Re-Examining the Gender Gap in Life Expectancy: a Cross Country Analysis

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Abstract

Objective: *We revisit the analysis of the gender gap in life expectancy with an emphasis on labor force participation rate in addition to other demographic, economic, and health related factors that may influence life expectancy.* ***Method:*** *We use data from the World Development Indicators, as well as 2SLS with time fixed effects to account for possible simultaneity.* ***Result:*** *We find that increasing female labor force participation rate in high income Organization for Economic Co-operation and Development (OECD) countries is positively related to the narrowing life expectancy gender gap among OECD countries.* ***Conclusion:*** *The findings support the notion that male – female competition and gender equality has health consequences for both males and females especially when the level of country development or income is considered. A variety of other factors also influence life expectancy across countries categorized by their levels of development and income. These factors are identified and discussed.*

I. Introduction

From 1980 to 2012, female labor force participation rate has increased by approximately 12% while male labor force participation rate decreased by approximately 9% within the same time frame in the United States (World Development Indicators). This trend is observed widely among high income Organization for Economic Co-operation and Development (OECD) countries. It is possible that the increase in female labor force participation rate and the decrease in male labor force participation rate depict a redistribution of responsibilities between men and women which may have some health consequences for both females and males. Since being healthy often translates to a higher life expectancy, it is also possible that changes in the labor market composition of males and females, may have some consequences for their life expectancies.

Clark and Peck (2012) examine the gender gap in life expectancy. The authors conclude that women's status, traditional male hazards, and development/modernization processes tend to widen the gender gap in life expectancy. In addition, they find that income inequality expands the gender gap, while female representation in parliament reduces it. In the same light, Medalia and Chang (2011) find that the life expectancy of males and females are converging in highly developed countries while it is diverging in less developed countries. Medalia and Chang (2011) use cross-sectional data to demonstrate that improvements in the status of women initially increases the gender gap in life expectancy in favor of females; however, further improvements in the status of women beyond a certain point decreases the gender gap in life expectancy - reducing the female advantage.
The analysis conducted in this essay builds on Medalia and Chang's analysis by using longitudinal data for groups of countries categorized by their level of income to re-investigate the relationship between life expectancy and labor force participation rate. This analysis also attempts to adjust for the possibility of a simultaneous relationship and accounts for demographic, economic and health factors that may influence the gender gap in life expectancy.

For the purpose of this analysis we assume that being healthy translates to a higher life expectancy and that women's economic status is evident in their labor force participation rates.

The relationship between labor force participation and health, as proxied by life expectancy, is simultaneous (Ross and Mirowsky, 1995; Cai and Cong, 2009; Zhang et al., 2009; and Cai, 2010). Health influences labor force participation but labor force participation also determines health outcomes.

In this essay, data from the World Development Indicators (WDI) is used to conduct a cross country analysis of the effect of increased female labor force participation on the life expectancy gender gap. We use two stage least squares (2SLS) estimation to account for the endogeneity of labor force participation rate in the model and following Clark and Peck (2012) we also account for time fixed effect (FEM). The findings suggest that a variety of factors influence the gender gap in life expectancy and these factors vary among different groups of countries categorized by their income. Specifically, female labor force participation rate is found to have a negative effect on the life expectancy gender gap in high income OECD countries.

Gender Differences in Labor Force Participation Rates

Women may choose to work more to support their families in response to lower male earnings; in addition, women may have higher incentives to work because they now have improved educational opportunities and higher wages (Cohen and Suzanne, 1999). Firms may also have a greater incentive to employ women in order to comply with rules against discrimination such as affirmative action regulation (Costa, 2000). Women may also 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 (Bianchi et al., 2000).
Analysis of the difference between the hours worked by women in the European Union (EU) and the U.S. reveal that in the U.S. the traditional household chores of women are more marketized compared to the EU. Women in the U.S. are therefore able to spend more of their free time engaged in market work (Freeman and Schettkat, 2005).

Gender Differences in Life Expectancy

In addition to changes in labor force participation, changes in life expectancy trends are also being observed. The mortality rate of both males and females are declining (Fogel, 1994). However, while men and women are living longer, men are beginning to catch up with women in terms of life expectancy (Meslé, 2006). Meslé supports his argument by analyzing individual-level data 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.

One of the reasons for this narrowing gap is health improvement in middle aged men relative to middle aged women (Meslé, 2006). Meslé 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.

Women in the U.S. and the Netherlands are experiencing an extensive slowdown in their old age life expectancy when compared to women in France and Japan (Meslé and Vallin, 2006). Using data from the World Health Organization the authors find that the advantage France and Japan have over the U.S. and the Netherlands in terms of life expectancy arise as a result of greater success treating and preventing cardiovascular diseases and lower incidence of mental disorders among older women. In France the negative effect of mental disorders is mild, and in Japan, the negative effects have been found to bevirtually non-existent among older wonen. It is noteworthy that the illnesses found to influence differences in life expectancy by Meslé and Vallin (2006) – cardiovascular diseases and mental disorders, are very often stress related and likely preventable (Fischer, 2003). DesMeules et al. (2004) suggest that most of the gender gap in life expectancy is explained by preventable causes. The authors also find that when preventable causes are excluded, women have shorter health-adjusted life expectancy when compared to men. 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.

