health outcomes are linked through the earnings and stress levels related to the jobs.

Irie et al. (2001), investigate the relationship between work-related factors, including psychological stress and a type of oxidative DNA damage, and find that psychological stress and perceived work overload lead to the development of cancer especially in female workers through the formation of 8-hydroxydeoxyguanosine (8-OH-dG). Urinary 8-OHdG is a biomarker of cellular oxidative stress and also a risk factor for cancer, atherosclerosis and diabetes. A study of women in Sweden (Kuper et al., 2007) also reveals that women employed full-time who experienced job strains had higher risk of developing breast cancer. This result was not found among women working only part-time. Furthermore, the National Institute for Occupational Safety and Health (2001) reports that 60% of women cited stress at work as their most important problem and that women are almost twice as prone to stress-related illnesses as men.

At the macro level of analysis, stress has sometimes been found to explain decline in life expectancy. In Russia, life expectancy at birth fell by 6.25 years for men and by 2.53 years for women between 1990 and 1994 (WDI, 2008). Leon et al. (1998) explain that the Russian mortality crisis coincided with the beginning of the collapse of the Soviet Union and the introduction of new socio-economic reforms. They argue that the stress caused by the shock of an abrupt economic transition contributed to the decline in the life expectancy of Russians as revealed by the observed adverse effects of increased alcohol consumption during the period.

When analyzing the causes of the Russian mortality crisis, Leon et al. (1998) found that the reduction in life expectancy from 1988 to 1994 was due to changes in death

rates of those ranging from 20 to 65 years of age. They also found that the proportional change in the probabilities of death by age was greatest among individuals aged 15 to 59 years, the age range of those who would typically be considered to be part of the labor force. In their analysis Leon et al. (1998) find that the increase in mortality among the least educated individuals was significantly greater than among highly educated individuals. They also found that among individuals with blue collar jobs the proportion of deaths due to external causes increased two-fold for men and eight-fold for women. The observed reduction in life expectancy during the collapse of the Soviet Union was not unique to Russia. Other countries of the former Soviet Union including Estonia, Ukraine, Latvia, and Belarus also experienced a significant decrease in life expectancy among both men and women (Brainerd E. and Cutler D., 2005).

Stress can also be linked to suicide mortality. MaÈ kinen (2000) examines the causes of the changes in suicide mortality in Eastern Europe during the past fifteen years by identifying how changes may have occurred in relation to changes in common causes of suicide such as alcohol consumption, economic changes, political changes, social disorganization and general pathogenic stress[1]. Using data from the World Health Organization, the World Health Statistics Annual and the Health For All data base, MaÈ kinen (2000) finds that the trend in suicide mortality and their causes vary widely between Eastern European countries and that general stress (as proxied by life expectancy at birth), alcohol consumption, democratization and social disorganization explained the percent changes in the suicide rates between 1984 and 1989 in 16 out of 28 Eastern Bloc countries investigated. However, the use of life expectancy at birth as a proxy for general stress was

[1] This is the unspecified, non-medical, non-economic stress.

questioned as other factors besides stress determine life expectancy at birth including the availability and quality of health care services.

While stress may have varying effects on the health of males and females, Lindeman et al. (1996) do not find significant differences in suicide mortality examined with regard to gender. Lindeman et al. (1996) reviewed fourteen studies in attempt to examine gender specific suicide mortality. They describe the variation in the relative risk of doctors dying of suicide as estimated in the studies and find that there was no statistically significant difference in male and female doctor suicide mortality even though they found that compared to the general female population, suicide morality was highest among female doctors.

4.2.4. Gender Differences in Labor Force Participation Rates

Juster and Stafford (1991) present data showing that while total work hours, both domestic and non-domestic, have decreased over time for both men and women, women work more total hours compared to men in most countries. They also show that over time more men have become involved in domestic work while women have become more active in the labor market. Between 1980 and 2006 the labor force participation rate of males in the US has decreased by 4.70%; on the other hand, female labor force participation rate within the same period increased by 17.22%. International statistics also reveal that between 1980 and 2006 male labor force participation rate decreased by 3.48% while female labor force participation rate increased by 2.52% (WDI, 2008). As of 2007, the percentage of males enrolled in tertiary institutions out of the total population of males of tertiary age in the US was 68% while the percentage of females enrolled in tertiary

institutions in the US out of the total population of females of tertiary age (UNESCO-UIS, 2009). Considering education as an indication of interest in future market work, these statistics imply future increases in female labor force participation. Blau (1998) affirms the trends in female labor force participation, finding that in the U.S., the gender gap in labor force participation and types of education and occupations have diminished significantly with women now remaining more consistently in the labor market.

Freeman and Schettkat (2005) seek to explain why women may be participating more in market work from a regional perspective. They analyze the difference between the hours worked by women in the European Union (EU) and the U.S. They hypothesize that the greater female market work in the U.S. compared to the EU is the result of the marketization of household production, such as: child care, care of the elderly, food preparation, and house cleaning. They find that, in the US, the traditional housedhold chores of women were more marketized compared to the EU. Women in the US were therefore able to invest more of their free time in market work.

Cohen and Bianchi (1999) suggest that women may choose to work more to support their families in response to lower male earnings. They also suggest that women may have higher incentives to work because they now have improved educational opportunities, higher wages. Costa (2000) argues that firms may have a higher incentive to employ women in order to comply with regulations against discrimination such as the affirmative action regulation. From a supply perspective, Costa (2000) supports the findings of Freeman and Schettkat (2005), suggesting that better access to child care and improvements in technology such as washing machines, vacuum cleaners and other home appliances provide women with more time to invest in market work activities. Bianchi et

al. (2000) suggest that women may be more involved in market work because husbands are more willing to assist in traditional household chores even though the persons doing most of the household chores are still mostly female.

Though increase in female labor force participation sheds a positive light on improvement in gender equity, it may also have some negative consequences for members of the household and also for themselves. Gennetian, Lopoo, and London (2008) support this notion; they find that increased maternal work hours have unfavorable effects on the academic outcomes of adolescents in terms of average school performance, truancy, and other behavioral problems. Though it can be argued that the additional wage (income) earned by women improves the financial circumstances of the household, studies such as Wilkie (1991) view the consequences of increased female labor force participation from a different perspective. Examining data from the U.S. Bureau of the Census, Wilkie (1991) argues that increased female labor force participation resulting from the decline in male economic status and earnings has lead to an increase in the number of female heads of households, thus giving women higher levels of financial independence and as such increasing their incentive to end unsatisfactory marriages. Wilkie (1991) explains further that increase in the financial strength of women is associated with increase in divorce which in turn leads to the amount of single mothers as well as increase in families without a male householder.

In addition to the effect increased female labor force participation may have on family related outcomes, stress associated with increased labor force participation may have negative effects on the health of women, especially if there is not a commensurate decline in their household work. The findings of Irie et al. (2001), Kuper et al. (2007) and

Occupational Safety and Health (2001) discussed above emphasize that stress has greater negative consequences for females compared to males. This paper is centered on analyzing the effect of changes in the labor force participation of males and females over time on their health as proxied by their life expectancies. In particular to see if labor force participation effects differ by gender.

