Gender longevity gap and socioeconomic indicators in developed countries

Igor Fedotenkov
Russian Presidential Academy of National Economy and Public Administration, Moscow, Russian Federation, and
Pavel Derkachev
Center for Institutional Studies, National Research University Higher School of Economics, Moscow, Russian Federation

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Abstract

Purpose – The purpose of this paper is to explain relations between socioeconomic factors and gender longevity gap and to test a number of contradicting theories.
Design/methodology/approach – Fixed effects models are used for cross-country panel data analysis.
Findings – The authors show that in developed countries (Organization for Economic Cooperation and Development and European Union) a lower gender longevity gap is associated with a higher real GDP per capita, a higher level of urbanization, lower income inequality, lower per capita alcohol consumption and a better ecological environment. An increase in women's aggregate unemployment rate and a decline in men's unemployment are associated with a higher gap in life expectancies. There is also some evidence that the effect of the share of women in parliaments has a U-shape; it has a better descriptive efficiency if taken with a four-year lag, which approximately corresponds to the length of political cycles.
Research limitations/implications – Findings are valid only for developed countries.
Practical implications – The findings are important for policy discussions, such as designs of pension schemes, gender-based taxation, ecological, urban, health and labor policy.
Social implications – The factors that increase male and female longevities also reduce the gender longevity gap.
Originality/value – The results contradict to a number of studies for developing countries, which show that lower economic development and greater women discrimination result in a lower gender longevity gap.
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Keywords Inequality, Life expectancy, Cross-country analysis, Gender longevity gap

Paper type Research paper

1. Introduction

On average, women live longer than men, and the gender longevity gaps differ across countries and change over time. To what extent can these differences and changes be explained by the socioeconomic environment and development? Does economic inequality between the sexes play a role? These questions are important for policy discussions, such as designs of pension schemes (Bajtelsmit *et al.*, 1999; Bertranou, 2001; Hári *et al.*, 2008) and gender-based taxation (Alesina *et al.*, 2011; Bastani, 2013). In this paper, we study these questions in detail in the context of Organization for Economic Cooperation and Development (OECD) countries. We focus on the role of socioeconomic inequalities between the genders and environmental factors.

JEL Classification — J11, J14, J16, J71

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We show that a greater difference between female and male aggregate unemployment rates increases the female advantage in life expectancy. Furthermore, lower income (per capita) and greater income inequality are associated with a lager gender longevity gap; a higher level of per capita alcohol consumption in a country, and a higher percentage of population living in a rural area give rise to a larger gender longevity gap too. We also found evidence that a deterioration in environmental factors, such as a lower percentage of renewable energy consumption and higher greenhouse gas emissions per capita are associated with a greater gender longevity gap. A few models also reveal some evidence for a U-shaped relation between the percentage of women in parliaments and the gender longevity gap – the minimum gap achieved when 45 percent of parliament members are females (50 percent female membership is always covered by the 95% confidence interval). This finding is stronger if the percentage of women in parliaments is taken with a four-year lag, which approximately corresponds to the length of political cycles.

1.1 Literature review

Some divergence between gender life expectancies can be attributed to natural biological factors (see Aviv *et al.*, 2005; Seifarth *et al.*, 2012; for example) – a difference observable not only in humans, but also in a number of animal species. Nevertheless, human and animal causes of death are different (Smith, 1989), and, in human societies socioeconomic factors must be taken into account (Rieker and Bird, 2005). If cross-country differences in gender longevity gaps are analyzed, socioeconomic factors should play a crucial role.

There are few cross-country studies that address the links between socioeconomic factors and the gender longevity gap. A few papers have studied large pools of countries (Ram, 1993; Clark and Peck, 2012; Ricketts, 2014). They find that higher income inequality and a higher level of economic development, measured as GDP per capita or energy consumption per capita, increase the gender longevity gap. These papers also find that the gender longevity gap increases with a higher level of female discrimination, measured as the ratio of male to female labor-force participation and enrollment in secondary schools. However, do these factors play the same role in developed and developing countries? In 32 developing countries women do not even have the right to apply for a passport; in 17 countries women cannot freely leave the home (World Bank Group, 2015). Such conditions are unimaginable in the European Union (EU) or OECD countries. Do socioeconomic factors have the same effects in African countries and in the EU? Not necessarily so. Clark and Peck (2012) mitigated this problem by controlling for country-fixed effects in their models. However, in general, the slopes can also be different.