Work, Health and Gender

Work is usually rewarded by wages, which can be spent in a variety of ways including health care, a healthier environment and better nutrition, all of which will likely have a positive effect on health. Specifically, paid labor force participation has significant positive effects on the health of young women and also tends to halt the decline in the health of older female workers (Lajeunesse, 2010).

Similarly, increases in hours worked per week have significant negative consequences for mortality even when income is accounted for in the model (Johansson, 2004).

Johansson explains that hours of work per person employed may capture the ability of the economy to hire people, and not necessarily the stress level of individuals in the economy. This is because, unlike labor force participation, hours of work per person employed does not account for the stress level of individuals who are seeking jobs (unemployed) in the economy.

Just as studies have shown that labor force participation can affect life expectancy, other studies (Soares and Falcão, 2008; Cai and Cong, 2009; Cai, 2010) support the notion that life expectancy (health) influences labor market participation, therefore suggesting that a simultaneous relationship exists between the two variables. Longevity gains are responsible for the increased participation of women in the labor market as well as the narrowing of the gender wage gap and women are choosing to participate more in the labor market because of the decrease in adult mortality (Soares and Falcão, 2008). This means that as people expect to live longer, they choose to participate more in the labor market.

Other health outcomes that can determine life expectancy influence labor force participation. Specifically, poor health has significant negative effects on labor force participation (Mutran and Reitzes, 1989) and improved health status has positive consequences for labor force participation (Cai, 2010).

For males, circulatory conditions and bronchitis have the largest negative effect on labor force participation, and for females coronary diseases have the largest negative effect on labor force participation. Chronic health conditions and mental health problems have negative consequences for the labor force participation of both males and females, especially for older workers. Also, mental health problems have greater negative consequences for the labor force participation of males than for females (Zhang et al., 2009). On the other hand, improvement in health status has positive consequences for labor force participation and these positive effects are greater for females than for males (Cai and Cong, 2009).

The studies discussed in this section suggest that the relationship between labor force participation and life expectancy is simultaneous; that is, changes in labor force participation affect life expectancy (health) and vice versa.

Other Determinants of Mortality

In addition to labor force participation rate, economic factors such as income, income inequality and education are also important determinants of mortality (Wolfson et al., 1999; Crimminsa and Saitob, 2001; Marmot, 2005). Healthy lifestyle choices, improved diet, exercise, and the elimination of substance abuse are health factors that influence life expectancy (mortality) (Manton et al., 1991; Cutler et al., 2006; Vollset, 2008).

There are differences in mortality across countries (Becker et al., 2005). In particular, the changes in mortality in developing countries is the result of the technology previously available to rich countries which poor countries have more recently received at relatively low cost. In developed countries, the changes in mortality are found to be the result of recent developments in medical technology.

The factors affecting life expectancy are likely to differ depending on the level of economic development (Becker et al., 2005). It is therefore important to investigate the relationship between life expectancy and labor force participation for countries of different levels of development separately.

Education can also influence life expectancy. Lleras-Muney (2005) finds that education has a positive causal effect on life expectancy. Similarly, in developing economies maternal education, income, new technologies, fertility, sanitation, nutrition, water supply, sewerage, immunization, AIDS and demand for health services are determinants of mortality (Soares, 2007).

The rest of this paper is divided into four sections. In section II we present the fixed effects model as well as the two-equation estimation model of life expectancy and labor force participation. We describe the data used in this essay in section III, and explain the model estimates in section IV. Section V concludes the paper, summarizing the findings, explaining limitations and indicating areas for possible future research.

II. Model

The gap in the life expectancy of males and females is calculated by taking the natural log of the ratio of female life expectancy to male life expectancy as follows:

$$\text{Life Expectancy Gap} = \ln\left(\frac{\text{female life expectancy}}{\text{male life expectancy}}\right)$$

Expressing the life expectancy gender gap this way allows us to interpret it in percentage terms while still measuring the difference between female and male life expectancy since ln(female life expectancy/ male life expectancy) = ln(female life expectancy) – ln(male life expectancy).

The relationship between the gender gap in life expectancy and economic (E), demographic (D) and health (H) factors can be expressed simply as follows:

Life Expectancy Gender Gap = $\beta_0+\beta_E E + \beta_H H+ \beta_D D+\varepsilon 1$ (1.1)

Following Clark and Peck (2012), the life expectancy gender gap model is estimated controlling for time fixed effects.[2] Unlike Clark and Peck (2012) and Medalia and Chang (2011), the possibility of a simultaneous relationship is considered while accounting for a variety of different demographic, economic and health predictors.