4.2.5. Summary of Literature Review

The studies discussed in the first section of this literature review indicate that economic factors such as income, income inequality and education are important determinants of mortality. Demographic factors influencing mortality including race, and age are also identified as factors influencing mortality. Healthy lifestyle choices, improved diet, exercise and the elimination of substance abuse are health factors that influence life expectancy (mortality) as identified in the literature discussed in this section.

The studies discussed in the second section of this literature review affirm that there are gender differences in life expectancy. Most of the gender differences in life expectancy for females are identified to be the result of biological reasons while the differences for males are identified to be the result of preventable causes such as tobacco consumption and accidents. Studies like Mecele (2006) suggest that the gender differences in life expectancy is the result of improved health of middle aged men relative to middle aged women. Most of the diseases found to influence gender gap in life expectancy are stress related often stress related.

The literature discussed in third section of this literature review suggest that work related stress also influence life expectancy (mortality) and in the fourth section, studies on gender differences in labor force participation indicate that women are participating more in the labor force than before. Women are also remaining more consistently in the labor market than before. The literature in this section also suggests that the increase in female labor force participation is the result of improvement in technology, increase in men's willingness to help with household chores among other reasons. While increased female labor force participation indicates improvements in gender equality it is suggested that it may have negative consequences for households linked to increased divorce rates, higher number of single mothers and female head of households. Work is a stress agent; increased female labor force participation may therefore also have negative consequences for their health. Several studies discussed suggest that females are more prone to stress related diseases compared to males. The analysis in this paper investigates the effect of labor force participation on health and how this effect differs by gender.

4.3. Data

The data used for analysis is this paper was obtained from the World Bank's World Development Indicator (WDI 2003 and 2008). The data comprises of data for 206 countries spanning from 1980 to 2001. However, only complete observations – those that have data for all the variables considered are used for the analysis of this paper. The analysis in this paper is divided into two sections. The first section is an analysis of all the countries for which data is available using single observations for each country. The second section is an analysis of all the countries for which data is available using a

stacked data set. The stacking the data allows for better comparison among gender groups through the creation of dummy variables for males and females as well as labor force participation rates interaction term. The second section also includes analysis for countries of different income levels in order to observe how the results may differ across countries with different levels of economic development.

It is anticipated, based on the findings of the studies discussed in the literature review section that health quality depends on health inputs, economic characteristics and demographic factors. Physicians (per 1,000 people) [PHYSICIANS], DPT immunization [DPT] and measles immunization [measles] are the health input used for this analysis. The demographic factors considered are age dependency ratio [AGEDEPR], organic water pollutants [OWP] and gender [MALE, FEMALE]. Economic factors used include labor force participation rate [LFPR] (a proxy for work), food price index [FPRI], food production index [FPDI], GDP per capita [GDPpc] and growth in GDP per capita [GGDPpc]. Life expectancy [LEXP] is used as a proxy for health. The summary statistics for the un-stacked and stacked data used for this analysis are presented in tables 4.1 and 4.2 below. The descriptions and definitions of each of the variables considered are also presented in table 4.3.

The number of physicians per population provides a measure for the availability of health care and as such it is expected to influence life expectancy positively. Similarly, vaccinations intended to prevent diseases are expected to influence life expectancy positively.

Table 4.1

Summary Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
LEXP	1,398	65.81	8.59	21.89	78.10
Health Input					
PHYSICIANS	899	2.03	1.20	0.02	5.19
DPT	1,398	79.69	21.48	1.00	99.00
MEASLES	1,398	76.63	22.10	1.00	99.00
Demographic Factors					
AGEDEPR	1,398	0.66	0.18	0.37	1.16
OWP	1,026	277,593.65	681,136.83	94.06	8,491,856.02
FEMALE	1,398	0.00	0.00	0.00	0.00
Economic Factors					
MALE LFPR	1,398	82.14	5.53	63.20	96.00
FEMALE LFPR	1,398	55.16	16.03	9.20	93.00
FPRI	1,398	108.21	304.33	0.00	7,967.80
FPDI	1,398	93.90	45.93	25.00	994.90
GDPpc	1,398	8,142.93	9,472.52	110.58	47,280.56
GGDPpc	1,398	1.32	5.15	-31.34	37.57

The demographic factors considered for this analysis are age dependency ratio, rural population, water pollution and gender. Age dependency ratio is a measure of the population of dependants; that is individuals younger than 15 or older than 64 relative to the working-age population of individuals between the ages of 15 and 64 (WDI 2008). Higher dependency ratios signify increase in the number of dependants relative to the working age population. It is expected that higher dependency ratios would have some stress effect, especially for the working age population. The higher the number of dependants on an individual, the higher the stress level experienced by that individual and this stress may result in a negative effect on life expectancy.

Table 4.2

Summary Statistics - Stacked Data

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
LEXP	2,796	68.54	9.51	21.89	84.90
Health Input					
PHYSICIANS	1,798	2.03	1.20	0.02	5.19
DPT	2,796	79.69	21.47	1.00	99.00
MEASLES	2,796	76.63	22.09	1.00	99.00
Demographic Factors					
AGEDEPR	2,796	0.66	0.18	0.37	1.16
OWP	2,052	277,593.65	680,970.76	94.06	8,491,856.02
FEMALE	2,796	0.50	0.50	0.00	1.00
Economic Factors					
LFPR	2,796	68.65	18.05	9.20	96.00
MALE LFPR	2,796	68.65	18.05	9.20	96.00
FEMALE LFPR	2,796	27.58	29.82	0.00	93.00
FPRI	2,796	108.21	304.27	0.00	7,967.80
FPDI	2,796	93.90	45.92	25.00	994.90
GDPpc	2,796	8,142.93	9,470.82	110.58	47,280.56
GGDPpc	2,796	1.32	5.15	-31.34	37.57
HIO	2,796	0.29	0.46	0.00	1.00
HINO	2,796	0.10	0.29	0.00	1.00
UMI	2,796	0.23	0.42	0.00	1.00
LMI&LI	2,796	0.38	0.49	0.00	1.00

Similarly, organic water pollutants are another demographic factor that can influence life expectancy. Organic water pollutants are measured by the amount of oxygen that bacteria in water will consume in breaking down waste, a standard water- treatment test (WDI