In our paper, we reconsider Clark and Peck and show that in developed countries some results shift to the converse. For example, in contrast to Clark and Peck we note that in developed countries a higher level of economic development, measured by per capita GDP, negatively affects the gender longevity gap. Other factors, however, such as female enrollment in secondary school, are of lesser importance in developed countries, since all girls have a right to secondary education. This allows us to expand our model with a few factors ignored in previous cross-country studies: the percentage of women in parliaments and environmental protection.

Gender differences in smoking and alcohol consumption are also enumerated among determinants of the gender longevity gap. Rochelle *et al.* (2015) showed that gender longevity gap increases in national level of alcohol consumption. This effect can be explained by the fact that usually men consume more alcohol than women (Keyes *et al.*, 2011); however, the gender gap in alcohol consumption is narrowing in many countries. Similar findings were also made for smoking (Pampel, 2002; Sundberg *et al.*, 2018).

A number of empirical studies examining the link between socioeconomic indicators and the longevity gap have been undertaken on the national level. Anson (2003) for

Belgium, Gächter *et al.* (2012) studied Austrian data. They found that in municipalities with higher income, the gender gap is lower. As we study cross-country effects in developed countries only, our results for income are closer to those found by Anson and Gächter *et al.* than to those cross-country works cited above.

An explanation to why higher income in developed countries is associated with a lower longevity gap has been offered in a number of papers. In Leung *et al.* (2004) time is used for both health-improving activities and work, and goods are apportioned between consumption and health investment. In their model men provide mental and physical labor, while women provide mental labor only. This setting assures that men's wages are higher than women's, and, consequently, women supply less labor compared to men due to lower opportunity costs. However, when the economy grows, the difference between men's and women's incomes declines, reducing the differences in time and health goods allocations between the genders. This leads to a lower gender longevity gap. Felder (2006) argues that there are higher marginal costs to maintain men's health capital stock than women's. Consequently, men live shorter lives. If income grows, health investments increase, both for men and women, but the effect on men is more pronounced. Therefore, higher income leads to a decline in the gender longevity gap. Trimborn *et al.* (2016) and Schünemann *et al.* (2017) suggest that men and women have different preferences for health goods, but when income grows, gender-specific utility functions become similar, leading to similar preferences and narrowing the gender longevity gap. In our empirical model, we cannot address the question of which of these explanations is valid. But, unlike other cross-country studies, our estimates are in line with these theoretical predictions.

It is also known that income inequality is one of the factors affecting longevity. A number of hypotheses about the links between income inequality and longevities are well explained by Wagstaff and Van Doorslaer (2000) – principally these theories are the absolute-income hypothesis and the relative-income hypothesis. The former is based on the assumption that the relationship between health and income is concave: each additional dollar of income boosts agents' health by a smaller amount. This hypothesis was empirically confirmed in a number of papers (Preston, 1975; Rodgers, 1979; Gravelle, 1998). The relative-income hypothesis asserts that higher mortality among the poor is a result of their low social status. Although the exact mechanisms of this relationship are debatable (Smith, 1996), this hypothesis has also garnered vast empirical confirmation (Duleep, 1995; Wilkinson, 1998; Lobmayer and Wilkinson, 2000; Elstad *et al.*, 2006; Karlsson *et al.*, 2010). Moreover, men's death rates are more sensitive to socioeconomic factors than women's (MacIntyre and Hunt, 1997; Mustard and Etches, 2003). Therefore, the hypothesis arises that the gender longevity gap may also depend on income distribution. We test this hypothesis, and confirm, that higher income inequality increases the gender longevity gap at the national level.