Two stage least squares (2SLS) estimation method is employed to account for simultaneity (Rogot et al., 1992; Bohle et al., 2004; Kuper et al., 2007; Cai and Cong, 2009; Cai, 2010). In this application, we estimate two reduced form equations for life expectancy gender gap and the natural log for female labor force participation; fitted values from the reduced form equation are used in the structural equations 1.2 and 1.3 presented below.

$$\text{Life Expectancy Gender Gap} = \beta_0 + \beta_1 \widehat{\text{Log LPR Female}} + \beta_E E + \beta_H H + \beta_D D + \varepsilon_1 \quad (1.2)$$

$$\log \text{LPR Female} = \varphi_0 + \varphi_1 \widehat{\text{Life Expectancy Gender Gap}} + \varphi_E E + \varphi_H H + \varphi_D D + \varepsilon_2 \quad (1.3)$$

where β and φ refer to the coefficients of the explanatory variables. E refers to economic factors, H refers to health inputs and D refers to demographic factors. The economic, demographic, and health inputs accounted for in the model are based on the analysis of Soares (2007) who studies the determinants of morality.

The explanatory variables included in the life expectancy gap structural equation are discussed in the data section of this essay. Exclusion restrictions are required for the structural equation for life expectancy gap to be identified; specifically, at least one variable has to be excluded from the structural model. It is very difficult to find variables that sufficiently satisfy the exclusion requirements for a health or life expectancy model; however, for the purpose of this analysis variables that are indirectly related to life expectancy are excluded from the model (equation 1.2). These excluded variables are urban population (%) and rural population growth.[1] Similarly, variables indirectly related to female labor force participation rate are excluded to meet the restriction requirements for the female labor force participation rate equation (equation 1.3) to be identified; specifically, DPT immunization is excluded for equation 1.3 to be identified.

III. Data

The data used for the analysis in this paper is from the World Development Indicators; it is comprised of data for 99 countries spanning from 1995 to 2010. The definitions for the variables used in this analysis are presented in Table 1.

It is anticipated that health quality depends on health inputs, economic characteristics and demographic factors. The economic factors included in the two equation system are labor force participation rate, consumer price index (CPI), growth in gross domestic product (GDP), GDP per capita, percent of female primary school enrollment, inflation, gross fixed capital formation and food production index (FPI).

Table 1: Description and Definition of Variables

VARIABLE	DEFINITION
Life Expectancy Female	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.
Life Expectancy Male	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	
DPT	The percentage of children ages 12-23 months whoreceived vaccinations before 12 months or at any time before the survey.
HIV Prevalence	The percentage of people ages 15-49 who are infected with HIV.
Out of Pocket Health Expenditure	Any direct outlay by households, including gratuities and in-kind payments, to health practitioners and suppliers of pharmaceuticals and therapeutic appliances.
Fertility	The number of children that would be born to a woman if she were to live to the end of her childbearing years specific fertility rates.
Public Health Expenditure	Recurrent and capital spending from government budgets, external borrowings and grants, and social (or compulsory) health insurance funds.
Demographic Factors	
ADR	The ratio of dependents--people younger than 15 or older than 64--to the working-age population—those ages 15-64.
Population Density	Midyear population divided by land area in square kilometers.
Rural Population Growth	Growth in the number of people living in rural areas as defined by national statistical offices.
Urban Population Growth	Growth in the number of people living in urban areas as defined by national statistical offices.
Urban Population (%)	Percent of people living in urban areas as defined by national statistical offices.
Low Income	Economies in which 2009 GNI per capita was $995 or less.
Lower Middle Income	Economies in which 2009 GNI per capita was between $996 and $3,945.
Upper Middle Income	Economies in which 2009 GNI per capita was between $3,946 and $12,195.
High Income Non-OECD	Economies in which 2009 GNI per capita was $12,196 or more.
High Income OECD	Economies in which 2009 GNI per capita was $12,196 or more.
Year	Year
Economic Factors	
Labor Force Participation Rate Female	The percent of the female population ages 15 andolder that is economically active
Labor Force ParticipationRate Male	The percent of the male population ages 15 and older that is economically active
School Enrolment Female	The ratio of total female enrollment, regardless of age, to the population of the age group that officially corresponds to the primary level of education.
Food Production Index	Food crops that are considered edible and that contain nutrients.
Consumer Price Index	Cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.
GDP Growth	Annual percentage growth rate of GDP at market prices based on constant local currency.
GDP Per Capita	GDP per capita is gross domestic product divided by midyear population.
Capital Formation	Includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings.
Inflation	The rate of price change in the economy as a whole.

Source: World Development Indicators 2010. Contact authors for more detailed definitions

DPT immunization, HIV prevalence, fertility, public health expenditure, and out-of-pocket health expenditure are the health inputs considered. The demographic factors considered are age dependency ratio (ADR), percent of total population that is urban population, urban population growth, rural population growth, and a time trend.[2]
When health inputs are considered, DPT immunization is intended to protect children between the ages of 12 – 23 months against diphtheria, pertussis (or whooping cough), and tetanus and so it is expected to have positive effects on life expectancy. HIV prevalence measures the degree of sexually transmitted diseases in a country, which are expected to have negative consequences for life expectancy. The signs of the coefficients for public expenditure on health and out-of-pocket expenditure on health may be positive or negative. This is because expenditure on health may be high in order to help with the treatment cost for severe health problems in which case high health costs will have positive health effects. On the other hand, if health care spending is not successfully preventing health problems, it may be negatively correlated with life expectancy.