Table 4.3

Description and Definition of Variables

Variable	Full Variable Name	Definition
LEXP	Life expectancy at birth (years)	Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.
Health Input	**Health Input**	**Health Input**
PHYSICIANS	Physicians (per 1,000 people)	Physicians are defined as graduates of any facility or school of medicine who are working in the country in any medical field (practice, teaching, research).
DPT	Immunization, DPT (% of children ages 12-23 months)	Child immunization measures the percentage of children ages 12-23 months who received vaccinations before 12 months or at any time before the survey. A child is considered adequately immunized against diphtheria, pertussis (or whooping cough), and tetanus (DPT) after receiving three doses of vaccine.
MEASLES	Immunization, measles (% of children ages 12-23 months)	Child immunization measures the percentage of children ages 12-23 months who received vaccinations before 12 months or at any time before the survey. A child is considered adequately immunized against measles after receiving one dose of vaccine.
Demographic Factors	**Demographic Factors**	**Demographic Factors**
AGEDEPR	Age dependency ratio (dependents to working-age population)	Age dependency ratio is the ratio of dependents--people younger than 15 or older than 64--to the working-age population--those ages 15-64. For example, 0.7 means there are 7 dependents for every 10 working-age people.
OWP	Organic water pollutant (BOD) emissions (kg per day)	Emissions per worker are total emissions of organic water pollutants divided by the number of industrial workers. Organic water pollutants are measured by biochemical oxygen demand, which refers to the amount of oxygen that bacteria in water will consume in breaking down waste. This is a standard water-treatment test for the presence of organic pollutants.
FEMALE	Female Dummy	Female dummy variable

Table 4.3 (continued)

Description and Definition of Variables

Economic Factors	**Economic Factors**	**Economic Factors**
LFPR	Labor force participation rate, male and female (% of female population ages 15-64, % of male population ages 15-64)	Labor force participation rate is the proportion of the population ages 15-64 that is economically active: all people who supply labor for the production of goods and services during a specified period. Labor force participation rate, male and female (% of female population ages 15-64, % of male population ages 15-64).
MALE LFPR	Male labor force participation rate (% of male population ages 15-64)	Male labor force participation rate is the proportion of the male population ages 15-64 that is economically active: all male people who supply labor for the production of goods and services during a specified period.
FEMALE LFPR	Female dummy*labor force participation rate, male and female (% of female population ages 15-64)	Female labor force participation rate is the proportion of the female population ages 15-64 that is economically active: all people who supply labor for the production of goods and services during a specified period.
FPRI	Food price index (1995 = 100)	This is a subindex of the consumer price index. Consumer price Index reflects changes in the cost to the average consumer acquiring a basket of goods and services that may be fixed or may change at specified intervals, such as yearly. The Laspeyres formula is generally used.
FPDI	Food production index (1999-2001 = 100)	Food production index covers food crops that are considered edible and that contain nutrients. Coffee and tea are excluded because, although edible, they have no nutritive value.
GDPpc	GDP per capita (constant 2000 US$)	GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant U.S. dollars.

Table 4.3 (continued)

Description and Definition of Variables

GGDPpc	Growth in GDP per capita (constant 2000 US$)	Annual percentage growth rate of GDP per capita based on constant local currency. GDP per capita is gross domestic product divided by midyear population. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.
HIO	High income OECD countries	High income Organisation for Economic Co-operation and Development (OECD) member aggregate. High-income economies are those in which 2006 GNI per capita was $11,116 or more.
HINO	High income Non- OECD countries	High income non Organisation for Economic Co-operation and Development (OECD) member aggregate. High-income economies are those in which 2006 GNI per capita was $11,116 or more.
UMI	Upper middle income countries	Upper middle income group aggregate. Upper-middle-income economies are those in which 2006 GNI per capita was between $3,596 and $11,115.
LMI&LI	Lower middle income countries and Low income countries	Lower middle income group aggregate. Lower-middle-income economies are those in which 2006 GNI per capita was between $906 and $3,595. Low income group aggregate. Low-income economies are those in which 2006 GNI per capita was $905 or less.

[1]Source: World Development Indicators

2008). The presence of organic water pollutants is expected to have a negative effect on life expectancy.

Economic factors considered for this analysis are food price index, food production index, gross domestic product (GDP) per capita, growth in GDP per capita and labor force participation rate. Higher food prices are indicative of high cost of nourishment and nutrition and as such, it is expected that increase in food price index

would negatively influence life expectancy. On the other hand, higher food production is likely to be indicative of increase the food available for consumption and nourishment. It is therefore expected that higher food production would have a positive effect on life expectancy. GDP is an indicator of the production and income of countries. GDP per capita accounts for the population of countries relative to their GDP. It is expected that over time increase in GDP per capita would positively influence life expectancy. Growth in GDP per capita accounts for annual the change in GDP per capita; it is an indicator of economic growth and as such, it is also expected to have a positive effect on life expectancy.

Labor force participation is expected to influence life expectancy positively as Rogot et al. (1992) find. Labor force participation (work) is expected to provide a sense of purpose that is likely to result in an improvement in mental health. Work requiring physical activity may also result in physical health improvement in terms of fitness. An increase in wages is expected to increase an individual's ability to afford health care and working provides a sense of purpose and achievement which should be positively related to life expectancy.

Labor force participation rates differ across countries. Though males have higher labor force participation rates than females in most countries, female labor force participation rate is increasing rapidly. In the U.S. for example, female labor force participation rate increased from 60% in 1980 to 70% in 2001, an increase of 16.67%. Male labor force participation rate on the other hand, decreased from 85% in 1980 to 83% in 2001, a decrease of 2.41% (WDI, 2008).

The life expectancy of males and females in the U.S. from 1960 to 2001 depicted in is Figure 4.1 below. The narrowing gap between the life expectancy of males and females in the U.S. is not readily observable from figure 4.1; however, it can be observed using Figure 4.2 which depicts the percent change or growth rate in the life expectancy of males and females in the U.S. It can observed in figure 4.2 that the growth rate in the life expectancy of females was higher than the growth rate in the life expectancy of males between the 1960s and 1970s; however, between the 1980s and 2000, it can be observed that the growth rate in the life expectancy of males is greater than the growth rate in the life expectancy of females.

Figure 4.3, on the other hand, depicts the labor force participation rate of males and females in the U.S. From figure 4.3 the increase in the labor force participation rate of women in the US and the decrease in the labor force participation of men in the U.S.