Higher agent's income is often associated with higher social status. The effect of social status on mortality has also been studied from other perspectives: education, race and other diverse factors, with higher social status being associated with increased longevity (Williams, 1999; Crimmins and Saito, 2001; Shkolnikov *et al.*, 2006; Olshansky *et al.*, 2012). Likewise, the improved social status accruing to members of a national academy of science or to winners of the Nobel Prize has a positive effect on their longevity vis-a-vis the rest of the nation's scientific community (Rablen and Oswald, 2008; Liu *et al.*, 2017). Gavrilov and Gavrilova (2015) found that the availability of radio in the household (1930 US census data), could be used as a measure of social status and a gender-specific predictor for female longevity.

Employment can also be considered a determinant of social status. Most micro-level studies find that paid work increases agents' life expectancy (Rogot *et al.*, 1992; Rose *et al.*, 2004). Employment may also increase emotional stability (Eisenberg and Lazarsfeld, 1938), improve mental health and life satisfaction (Broomhall and Winefield, 1990), facilitate access to public healthcare, provide social support from coworkers and build up a sense of achievement (Kalben, 2000). Therefore, hypothetically, the improving socioeconomic status of women, as well as greater female participation in the labor force, should increase the gender longevity gap (Repetti *et al.*, 1989; Waldron, 1991). However, apart from the positive effects on social status and the affordability of healthcare, labor participation can also bring harmful health effects: exposure to job stress and physical and chemical occupational hazards. Moreover, the combination of job and domestic responsibilities may lead to overload, especially for employed women with children (Arber *et al.*, 1985; Waldron, 1991). In our models we control for gender-specific unemployment rates; and our result is in line with the latter hypothesis: higher rates of unemployment for men and women increase their longevities vis-a-vis the opposite gender.

We also controlled for the number of women members of parliament as a proxy for women's socioeconomic status. However, our estimates reveal a more complicated relation between this factor and the gender longevity gap.

It is also generally accepted that men and women often perform different types of works, implying that gender-specific environmental and pollution-related hazards can be different. Kalben (2000) formulated a hypothesis that environmental factors do affect the gender longevity gap; however, we are not aware of any empirical work that tests this hypothesis. We include environmental variables in our model and find that higher pollution indeed widens the gender longevity gap.

2. Data and methodology

We use data from the following sources: World Bank Development Indicators, World Bank Health Organization and International Labor Organization.

Our focus is on developed countries, members of the OECD or EU. The period examined is 1990–2015; however, most observations are post-1995. The data constitute an unbalanced panel.

2.1 Descriptive statistics

Table AI presents descriptive statistics of the data used in our analysis. It is worth mentioning that the volatility of female longevity (standard deviation is 2.278) is lower than the volatility of male longevity (standard deviation is 3.485). The scale of GDP per capita in 2011 prices is much higher compared to other observations. In computations, we rescale GDP per capita, dividing it by its arithmetic mean.

We illustrate statistics for employment in various sectors for males and females, but differences between male and female employment are used in regressions. The variable "women in parliament" represents the percentage of women in lower chambers of parliaments, elected under generally free and fair conditions in the countries under analysis. In our models, we do not specify those countries wherein a minimal number of women in parliaments is prescribed by law. We presume that if such laws exist, the societies are disposed to a higher number of women politicians. Upper parliament chambers are not considered.

In Figure 1 we present the difference between female and male life expectancies at birth in rich western economies (developed countries) and developing or less wealthy countries, such as Latin American countries, the Baltic States and other post-communist countries[1]. The figure indicates that in both groups of countries there are small but permanent long-term downward trends in the gender longevity gap. On the one hand, it is interesting to consider whether this trend is determined by socioeconomic factors, but on the other, if we do not remove the trend with time-fixed effects, the significance of certain coefficients may be determined by similar time-specific trends in the explanatory variables. Therefore, we estimate models both with and without fixed time effects.