Demographic factors such as region, age dependency ratio, population composition and growth can also influence life expectancy. Life expectancy is also expected to differ between countries categorized by their income levels. A higher income level is associated with the ability to afford better health care; as such, it is expected that a higher income level would be positively associated with a higher life expectancy. A higher age dependency ratio may increase the burden of care on the working age population and so may have a negative consequence for life expectancy. However, a higher age dependency ratio may also mean that people are living longer in their retirement years, in which case the coefficient may be positive. A high population density may also have a negative consequences for health because there are likely to be many people competing for the available health care amenities. However, if a high population density results in increasing returns to scale in providing health care, the coefficient for population density would more likely be positive. Similarly, residents of rural areas are likely to have little access to health care, and so a large urban population may have positive consequences for life expectancy.

In addition to labor force participation rate, other economic factors can also influence life expectancy. Consumer price index (CPI), for example, measures the average cost to consumers for purchasing goods and services. Higher cost of living may reduce individuals' ability to pay for medical care and so have negative effects on life expectancy. Gross domestic product (GDP) measures income in the economy which is expected to have positive effects on life expectancy. In this analysis, education is measured by percent of female primary school enrollment rate. In many developing countries, there is usually a preference for males to attend school as such female primary school enrollment is considered a good measure of how important education is in a country, as well as the level of basic education its citizens have. Gross fixed capital formation is a measure of technological advancement which is expected to influence life expectancy positively. Food production is included as a proxy of the level of nutrition available to people and is therefore expected to have positive effects on life expectancy.

Finally, labor force participation is expected to influence life expectancy positively. 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 wage is also expected to increase an individual's ability to afford health care which should be positively related to life expectancy. However, in excess, labor force participation may have negative consequences for life expectancy because it may have detrimental health impacts.

Following the findings of Becker et al. (2005), the 2SLS models are estimated for high income OECD countries (HIO), upper middle income countries (UMI), and lower income countries (LIC) separately. The summary statistics for each of these country groups are presented in Table 2 - 4.

Table 2: Summary Statistics (HIO)

VARIABLE	OBS	MEAN	SD	MIN	MAX
Life Expectancy Female	131	81.4328	1.8261	76.3000	85.0000
Life Expectancy Male	131	75.9521	2.4680	68.4000	79.7000
Health Input					
DPT	131	92.3053	6.1618	73.0000	99.0000
HIV Prevalence	131	0.1954	0.1066	0.1000	0.4000
Fertility	131	1.6793	0.3843	1.1555	2.9800
Out of Pocket Health Expenditure	131	19.6325	8.2850	6.6511	45.9435
Public Health Expenditure	131	6.0855	1.0647	4.3419	8.5363
Demographic Factors					
ADR	131	49.0009	4.0218	39.8810	62.5037
Population Density	131	101.3219	84.1762	2.3524	353.6471
Rural Population Growth	131	0.7152	0.6448	0.0048	2.6997
Urban Population Growth	131	1.0580	0.6858	0.0117	2.8769
Urban Population (%)	131	74.4887	11.7244	50.7600	97.3600
Year	131	2001.96	4.1070	1995	2008
Economic Factors					
Labor Force Participation Rate Female	131	52.3748	9.0362	36.4000	74.5000
Labor Force Participation Rate Male	131	70.1168	5.6367	60.7000	85.9000
School Enrolment Female	131	101.4986	3.5152	92.2242	112.6790
Food Production Index	131	100.1450	7.4721	79.0000	124.0000
Consumer Price Index	131	93.1933	11.7491	50.6747	126.2869
GDP Growth	131	3.7627	2.2761	0.0287	11.4946
GDP Per Capita	131	24166.6400	11620.0400	4427.0400	56624.7300
Capital Formation	131	22.5155	3.4084	17.0252	35.7619
Inflation	131	3.1359	2.3321	0.0794	11.8569

OBS = Observations; SD = Standard Deviation; MIN = Minimum; MAX = Maximum

Table 3: Summary Statistics (UMI)

VARIABLE	OBS	MEAN	SD	MIN	MAX
Life Expectancy Female	100	71.6496	7.1190	53.0630	81.2650
Life Expectancy Male	100	65.7909	6.6720	49.9670	76.4410
Health Input					
DPT	100	86.3200	9.5377	67.0000	99.0000
HIV Prevalence	100	3.4890	6.7554	0.1000	25.3000
Fertility	100	2.5638	0.5305	1.5000	3.8660
Out of Pocket HealthExpenditure	100	32.2729	20.0020	3.2414	83.0489
Public Health Expenditure	100	3.0995	1.4821	0.7918	6.6964
Demographic Factors					
ADR	100	57.8601	8.7851	42.6590	77.7111
Population Density	100	115.4285	188.2502	2.3060	628.2379
Rural Population Growth	100	0.7082	0.4008	0.0266	1.4813
Urban Population Growth	100	2.0449	1.0166	0.4277	4.3106
Urban Population (%)	100	58.2080	11.9705	33.4800	74.8000
Year	100	2001.8300	4.1294	1995	2009
Economic Factors					
Labor Force ParticipationRate Female	100	46.4470	10.8593	26.6000	68.8000
Labor Force ParticipationRate Male	100	74.7340	6.8970	60.9000	84.1000
School Enrolment Female	100	107.5846	8.1338	91.1301	122.5402
Food Production Index	100	105.3800	15.8674	71.0000	147.0000
Consumer Price Index	100	83.8248	28.5150	1.8534	152.6312
GDP Growth	100	6.0886	4.9973	0.2149	34.5000
GDP Per Capita	100	2935.2600	1202.8500	489.1026	5934.9800
Capital Formation	100	22.9285	6.6679	14.3055	57.7091
Inflation	100	12.8099	13.5752	0.4722	86.0075