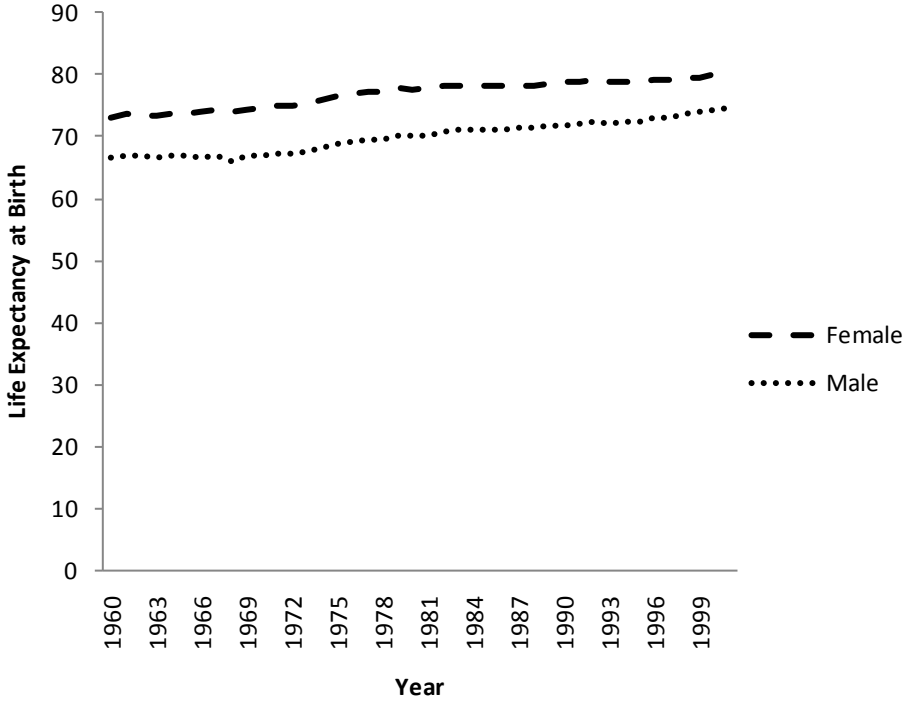

Figure 4.1 Life Expectancy at Birth – Female and Male

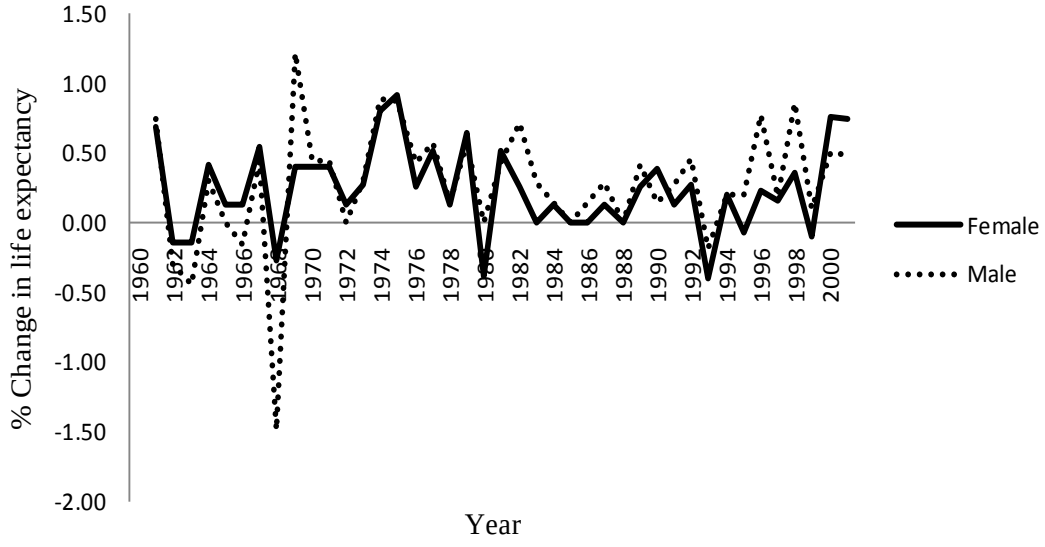

Figure 4.2 Percent Change in Life Expectancy at Birth – Female and Male

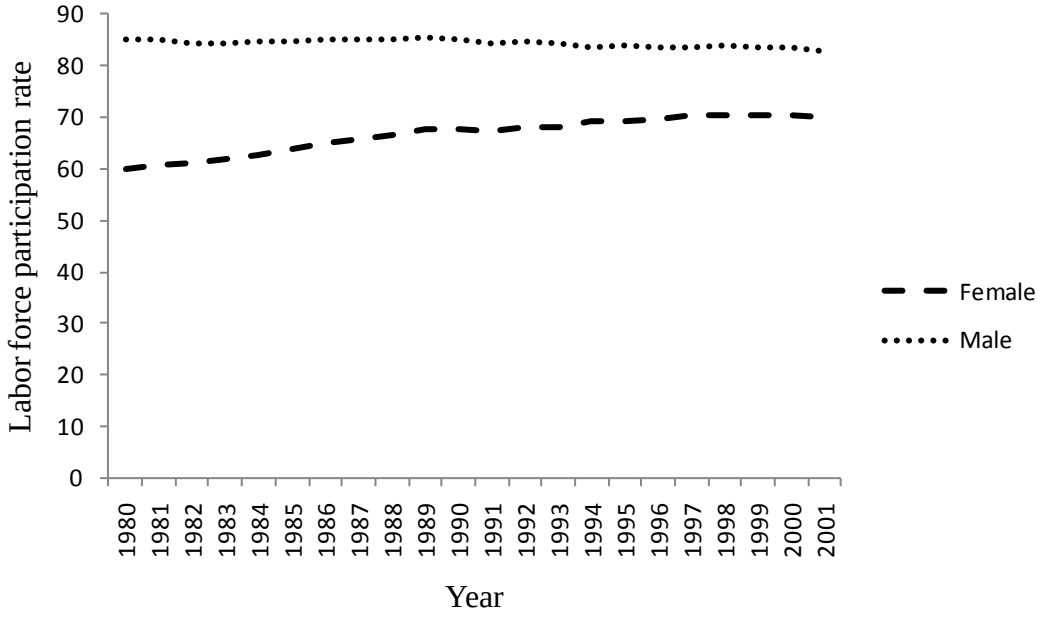

Figure 4.3 Labor Force Participation Rate – Female and Male

between 1980 and 2001 can be observed. The focus in this paper is on the investigation of the effect of the changes in labor force participation rates of males and females on their life expectancy.

The change over time in labor force participation rates of males and females is not unique to the U.S. Female labor force participation rates worldwide have increased from 56% in 1980 to 58% in 2001 an increase of about 3.57%. Worldwide male labor force participation rates on the other hand, have decreased from 87% in 1980 to 84% in 2001, a decrease of about 3.45% (WDI, 2008). It is anticipated that the changes in the labor force participation rates of males and females will have different effects on their health as measured by life expectancy. As a result of the differences in labor force participation rates that exist across countries, it is also expected that the effect of these changes on life expectancy will also differ across countries as well.

To be able to distinguish between the effects of labor force participation rate on the health of females and males, the data is stacked and then dummy variables are created for females and males. For females, the value of 1 is given for the first half of the stacked data and then the values of 0 for the second half of the data. For males, the value of 0 is given for the first half of the stacked data and then the value of 1 for the second half of the stacked data. The dummy variables for females (a column of 1 for the first half of the stacked data and 0 for the second half of the stacked data) is then multiplied by the labor force participation rate of females and similarly, the male dummy variable (a column of 0 for the first half of the stacked data and 1 for the second half of the stacked data) is then used to multiply the labor force participation rate of females; thus creating a column of

the labor force participation rates of female in the first half and then males in the second half of the staked data. This column is labeled: labor force participation rate of males and females (LFPRmf). The LFPRmf is then used to create an interaction term for female labor force participation rate [FEMALE LFPR]; this is interaction term is derived by multiplying LFPRmf and the female dummy. The LFPRmf, FEMALE LFPR, and the female dummy variables are included in the model; thus providing a means to observe the differences in the effect of labor force participation rates of females and males, as stress agent and economic factor, on life expectancy in one estimation model.