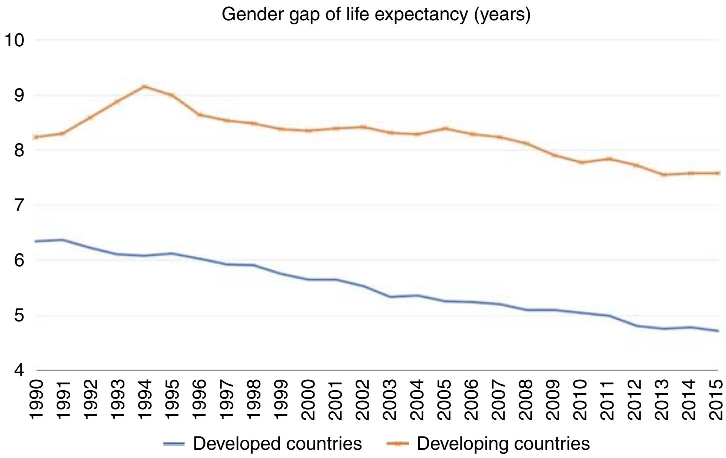

Figure 1.
Gender longevity gap of life expectancies at birth in 1990–2014 by countries

2.2 Methodology

We define our explanatory variable as a difference between female and male life expectancies at birth, i.e.:

$$Y = \text{female life expectancy} - \text{male life expectancy}. \tag{1}$$

The functional form of our models is the following:

$$Y_{c,t} = f_c + (f_t) + \gamma_1 X_{1,ct} + \gamma_2 X_{2,ct} + \ldots \gamma_k X_{k,ct} + \varepsilon_{ct}, \tag{2}$$

where index c stands for country, t denotes time, $X_{j,ct}$– explanatory variables, $j = 1, \ldots, k$, f_c and f_t are country and time-fixed effects, and ϵ_{ct}– unobserved shocks. The standard "within" estimator is applied.

Using the Breusch–Godfrey test (Breusch, 1978; Godfrey, 1978), we find that the residuals are auto-correlated in all our models. Consequently, we use an Arellano-type auto-correlation-robust covariance matrix (Arellano, 1987) to test the significance of the coefficients. The use of a robust covariance matrix also accounts for possible heteroscedasticity in the data.

3. The results

3.1 Country-fixed effects

Table I presents the Equation (2) estimates with country-fixed effects. The models indicate that higher GDP per capita reduces the gender longevity gap, while higher income inequality increases it. Depending on the model, a $1,000 increase in the real GDP per capita corresponds to an 8.4–16.8 days decline in the gender longevity gap. In most cases, the corresponding coefficients are highly significant. The percentage of rural population has a positive impact on the gender longevity gap.

The difference in unemployment rates, defined as female unemployment minus male unemployment, has a positive impact as well. This suggests that higher gender-specific unemployment increases the life expectancy of that gender. An increase in male unemployment by 1 percent of male labor force or a corresponding decline in female unemployment is associated with 19–30.5 days decline in the gender longevity gap. As Table AI implies, women's unemployment is on average higher than men's; therefore, an equalization of these two factors between the genders should reduce the gender longevity gap.

Table I. Dependent variable: longevity difference, fixed country-specific effects