OBS = Observations; SD = Standard Deviation; MIN = Minimum; MAX = Maximum

Table 4: Summary Statistics (LIC)

VARIABLE	OBS	MEAN	SD	MIN	MAX
Life Expectancy Female	499	60.1396	9.3287	42.4810	78.2850
Life Expectancy Male	499	56.7134	8.2345	40.7390	74.4550
Health Input					
DPT	499	75.9459	18.6439	16.0000	99.0000
HIV Prevalence	499	3.5814	5.6335	0.1000	26.2000
Fertility	499	4.5262	1.3747	1.7320	7.7030
Out of Pocket HealthExpenditure	499	45.2634	18.3639	5.5867	88.0048
Public HealthExpenditure	499	2.3225	1.0866	0.0041	6.6347
Demographic Factors					
ADR	499	80.7789	14.1608	41.6466	109.3601
Population Density	499	86.3594	141.1900	1.4611	1246.2200
Rural Population Growth	499	1.5696	0.8477	0.0586	3.5972
Urban Population Growth	499	3.5134	1.4480	0.0044	9.5548
Urban Population (%)	499	35.2232	14.5257	7.8600	65.5800
Year	499	2002.1300	4.1209	1995	2009
Economic Factors					
Labor ForceParticipation RateFemale	499	58.0681	18.8714	12.5000	90.7000
Labor ForceParticipation Rate Male	499	82.1142	5.5117	67.5000	91.3000
School EnrolmentFemale	499	91.0857	25.2578	21.3825	s166.7647
Food Production Index	499	107.3707	19.7939	49.0000	201.0000
Consumer Price Index	499	90.6230	31.3138	0.0000	311.3909
GDP Growth	499	5.4343	3.1703	0.1000	33.6294
GDP Per Capita	499	689.4524	637.4586	107.0322	3755.5800
Capital Formation	499	21.5131	8.6303	5.9693	76.6930
Inflation	499	9.4919	9.5069	0.0100	80.7501

OBS = Observations; SD = Standard Deviation; MIN = Minimum; MAX = Maximum

IV. Estimation Results

In this section we discuss the two stage least squares estimation results for the structural equations 1.2 and 1.3. The dependent variables for these equations are the gap between the life expectancy of females and males and female labor force participation rate, respectively. Separate models are estimated for countries categorized by their income level and time fixed effects are accounted for.[3] The income level country categories are high income OECD countries (HIO), upper middle income countries (UMI), lower middle income countries (LMI), and low income countries (LI). For the purpose of this analysis, LMI and LI countries are combined and categorized as lower income countries (LIC). The estimation results for the structural equations for life expectancy gap and female labor force participation for HIO, UMI, and LIC are presented in Tables 5 and 6 respectively.[4]

The estimation results presented in Table 5 show that female labor force participation rate is significantly related to the gap in life expectancy when HIO countries are considered. Specifically, a one percent increase in female labor force participation rate is associated with a decrease in the life expectancy gender gap of 0.03%. This result is significant at the 5% level. It suggests that increases in female labor force participation rates contribute to the narrowing life expectancy gender gap in HIO countries. However, as shown in the second and third columns of Table 5, there appear to be no statistical significant effect of female labor force participation rate on the life expectancy gap in UMI and LIC. Population and demographic factors have more significant effects on the life expectancy gap in these countries.

Economic factors often encourage women to be economically active especially in developed countries. In many cases, this means that women both participate in market work and remain responsible for most of the domestic work as well.