4.4. Estimation model, Analysis and Results

As discussed in the literature review and data sections of this paper, health inputs, demographic factors and economic factors are all expected to have some effect on life expectancy thus it can be expressed as in equation 4.1 below.

Life expectancy = f (economic characteristics, demographic factors, and health inputs)

4.1

The analysis in this paper is subdivided into two sections. The first section is an analysis of all the countries for which data is available using single observations for each country. In the first, OLS models are estimated for male and female life expectancy considering the health inputs, demographic factors and economic characteristics including labor force participation. The results for the OLS analysis and the heteroskedadticity consistent standard errors are presented in table 4.4 below. . The second section is an

analysis of all the countries for which data is available using a stacked data set also considering the same health inputs, demographic factors, and economic factors. The results for the OLS analysis and the heteroskedadticity consistent standard errors for the second section of this analysis are presented in table 4.5 below.

4.4.1. Ordinary Least Squares (OLS) Estimation Results Using Single Observations per Country

In model 1, Ordinary least squares (OLS) is used to estimate equation 4.1 using the data with single observations per country. Male life expectancy is expressed as depending on the number of physicians is 1,000 people, DPT and measles immunizations, age dependency ratio, organic water pollutants, male labor force participation rate, food price index, food production index, growth in GDP per capita and GDP per capita. The estimation result included the heteroscedasticity consistent standard errors in parenthesis below the parameter estimates.

From model 1 it can be observed that the coefficient of the variable log of male labor force participation rate is negative (-1.7121); however, insignificant at the 10% level of significance. Food price index is also found to be insignificantly related to male life expectancy in this model. The coefficient of the variable food production index is negative (-0.0075) and significant at the 10% level of significance. This is not as expected, food production is indicative of the availability of better nutrition as such it is expected to be positively related to life expectancy; the reason for the negative relationship found is not clear at this point.

Table 4.4

Ordinary Least Squares (OLS) Estimation Results Using Single

Observations per Country.

DEPENDENT VARIABLE: LEXP				
VARIABLE	**MODEL 1**	**MODEL 2**	**MODEL 3**	**MODEL 4**
	Male	Female	Male	Female
CONSTANT	75.5955***	96.4858***	66.9045***	83.6645***
	(11.0534)	(2.8601)	(9.2614)	(7.9024)
LOG (MALE LFPR)	-1.7121		5.9071**	3.03275*
	(2.4363)		(2.1120)	(1.7448)
LOG (FEMALE LFPR)		-5.1346***	-6.7387***	-5.2920***
		(0.5807)	(0.5768)	(0.5931)
FPRI	-0.0003	-0.0006***	0.0001	-0.0004**
	(0.0002)	(0.0001)	(0.0002)	(0.0002)
FPDI	-0.0075*	-0.0056*	-0.0046*	-0.0058*
	(0.0042)	(0.0023)	(0.0023)	(0.0024)
GDPpc	0.0003***	0.0003***	0.0004***	0.0003***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GGDPpc	0.0899***	0.0389*	0.0818***	0.0434*
	(0.0245)	(0.0194)	(0.0240)	(0.0196)
AGEDEPR	-13.8106***	-21.5089***	-15.2200***	-21.6870***
	(1.7135)	(1.4446)	(1.4413)	(1.4542)
OWP	-7.8047E-7**	-5.0255E-7***	-5.1611E-7*	-5.2724E-7***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
PHYSICIANS	0.2445	1.1475***	0.7317***	1.2553***
	(0.1716)	(0.1208)	(0.1611)	(0.1267)
DPT	0.0583***	0.0594***	0.0563***	0.0612***
	(0.0164)	(0.0133)	(0.0129)	(0.0134)
MEASLES	0.0079	0.0233***	0.0272***	0.0226**
	(0.0080)	(0.0069)	(0.0073)	(0.0070)
R-SQUARE	0.6982	0.8294	0.7703	0.8300
ADJUSTED R-SQUARE	0.694	0.827	0.7667	0.8274
OBSERVATIONS	720	720	720	720

[1] * implies 10% level of significance

[2] ** implies 5% level of significance
[3]*** implies 10% level of significance
[4] Heteroskedasticiaty consistent standard errors in parenthesis

The effect of GDP per capita and growth in GDP per capita are both found to be positive and significant for male life expectancy at the 1% level of significance. Based on the result presented in model 1, male life expectancy is expected to increase by 0.03% for a unit increase in GDP per capita. Similarly, male life expectancy is expected to increase by 8.99% in response to a unit increase in the growth of GDP per capita.

The demographic factor age dependency ratio is found to be significant and negatively related to male life expectancy. The coefficient of age dependency ratio is -13.81 and it is significant at the 1% level of significance. Organic water pollution has a small but negative and significant effect on the life expectancy of males.

The health input, number of physicians per thousand people is found to be positively related to male life expectancy; however, it is insignificant at the 10% level of significance. Similarly, measles immunization is found to have an insignificant effect on the life expectancy of males. However, DPT immunization is found to be significant in explaining male life expectancy. A unit increase in DPT immunization would increase male life expectancy by 5.83%. (0.0583 years) and this result is significant at the 1% level of significance.

The results presented under Model 2 in table 4.4 are the OLS estimation results for equation 4.1, considering only female life expectancy as the dependent variable. Female life expectancy is expressed as depending on female labor force participation rate, food price index, food production index, GDP per capita, growth in GDP per capita, age dependency ratio, organic water pollutants, the number of physicians per 1,000 people,

DPT and measles immunizations. The estimation result included the heteroscedasticity consistent standard errors in parenthesis below the parameter estimates.

From model 2 it can be observed that the coefficient of the variable log of female labor force participation rate is negative (-5.1346) and it is significant at the 1% level of significance. This result implies that a percent increase in the labor force participation rate of females would decrease female life expectancy by approximately 5.14 years. Unlike the case for males, food price index is found to be significantly related to female life expectancy in model 2. The coefficient of the variable food price index is negative (-0.0006) and it is significant at the 1% level of significance. Similar to the result for males and also contrary to expectation, food production index is found to be negatively (-0.0056) related to the life expectancy of females and it is significant the 10% level of significance. The effect of GDP per capita and growth in GDP per capita are both found to be positive and significant for female life expectancy as well. Based on the result presented in model 2, female life expectancy is expected to increase by 0.03% for a unit increase in GDP per capita. Similarly, female life expectancy is expected to increase by 3.89% in response to a unit increase in the growth of GDP per capita. These results are significant at the 1% level of significance and 10% levels of significance respectively.