Regressors	1	2	3	4	5	6	7
GDP/cap 2011 prices	−1.1688** (0.4705)	−1.6649*** (0.4021)	−1.3805*** (0.4336)	−1.6741*** (0.4177)	−1.2696*** (0.4234)	−0.8393 (0.6733)	−1.2576*** (0.3394)
Gini coefficient	0.0341*** (0.0130)	0.0317** (0.0124)	0.0365*** (0.0125)	0.0340*** (0.0127)	0.0333*** (0.0124)	0.0318 (0.0199)	0.0023 (0.0199)
Rural population	0.0888** (0.0419)	0.0710** (0.0357)	0.0697* (0.0377)	0.0687* (0.0411)	0.0753** (0.0357)	0.1069** (0.0483)	0.1069** (0.0483)
Diff. unemployment	0.0838*** (0.0194)	0.0779*** (0.0212)	0.0625*** (0.0230)	0.0767*** (0.0214)	0.0609*** (0.0223)	0.0795* (0.0478)	0.0795* (0.0478)
Diff. services empl.	0.0133 (0.0141)	0.0166 (0.0128)	0.0140 (0.0134)	0.0160 (0.0139)	0.0116 (0.0130)	0.0017 (0.0256)	0.0017 (0.0256)
Diff. industry empl.	0.0109 (0.0143)	0.0120 (0.0124)	0.0111 (0.0115)	0.0128 (0.0126)	0.0078 (0.0109)	0.0481 (0.0342)	0.0481 (0.0342)
Women in parliament	−0.0303 (0.0194)	−0.0213 (0.0200)	−0.0269 (0.0225)	−0.0186 (0.0195)	−0.0190 (0.0192)	0.0147 (0.0340)	0.0147 (0.0340)
Wom.parliament^2	0.0005 (0.0004)	0.0002 (0.0003)	0.0004 (0.0004)	0.0001 (0.0003)	0.0002 (0.0003)	0.0000 (0.0007)	0.0000 (0.0007)
Alcohol consumption		0.0820** (0.0358)	0.0756 * (0.0397)	0.0777** (0.0341)	0.0703* (0.0414)	0.1053** (0.0452)	0.1053** (0.0452)
Voice&Accountability			−0.2493 (0.2340)	−0.2121 (0.2417)	−0.2172 (0.2411)	−0.3386 (0.4305)	−0.3386 (0.4305)
Renewable energy			−0.0264** (0.0107)			−0.0310** (0.0136)	−0.0284** (0.0126)
Greenhouse gases				30.949** (13.620)			
Combust. renewables					−0.0397** (0.0162)		
Diff. smoking						0.0039 (0.294)	
Health expenditures							−0.0661 (0.0498)
R^2	0.3270	0.3609	0.3862	0.3678	0.3844	0.4410	0.3183
R^2-adj	0.2261	0.2606	0.2850	0.2606	0.2828	0.1395	0.1989
n	346	340	340	332	340	138	323
df	300	293	291	283	291	89	274

Notes: $*p < 0.1$; $**p < 0.05$; $***p < 0.01$ significance level

It shall also be mentioned that there are differences in how males and females cope with the job loss. Unemployed men usually rely more on job search and other problem-focused activities, while women prefer seeking for social support (Leana and Feldman, 1991). As a consequence, even the same gender-specific unemployment rates may hypothetically affect genders' longevities differently. Nevertheless, larger equalization of unemployment rates is estimated to reduce the gender longevity gap.

Improved environmental conditions, measured as a more intensive use of renewable energy as a percentage of energy produced in a country, a more intensive use of combustible renewables and a lower emission of greenhouse gases per capita, reduce the gender longevity gap. Because combustible renewables reduce CO_2 emissions in comparison with fossil fuel (Jebli and Youssef, 2015), in developed countries their usage may serve as a proxy for ecological standards[2]. The "ecological" variables are considered to be proxies. It is likely that these proxies are correlated with better environmental standards, which have direct effects on worker's life expectancies, men being faced with unhealthy working conditions more often than women.

We also hypothesize that not all jobs are equally risky and controlled for differences in employment sectors: services and industry with agricultural sector as a control group. However, none of these variables is significant at the 10 percent significance level.

Higher per capita alcohol consumption in a country increases the gender longevity gap, implying that most alcohol is consumed by men. In Column 6, we also control for difference in smoking between female and male, the corresponding coefficients being insignificant. This could be the case due to a lower number of observations. Nevertheless, the coefficient remains positive, and the corresponding p-value is close to the 10 percent significance level. Percentage of women in parliaments is insignificant for all reasonable significance levels. Finally, in Model 7, we control for government's health expenditures as a share of GDP. The corresponding coefficient is negative; however, it is statistically insignificant.