Table 5: Structural Equations for Life Expectancy Gap

	HIO	UMI	LIC
Intercept	0.1247***	0.3169*	-0.1474
	(0.0312)	(0.1365)	(0.1843)
Labor Force Participation Rate Female	-0.0295**	0.0304	0.0624
	(0.0088)	(0.0322)	(0.0450)
Consumer Price Index^{+}	0.1555	0.2600	-0.0273
	(0.1459)	(0.2459)	(0.0689)
GDP Growth^{+}	-0.0689	-0.1702	1.2200***
	(0.3281)	(0.6441)	(0.3575)
GDP Per Capita^{++}	-0.0008	-0.0234	0.1298
	(0.0013)	(0.0382)	(0.1038)
School Enrolment Female^{+}	0.7802**	0.1856	-0.1245
	(0.2885)	(0.4307)	(0.1909)
Inflation^{+}	0.2674	0.1368	-0.0125
	(0.3151)	(0.2526)	(0.1418)
Capital Formation^{+}	1.1589***	0.4360	0.2023
	(0.3205)	(0.3579)	(0.2268)
DPT^{+}	0.3873**	0.2856	0.2587*
	(0.1432)	(0.4195)	(0.1117)
Food Production Index^{+}	0.0270	-0.6752*	-0.0369
	(0.1340)	(0.2903)	(0.0601)
HIV Prevalence^{+++}	0.0739	0.01013	-0.0063
	(0.1294)	(0.0081)	(0.0050)
Public Health Expenditure^{+}	-3.5186***	-0.4029	2.7899
	(0.9339)	(4.3261)	(2.6701)
Out of Pocket Health Expenditure $^{+}$	-0.5784***	-0.8067*	0.3554
	(0.1047)	(0.3698)	(0.3556)
Age Dependency Ratio^{+}	-0.7590***	-4.1216***	-0.5711***
	(0.2087)	(0.7110)	(0.1600)
Population Density^{+}	-0.0102	-0.1024***	-0.0243*
	(0.0160)	(0.0286)	(0.0113)
Urban Population Growth	-0.0122***	-0.01739**	-0.0078*
	(0.0016)	(0.0056)	(0.0032)
R Square	0.8694	0.7181	0.2789
Adjusted R Square	0.8335	0.6013	0.2343
Observations	131	100	499

*** refers to 1%; ** refers to 5%; * refers to 10% levels of significance respectively $^{+}$ Measured in thousands, $^{++}$ Measured in ten thousands, $^{+++}$Scaled by ten Heteroscedasticity consistent standard errors in parenthesis

Though studies such as Juster and Stafford (1991) find that male domestic work has increased somewhat over time, historically males have increased their domestic work far less than females have increased their market work. Therefore, the negative effect of female labor force participation rates on the life expectancy gender gap in HIO countries may be the result of a double burden of market work and domestic work on women in these countries.

In addition to the labor force participation rate, other factors are significantly related to the life expectancy gender gap of females and males in each of the groups of countries considered. From the first column of Table 5, the estimation results for HIO show that DPT immunization, gross fixed capital formation and female school enrollment are found to be positively and significantly related to the gap between the life expectancy of females and males, while public health expenditure, out-of-pocket health expenditure, age dependency ratio, and urban population growth are negatively related to the gender gap in life expectancy and significant.

The positive effect of DPT immunization on the life expectancy gender gap suggests that DPT immunization may havegreater benefits, in terms of health, for females than for males. Similarly, the positive effect of gross fixed capital formation on the life expectancy gender gap suggests that technological advancements have greater positive consequences for the life expectancy of females than males. By definition, increase in capital formation refers to increase in machinery, equipment, roads and railways among other assets. Therefore, this result is not surprising since HIO countries are developed countries that usually have more advanced machinery and equipment compared to less developed countries. Improvement and invention of household appliances such as the dish washer, micro wave, and vacuum cleaner, among other appliances, may have a greater negative effect on the stress females are exposed to than males since females are more likely to be responsible for domestic chores. The positive effect of female school enrollment on the life expectancy gender gap is also as expected because increase in education results in better job opportunities, income and knowledge about hygiene and health care - all of which have positive consequences for life expectancy.

The negative effects of public health expenditure on the life expectancy gender gap in HIO countries suggest that life expectancy (health) benefit from public health expenditure is greater for males than females in these countries. It may also mean that males are still ahead of females in terms of competing for public health care because health care is usually related to job quality and males usually have job of higher quality than females. In the same light, the negative effect of out-of-pocket health expenditure on the gender life expectancy gap may be the result of the relatively higher income males receive compared to females. Specifically, males may be more able to afford higher out-of-pocket health expenditures than females because they earn more.

Higher age dependency ratio means that there are more infants and aged individuals that need care. The coefficient for age dependency ratio is negative in all the life expectancy gap models estimated. This result suggests that caring for dependants, who include infants and the elderly, mainly falls on females rather than males; this means that females may have higher burden of care than males due to the burden of care for dependants, therefore influencing the narrowing life expectancy gender gap negatively. Urban population growth is also observed to have a negative effect on life expectancy gender gap in all the country groups considered. This may be because males and females compete more fiercely for amenities, health care, and position in the labor market among other factors when the population is higher.

In the second column of Table 5, the estimation results for upper middle income countries are presented. From the results it can be observed that food production index, out-of-pocket health expenditure, age dependency ratio, population density and urban population growth are the factors found to significantly influence the gap between the life expectancy of males and females in upper middle income countries (UMI). All of these factors are found to affect the gender gap in the life expectancy of individuals in UMI countries negatively.

The negative effect of food production index on the life expectancy gender gap suggests that the life expectancy or health benefit from higher food production is greater for males than females. This may because males are more likely than females to be able to afford the food that is produced since males likely earn more than females. Similarly, the negative effect of out-of-pocket health expenditure on the life expectancy gender gap in UMI countries may be the result of males being more able to afford higher out-of-pocket health costs than females. Like in the case of urban population growth, higher population density is associated with more fierce competition for jobs, health care, and amenities between males and females; therefore, the negative effect of population density on the life expectancy gender gap in UMI is not surprising.