The demographic factor age dependency ratio is also found to be significant and negatively related to female life expectancy. The coefficient of age dependency ratio is -21.5089 and it is significant at the 1% level of significance. Organic water pollution has a small negative and significant effect on the life expectancy of females. A unit increase in organic water pollutants is expected to decrease female life expectancy by 0.00005% and this result is significant at the 1% level of significance.

The health input, number of physicians per thousand people is found to be significant (1%) and positively (1.1475) related to female life expectancy. A unit increase in the number of physicians per thousand people is expected to increase female life expectancy by 1.15 years. Similarly, DPT immunization is found to be significant in explaining female life expectancy. A unit increase in DPT immunization would increase female life expectancy by 5.9%. (0.0594 years) and this result is significant at the 1% level of significance. Measles immunization is also found to have a significant effect on the life expectancy of females. A unit increase in measles immunization would increase female life expectancy by 2.33%. (0.0233 years) and this result is significant at the 1% level of significance.

Female labor force participation rate is included as an explanatory variable for the life expectancy of males in model 3 presented in table 4.4. Similarly, male labor force participation rate is included as an explanatory variable for the life expectancy of females in model 3 presented in table 4.4. With particular regard to labor force participation rates, the result for model 3 shows that there exist a positive relationship between male labor force participation rate and male life expectancy and the result is significant at the 5% level of significance. Female labor force participation rate is however found to have a negative effect on the life expectancy of males. A one percent increase in female labor force participation rate is expected to decrease male life expectancy by 6.7387 years and this result is significant at the 1% level of significance. There are several reasons why female labor force participation may influence male life expectancy negatively. Increase in the stress of domestic work on males may be one of the reasons for the negative effect especially because domestic work, in most parts of the world, have been traditionally the

responsibility of females. It may also be that the amount of time female devote to taking care of members of the household including males (spouses) and children has diminished as a result of their increased labor force participation rate and as such, a negative effects results for males.

From the result for model 4, it can be observed that female life expectancy is positively influenced by increase in male labor force participation rates. A one percent increase in male labor force participation rate is expected to increase female life expectancy by 3.0328 years and this result is significant at the 10% level of significance. Female labor force participation rate is however found to be negatively related to female life expectancy. Based on the result in model 4, a one percent increase in female labor force participation rate would reduce female life expectancy by 5.2920 years and his result is significant at the 1% level of significance. Stress from a double burden of domestic and market work may explain the negative effect of labor force participation rate on the life expectancy of females. It is noteworthy that female labor force participation rate is found to have significant negative effects on female life expectancy negatively in both models 2 and 4 while male labor force participation rate is found to have an insignificant effect on male life expectancy in model 1; however, in model 3 male labor force participation rates is found to have a positive and significant effect on the life expectancy of males. The negative effect may also be the result of stress from competing in the market place with males on traditionally male jobs. Increased female labor force participation rates would likely lead to fewer females having children and/or a postponement of child bearing to a later time in life after career goals may have been met.

Having fewer children and/or having children later than the age of 30 influences the risk of breast cancer positively (American Cancer Society, 2009).

4.4.2. Ordinary Least Squares (OLS) Estimation Results Using Stacked Data

To be able to better compare the effect of labor force participation rates on life expectancy across gender groups, the data used for the first section of the analysis of this paper is stacked to allow for the creation of dummy variables males, as well as an interaction term for females labor force participation. Estimation models including the same health inputs, demographic factors and economic characteristics as explanatory variables for life expectancy are presented in table 4.5 below. In model 5 the interaction term for female labor force participation rate is included in the model as well as the dummy variable. Model 6 includes dummy variables for countries grouped by their lavle of income; upper middle income countries [UMI], high income OECD countries [HIO] and high income non-OECD countries [HINO]. Lower middle income countries and low income countries are used as the comparison group [LMI&LI].

From the estimation result presented in table 4.5, it can be observed that the signs of most of the coefficients of the explanatory variables are consistent with the findings in the first section of the analysis of this paper. In model 5, food price index is found to have a significant (10%) negative (-0.0003) effect on life expectancy. Similar to the findings of the first section of the analysis of this paper, the coefficient for food production index is negative (-0.0072) and significant at the 5% level of significance. This result is contrary to expectation and the reason for this negative effect is unclear. GDP per capita is positively and significantly related to life expectancy as expected. A one unit increase in

GDP per capita increase life expectancy for males and females by 0.03% and this result is significant at the 1% level of significance. Growth in GDP per capita is however, found to positively influence life expectancy. The coefficient of growth in GDP per capita is 0.0725 and it significant at the 1% level of significance, signifying that economic growth is positively related to life expectancy.

Age dependency ratio, organic water pollutants and the female dummy (gender) variable are the demographic variables which are expected to influence health. In model 5, the coefficient of age dependency ratio is (-17.7624) and it is significant at the 1% level of significance. This result is as expected increase in the number of dependants relative to the number of the working age population is expected to have some stress effects on the people especially those in the working age population and as such a negative effect on life expectancy would result.

The coefficient for the variable organic water pollutants (-7.13573E-7) another demographic factor, is negative and significant at the 1% level of significance. The presence of organic water pollutants signify poor water quality and indicate unhealthy living conditions which is expected to affect health (life expectancy) negatively. The female dummy variable is another demographic variable included in the model so as to show difference that may exist in the effect of being male or female on life expectancy. The coefficient of the female dummy variable (47.8869) is positive and significantly (1%) related to life expectancy. This result supports the notion that women live longer than men in most countries of the world.

Table 4.5

Ordinary Least Squares (OLS) Estimation Results Using Stacked Data

DEPENDENT VARIABLE: LFEXP		
VARIABLE	**MODEL 5**	**MODEL 6**
CONSTANT	43.0380***	27.5530**
	(10.3250)	(9.5010)
LOG (MALE LFPR)	5.9044*	8.2741***
	(2.3327)	(2.1055)
LOG (FEMALE LFPR)	-9.8378***	-11.7216
	(2.4430)	(2.2146)
FPRI	-0.0003*	0.0001***
	(0.0001)	(0.0001)
FPDI	-0.0072**	-0.0070***
	(0.0025)	(0.0019)
GDPpc	0.00029***	0.0002***
	(0.0000)	(0.0000)
GGDPpc	0.0725***	0.0520***
	(0.0171)	(0.0173)
FEMALE	47.8869***	56.3377***
	(10.6258)	(9.6128)
AGEDEPR	-17.7624***	-13.0838***
	(1.1865)	(1.4556)
OWP	-7.13573E-7***	-3.80864E-7**
	(0.0000)	(0.0000)
PHYSICIANS	0.8042***	0.8326***
	(0.1085)	(0.1096)
DPT	0.0619***	0.0647***
	(0.0110)	(0.0107)
MEASLES	0.0122*	0.0211***
	(0.0052)	(0.0056)
UMI		1.3050***
		(0.3730)
HIO		4.1164***
		(0.4513)
HINO		4.7194***
		(0.4315)
R-SQUARE	0.7985	0.8152
ADJUSTED R-SQUARE	0.7968	0.8133
OBSERVATIONS	1,440	1,440