In the third column of Table 5, the estimation result for lower income countries (LIC) is presented. GDP growth and DPT immunization are positively and significantly related to the gender gap in life expectancy; while age dependency ratio, population density and urban population growth are negatively related to the gender gap in life expectancy in lower income countries (LIC). The positive and significant effect of GDP growth on the life expectancy gender gap in LIC suggests that GDP growth or increase in income has greater benefits for the life expectancy of females than males in these countries. The positive effect of DPT immunization on the life expectancy gender gap in LIC also suggests that females get greater health benefits from the immunization in these countries than males.

The estimation results for the female labor force participation models (Equation 1.3) are presented in Table 6. The gap in the life expectancy of females and males is found to be significantly related to the female labor force participation rate for upper middle income (UMI) countries. This result is presented in the second column of Table 6. A larger difference between female life expectancy and male life expectancy is found to be positively related to female labor force participation rates. The coefficient for life expectancy gap for UMI countries is 6.918 and this result is significant at the 1% level of significance. These results suggest that a one unit increase in life expectancy gender gap increases female labor force participation by 6.918% in upper middle income countries. Therefore, longer life expectancy experienced by women influences their decision to participate in the labor market positively.

Table 6: Structural Equations for Female Labour Force Participation

	HIO	UMI	LIC
Intercept	5.0389***	0.0798	3.3498***
	(0.6680)	(0.7662)	(0.3984)
Life Expectancy Gap	-5.5670	6.9178***	4.5690
	(4.1190)	(1.6173)	(2.8423)
Consumer Price Index+	-0.5245	2.0656	0.6647
	(2.6089)	(1.9690)	(0.5321)
GDP Growth	-8.3110	6.9677	-7.1068
	(6.0374)	(4.6643)	(4.6693)
GDP Per Capita++	0.0299	0.4072	-2.2818***
	(0.0218)	(0.2842)	(0.2892)
School Enrolment Female+	-9.0922*	4.0499	3.3478***
	(4.3355)	(5.9558)	(0.7845)
Inflation+	-3.1629	-0.6167	0.5817
	(6.1273)	(1.8534)	(1.4808)
Capital Formation+	20.8649***	1.6453	-3.4666*
	(4.8585)	(2.4859)	(1.5410)
Food Production Index+	2.2774	7.7547***	0.0862
	(2.1380)	(1.8050)	(0.9888)
HIV Prevalence+++	2.5993	0.0717	0.0812**
	(1.9904)	(0.0607)	(0.0264)
Fertility	0.5516***	-0.2717*	0.0168
	(0.0842)	(0.1139)	(0.0364)
Public Health Expenditure +	-0.1864	3.8549*	-6.3963***
	(3.5079)	(2.1318)	(1.2564)
Out of Pocket Health Expenditure +	37.2883	-55.8055*	-40.4852*
	(23.8139)	(25.2082)	(19.4724)
Age Dependency Ratio+	-28.1062***	31.9922***	1.6797
	(4.5820)	(7.4408)	(2.5183)
Urban Population (%)+	-0.1921	-0.8717	0.2657
	(2.2607)	(2.3540)	(1.3200)
Urban Population Growth	-0.1346*	0.1141*	0.0867***
	(0.0685)	(0.0456)	(0.0165)
Rural Population Growth	-0.0527	0.1852*	0.0302
	(0.0361)	(0.0925)	(0.0255)
R Square	0.7337	0.7909	0.4520
Adjusted R Square	0.6572	0.7001	0.4169
Observations	131	100	499

***refers to 1%; ** refers to 5%; * refers to 10% levels of significance respectively

+ Measured in thousands, ++ Measured in ten thousands, +++ Scaled by ten Heteroscedasticity consistent standard errors in parenthesis

Factors found to significantly affect female labor force participation as presented in Table 6 include: female school enrollment, capital formation, fertility, age dependency ratio, and urban population growth in HIO countries. In addition to life expectancy gender gap, food production index, public health expenditure, age dependency ratio and urban population growth are found to significantly influence female labor force participation in UMI countries. In lower income countries (LIC) GDP per capita, female school enrollment, HIV prevalence, public health expenditure and urban population growth are found to significantly influence female labor force participation.

Fertility which measures the average number of children a woman will have in her child bearing years may be a good indicator of the domestic work required of individuals in the economy. From the estimation results for the HIO countries, presented in the first column of Table 6, it can be observed that the coefficient for fertility is 0.5516 and significant at the 1% level. This result suggests that a unit increase in fertility will increase female labor force participation rate in HIO countries by 0.5516%. The effect of fertility on labor force participation would normally be expected to be negative like in the case for UMI countries presented in the second column of Table 6 where the result suggests that women with more children (higher fertility rate) are less likely to participate in the labor market. The positive coefficient found for the effect of fertility on female labor force participation rates for HIO countries suggests that women with higher number of children are choosing to participate more in the labor market in HIO countries. This results supports the notion that a double burden of domestic and market work exists for females in HIO countries; therefore, increase in female labor force participation rates is associated with negative consequences for the life expectancy of females in these countries as the result in the first column of Table 5 suggests.

V. Conclusion

The life expectancy of both males and females has been increasing over time, (Fogel, 1994) and in most countries female life expectancy is higher than male life expectancy.

However, the growth in female life expectancy has been observed to be declining while that of males has been observed to be growing at a faster rate (Meslé, 2006). Conversely, the growth in female labor force participation is rapid while male labor force participation rates are declining (Blau, 1998). This paper investigates factors that may be responsible for the declining growth rate in the life expectancy of women relative to men – with an emphasis on female labor force participation rate as a proxy for the economic status of women. In addition to labor force participation, other demographic, economic and health factors influencing the gender gap in life expectancy are identified.

Studies such as Cai and Cong (2009) and Cai (2010) have found that there exists a simultaneous relationship between labor force participation rate and life expectancy. A simultaneous relationship between labor force participation rate and life expectancy is also intuitively appealing because individuals anticipating longevity are likely to work more in order to save enough to sustain their current level of consumption when they retire. Also, work provides as sense of purpose that is likely to have positive consequences for health to some extent after which further increase in work can be detrimental to health; therefore, work in excess can be detrimental to life expectancy as well. Data from the World Development Indicators is used to investigate this relationship and two stage least squares estimation (2SLS) is used to account for simultaneity.

Given that countries are in different stages of development and women participate differently in various countries, this result is expected to differ across countries. Separate models are estimated for countries grouped by their level of income and the results suggest that increase in female labor force participation rate is a contributing factor to the narrowing life expectancy gender gap in high income OECD countries (HIO). The coefficients for each of the country groups presented in Table 5 support the notion that perhaps male-female competition and gender inequality with regard to income have significant effects on life expectancy gender gaps. The longitudinal data analysis discussed in this paper therefore supports the findings of Medalia and Chang (2011) who use cross-sectional data for a similar analysis.

The results of the analysis presented in this paper also suggest that the effect of changes in labor force participation rate on life expectancy will differ depending on the country's state of development. The difference between the effects from country to country may reflect the distribution of market work and domestic work among males and females. While the data used for this analysis does not include information on domestic work, it is anticipated that females in countries with lower female labor force participation rate are more involved in domestic work. However, for countries with high female labor force participation rate, it is unclear whether domestic work is lesser for the females of these countries or if the females, in fact, bear a double burden of both market and domestic work.

Female labor force participation rates is not found to be significantly related to the life expectancy gap in upper middle income countries (UMI) and lower income countries (LIC). Other demographic and health factors appear to be more important in explaining the life expectancy gender gap in UMI countries and LIC. Overall, the analysis presented in this paper suggests that if the labor force participation rates of women approach those of men, women's life expectancy (health) is also expected to approach those of men and vice versa.

There are some limitations to the analysis presented in this paper. Fertility is commonly accounted for in female life expectancy estimations; however, in this analysis of the gender gap between male and female life expectancy, it creates a very high level of multicolinearity among the variables with a variance inflation of (VIF) of 434.43 in the model for high income OECD countries (HIO). For this reason fertility is not included in the structural equation for the gender gap between female and male life expectancy. Excluding fertility does not change the signs on the coefficients or the direction of effect. Also, all the VIFs are within acceptable range when fertility is excluded - less than five for most variables and all other variables (mostly time fixed effects) are under 8. To account for the possible effect of having dependents, age dependency ratio is included in the structural equation for the gender gap in life expectancy (equation 1.2). Population density which is included in the system of equations is excluded from equation 1.3 because it also results in high multicolinearity especially in the estimation for upper middle income countries (UMI) -VIF of 233.8. Never-the-less, the effect of population in equation 1.3 is still accounted for using urban population percent, urban population growth, and rural population growth. Tobacco use is also not included in this analysis due to data limitations.

Future analysis would investigate other possible reasons for the differing effects of labor force participation rates on life expectancy among country groups, besides the possibility of imbalance between domestic and market work. Also, calculating the average labor force participation rate that would maximize health benefits for males and females, given their level of domestic work, would be of interest. It is expected that the average labor force participation rate that would maximize health benefits would differ among countries depending on the level of domestic and market work males and females take on. Information about average hours of work that maximize health benefits would help individuals make educated choices as they manage their domestic and market work time. It would also be interesting to see the outcome of this analysis using data from after the recent recession which seemed to affect manufacturing jobs which are often male oriented, more than service jobs which are often female oriented.

VI. References

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Footnotes

1. To still capture any possible effect of population on the life expectancy gender gap, urban population growth and population density are accounted for in the structural equation for life expectancy gender gap (equation 1.2).
2. The time trend variables are accounted for in the models but the results are not included in the result tables to conserve space.
3. Chow test for whether the three regional regression functions (HIO, UMI, and LIC) are identical was conducted; the result suggests that at least one of the regional regression functions is statistically different.
4. High income non- OECD (HINO) countries have only 27 observations; about 0.0357% of the 757 observations available for the analysis in this essay. Because of the small number of observations, a separate model is not estimated for HINO countries. HINO and HIO countries are not combined because there are usually major differences between the labor force participation rate of females and males in HINO and HIO countries. HINO countries include countries which have predominantly Islamic culture that often do not advocate female labor force participation (Moghadam, 1990).