[1] * implies 10% level of significance
[2] ** implies 5% level of significance
[3]*** implies 10% level of significance
[4] Heteroskedasticiaty consistent standard errors in parenthesis
[5] Used World Development Indicators 2008 categories of countries by income level

As expected, positive and significant effects are found for the health inputs, physicians per thousand people, DPT immunization, and measles immunization on life expectancy. Based on the results for model 5 in table 4.5, a unit increase in the number of physician per thousand people would increase life expectancy at birth by 80.42% (0.8042 years) and this result is significant at the 1% level of significance. Similarly, a unit increase in DPT immunization measured in terms of the percent of children between 12 and 23 months of age, who receive the immunization, increases life expectancy by 6.19% and this result is also significant at the 1% level of significance. The coefficient for measles immunization (0.0122) is positive and significant at the 10% level of significance, implying that a unit increase in measles immunization measured in terms of the percent of children between 12 and 23 months of age, who receive the immunization, will increase life expectancy by 1.22%. Physician per thousand people and DPT and measles immunization are indicators of the availability of health care and receipt of health care; thus their positive effect on life expectancy is as expected.

Labor force participation rate is another economic factor expected to have an effect on health (life expectancy). The main hypothesis of this paper is that changes in the labor force participation rate of males and females over time has affected their health, proxied by life expectancy, differently. Bearing in mind that male labor force participation rates have been declining over time and female labor force participation rate has been increasing rapidly, it is expected that the stress level of increased market work on females would result in a negative effect on their health as such, the coefficient of the female labor force participation rate interaction term [FEMALE LFPR] is expected to be negative.

The result presented in table 4.5 is consistent whit these expectations and supports the hypothesis of this paper. The coefficient of male labor force participation (5.9044) is positive and significant at the 10% level of significance. The coefficient of the female labor force participation rate variable (-9.8378) is negative and also significant at the 1% level of significance. The marginal effect of males and females labor force participation rates on their life expectancy are calculated to allow for comparison across the gender groups. The marginal effect is obtained by taking the derivative of the estimation model with respect to labor force participation rates. The marginal effect of female labor force participation rate on their life expectancy is (-3.9334) and the marginal effect of male labor force participation rate on their life expectancy is (5.9044). This result signifies that for males, there is a benefit of increased life expectancy of 5.90 years resulting from a percent increase in their labor force participation rates; on the other hand, for females a loss in life expectancy of 3.93 years results from a one percent increase in female labor force participation rates.

The signs of the coefficients in model 6 are consistent with those in model 5 and the coefficients of all the income level dummy variables are positive and significant at the 1% level of significance. As expected, upper middle income countries have higher life expectancies (1.3050) compared to lower middle income countries and low income countries. Also as expected, high income OECD countries and high income non-OECD countries have higher life expectancies (4.1164) compared to upper middle income countries, lower middle income countries and low income countries. It is however interesting to find that high income non-OECD countries have higher life expectancies (4.7194) compared to high income OECD countries. The significance of the dummy

Table 4.6

Ordinary Least Squares (OLS) Estimation Results Using Stacked Data for Different Income Groups of Countries

VARIABLE	MODEL 7	MODEL 8	MODEL 9	MODEL 10
	HIO	HINO	UMI	LMI & LI
CONSTANT	45.5011	61.2123***	-7.4445	5.6563
	(7.5358)	(13.7451)	(16.0681)	(27.3121)
LOG (MALE LFPR)	3.8620*	3.1122	17.0653***	11.9431*
	(1.6635)	(3.1076)	(3.8382)	(6.1507)
LOG (FEMALE LFPR)	-6.6101***	-1.918	-15.1493***	-14.4361*
	(1.6324)	(3.6026)	(4.4029)	(6.3390)
FPRI	0.0378***	0.0029	0.0011***	0.0059*
	(0.0036)	(0.0039)	(0.0003)	(0.0025)
FPDI	0.0203**	-0.0021*	-0.0181*	-0.0401*
	(0.0062)	(0.0009)	(0.0088)	(0.0141)
GDPpc	0.0001***	0.0002***	0.0013***	0.0043***
	(0.0000)	(0.0000)	(0.0002)	(0.0004)
GGDPpc	-0.0349	0.0986***	-0.0174	0.046
	(0.0249)	(0.0290)	(0.0220)	(0.0328)
FEMALE	34.5332***	13.687	74.3869***	67.6989*
	(7.1738)	(15.2913)	(18.8810)	(27.7332)
AGEDEPR	1.0839	-12.8441***	-18.6868***	-9.7887***
	(1.5799)	(2.3532)	(3.5367)	(2.5317)
OWP	-1.7691E-7*	3.026E-05*	-2.030E-06***	2.4027E-7*
	(0.0000)	2.5243***	(0.0000)	(0.0000)
PHYSICIANS	0.9950***	(0.2533)	-0.5204**	2.19872***
	(0.0943)	1.13E-05	(0.1953)	(0.2848)
DPT	-0.0132*	(0.0138)	0.0859*	0.0970***
	(0.0056)	-0.0276*	(0.0337)	(0.0250)
MEASLES	0.0226***	-0.0276*	0.0157	-0.0089
	(0.0041)	0.0000	(0.0313)	(0.0227)
	0.8893	0.8268	0.7728	0.7377
	0.8872	0.808	0.7653	0.7262
	652	124	376	288

[1] * implies 10% level of significance
[2] ** implies 5% level of significance
[3]*** implies 10% level of significance
[4] Heteroskedasticiaty consistent standard errors in parenthesis

variables suggests that the effect of the factors considered on life expectancy may differ across different kinds of economies; that is, high income, middle income etc. The estimation results presented in table 4.6 are for each of the income levels.

For high income OECD countries, male labor force participation rate is positively related to life expectancy (3.8620) and it is significant at the 10 % level of significance. The coefficient of female labor force participation rate is -6.6101 and it is significant at the 1% level of significance. For high income non-OECD countries, male labor force participation rate is positively related to life expectancy (3.1122); however it is not significant at the 10 % level of significance. The coefficient of female labor force participation rate is -1.918 and it is also insignificant at the 10% level of significance. For upper middle income countries, male labor force participation rate is positively related to life expectancy (17.0653) and it is significant at the 1% level of significance. The coefficient of female labor force participation rate is however negative (-15.1493) and it is also significant at the 1% level of significance. For lower middle income countries and low income countries, male labor force participation rate is positively related to life expectancy (11.9431) and this result is significant at the 10% level of significance. The coefficient of female labor force participation rate is however negative (-14.4361) and it is also significant at the 10% level of significance.

Based on the results presented in table 6, the marginal effects for each of the countries' groups are calculated and presented in table 4.7 below. The highest negative effect to increase in labor force participation rate found is for females in high income OECD countries. Lower middle income countries and low income countries have the next highest negative effect on life expectancy resulting from increased female labor

force participation. Upper middle income countries have the lowest negative effect on life expectancy resulting from increased female labor force participation.

Table 4.7

Marginal Effects of Labor Force Participation Rates on Life Expectancy

	ALL COUNTRIES	HIO	HINO	UMI	LMI&LI
MALE	8.2741	3.8620	3.1122	17.0653	11.9431
FEMALE	-3.4475	-2.7481	1.1942	1.9160	-2.4930

For high income non-OECD countries the coefficients for both male and females labor force participation rates are insignificant at the 10% level of significance. This implies that labor force participation rate does not significantly influence the life expectancy of countries who not members of the OECD but categorized as high income countries. Many of the high income non-OECD countries are characterized by lower female labor force participation rates. It may be that there exist a better balance between the division of domestic and market work among males and females in these countries. Summary statistics for the income level groups of countries are presented in the appendix.

4.5. Conclusion

This paper sheds light on another factor that may be responsible for the slowing down in the growth rate of the life expectancy of women – their labor force participation rate. While work has a positive effect on life expectancy, work in excess would have a negative effect on the life expectancy of both males and females as shown in the first

chapter of this dissertation. The multi country level analysis done in this third chapter affirms that further increases in the labor force participation rate of females has a negative effect on their life expectancy.

This result is expected to differ across countries. It is anticipated based on this result, that countries with very high male labor force participation rates relative to female labor force participation rates would find that further increase in male labor force participation rates would have a negative effect on the life expectancy of males. Similarly, countries with high or rapidly increasing female labor force participation rates relative to the decline in male labor force participation rates would find that further increase in female labor force participation rates would have a negative effect on the life expectancy of females. The result is also expected to differ for countries of different income groups as revealed by the coefficients of the income level dummy variables in table 5.

Overall, this is a proposal for a balance between males and females in terms of labor force participation as well as domestic work. Both males and females should be mindful to work as much as would only result in positive health benefits. Bearing in mind the findings of several studies such as Masahiro Irie et al. (2001) and Kuper et al., 2007, who find that women are prone to stress related diseases compared to men. Women are to be especially careful to ensure that they do not suffer in terms of their health for their good intensions to work more and be more productive.

A further analysis of this hypothesis would calculate the average labor force participation rate that results in the maximum health benefits for males and females. Though this is expected to differ across countries as a result of varying health, demographic and economic circumstances, the ability for countries to calculate these

limits for male and female labor force participation rates may help influence economic policies that seek not just equity of males and females in the labor market but also a balance that results in positive health effects of the labor force participation rate for both males and females. The analysis done in this paper does not suggest that women should not work; it simply advocates for a healthy balance of male and female labor force participation.

4.6. References

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APPENDIX

Table A1

Summary Statistics of High Income OECD (HIO) Countries

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
LEXP	824	76.54	3.76	62.28	84.90
Health Input					
PHYSICIANS	714	2.49	0.73	0.50	4.40
DPT	824	88.67	11.71	10.00	99.00
MEASLES	824	82.04	17.62	5.00	99.00
Demographic Factors					
AGEDEPR	824	0.50	0.04	0.39	0.67
OWP	754	438,103.15	632,348.91	6,160.38	2,742,992.82
FEMALE	824	0.50	0.50	0.00	1.00
Economic Factors					
LFPR	824	71.47	13.08	34.30	90.20
MALE LFPR	824	81.59	4.28	72.30	90.20
FEMALE LFPR	824	61.34	10.88	34.30	83.30
FPRI	824	90.73	18.97	15.88	127.51
FPDI	824	95.23	10.40	62.50	118.20
GDPpc	824	20,035.23	7,843.41	3,367.07	47,280.56
GGDPpc	824	2.26	2.29	-6.77	10.56

Table A2

Summary Statistics of High Income Non - OECD (HINO) Countries

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
LEXP	268	73.74	4.45	60.19	81.00
Health Input					
PHYSICIANS	156	2.37	0.98	0.44	4.48
DPT	268	88.11	12.63	26.00	99.00
MEASLES	268	82.35	18.03	8.00	99.00
Demographic Factors					
AGEDEPR	268	0.56	0.11	0.37	0.89
OWP	192	22412.13	18979.76	606.25	55324.46
FEMALE	268	0.50	0.50	0.00	1.00
Economic Factors					
LFPR	268	63.79	20.47	9.20	90.50
MALE LFPR	268	80.05	6.57	65.20	90.50
FEMALE LFPR	268	47.53	16.24	9.20	77.00
FPRI	268	85.97	32.74	0.10	163.87
FPDI	268	116.06	133.45	25.00	994.90
GDPpc	268	11780.05	5273.13	2793.59	29915.40
GGDPpc	268	1.29	5.20	-25.18	12.37

Table A3

Summary Statistics of Upper Middle Income Countries

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
LEXP	636	69.14	6.46	45.00	80.21
Health Input					
PHYSICIANS	436	2.16	1.17	0.19	5.17
DPT	636	85.03	16.75	16.00	99.00
MEASLES	636	84.46	16.79	17.00	99.00
Demographic Factors					
AGEDEPR	636	0.62	0.14	0.43	0.99
OWP	514	183313.49	302744.73	163.87	1911347.64
FEMALE	636	0.50	0.50	0.00	1.00
Economic Factors					
LFPR	636	66.11	17.74	15.00	89.60
MALE LFPR	636	80.73	5.36	63.20	89.60
FEMALE LFPR	636	51.50	13.14	15.00	72.20
FPRI	636	151.57	435.83	0.00	3493.10
FPDI	636	98.43	25.43	34.80	195.88
GDPpc	636	3373.12	1568.91	317.35	8270.76
GGDPpc	636	1.36	5.80	-31.34	24.47

Table A3

Summary Statistics of Lower Middle Income Countries and Low Income Countries

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
LEXP	1068	60.72	8.88	21.89	77.88
Health Input					
PHYSICIANS	492	1.15	1.35	0.02	5.19
DPT	1068	67.46	25.47	1.00	99.00
MEASLES	1068	66.36	24.84	1.00	99.00
Demographic Factors					
AGEDEPR	1068	0.82	0.16	0.43	1.16
OWP	592	237780.62	978163.35	94.06	8491856.02
FEMALE	1068	0.50	0.50	0.00	1.00
Economic Factors					
LFPR	1068	69.21	20.33	16.90	96.00
MALE LFPR	1068	83.94	5.68	65.60	96.00
FEMALE LFPR	1068	54.48	18.97	16.90	93.00
FPRI	1068	101.47	356.94	0.00	7967.80
FPDI	1068	84.61	19.38	36.20	152.66
GDPpc	1068	895.35	638.02	110.58	3240.63
GGDPpc	1068	0.58	6.12	-30.29	37.57