A decline in the gender longevity gap may result from an increase in male longevity, but also from a decline in female longevity. To ascertain if our above explanations are correct, we present estimates of regressions separately for male and female life expectancies at birth in Tables AII and AIII. The main finding is: the factors which reduce the gender longevity gap increase both male and female longevities. But absolute sizes of coefficients for men are higher than those for women, which imply that male life expectancies are more sensitive to socioeconomic factors. The only exception is that the allocation of women between sectors does have a statistically significant impact on their longevities. Namely, service work prolongs female lifespan vis-a-vis agricultural work, which is taken as a control group and work in industry shortens it. For men, most of the models find no statistically significant relation. This result for services can be explained by the fact that men and women often choose different jobs: men often prefer transportation and communication, while women work in healthcare, education and domestic services (Organisation for Economic Co-operation and Development, 2002, p. 87). Nevertheless, the signs of the estimated coefficients for males and females are the same in most cases.

3.2 Country and time-fixed effects

When time-fixed effects are added to the model, all global trends, seen in the data are removed and only short-run deviations from these global trends are analyzed. Table II presents regression estimates, where both time- and country-specific effects are included in the model. In this case, the coefficient of GDP per capita declines, remaining, however, statistically significant in most models. Gini coefficients, unemployment rate disparities between women and men and per capita alcohol consumption remain highly significant with reasonable coefficient signs. This means that short-run deviations from these trends do affect the gender longevity gap. However, "rural population" and "ecological factors" lose their significance. Nevertheless, their signs remain unchanged.

Table II.
Dependent variable: longevity difference, fixed country- and time-specific effects

Regressors	1	2	3	4	5	6	7
GDP/cap 2011 prices	−0.7602 (0.7266)	−1.4723** (0.6571)	−1.4545** (0.6576)	−1.5591** (0.6567)	−1.3356** (0.6508)	−1.2756 (0.9704)	−0.8926* (0.5025)
Gini coefficient	0.0402*** (0.0130)	0.0369*** (0.0121)	0.0387*** (0.0114)	0.0396*** (0.0120)	0.0375*** (0.0116)	0.0270 (0.0203)	0.0371*** (0.0105)
Rural population	0.0410 (0.0484)	0.0362 (0.0418)	0.0470 (0.0429)	0.0360 (0.0442)	0.0482 (0.0422)	0.1179* (0.0557)	0.0385 (0.0268)
Diff. unemployment	0.0388** (0.0185)	0.0400* (0.0230)	0.0422* (0.0215)	0.0422* (0.0234)	0.0398* (0.0226)	0.0944* (0.0446)	0.0425** (0.0180)
Diff. services empl.	0.0148 (0.0129)	0.0177 (0.0120)	0.0161 (0.0127)	0.0186 (0.0140)	0.0144 (0.0127)	0.0206 (0.0282)	0.0143 (0.0120)
Diff. industry empl.	0.0136 (0.0122)	0.0156 (0.0112)	0.0156 (0.0117)	0.0168 (0.0119)	0.0135 (0.0112)	0.0875*** (0.0305)	0.0139 (0.0117)
Women in parliament	−0.0199 (0.0218)	−0.0111 (0.0200)	−0.0142 (0.0215)	−0.0095 (0.0198)	−0.0105 (0.0194)	0.0216 (0.0338)	0.0043 (0.0179)
Wom.parliament^2	0.0005 (0.0004)	0.0002 (0.0004)	0.0003 (0.0004)	0.0002 (0.0004)	0.0002 (0.0004)	−0.0001 (0.0006)	−0.0000 (0.0003)
Alcohol consumption		0.0899** (0.0402)	0.0885** (0.0406)	0.0894** (0.0386)	0.0845** (0.0424)	0.1084** (0.0519)	0.0391 (0.0256)
Voice&Accountability			−0.1173 (0.2860)	−0.1225 (0.2893)	−0.1148 (0.2832)	−0.0049 (0.3810)	−0.1673 (0.2562)
Renewable energy			−0.0117 (0.0134)			−0.0162 (0.0189)	
Greenhouse gases				17.9696 (12.3977)			
Combust. renewables					−0.0184 (0.0186)		
Diff. smoking						0.0094 (0.0270)	
Health expenditures							−0.0034 (0.0399)
R^2	0.0732	0.1172	0.1220	0.1290	0.1221	0.2440	0.0888
R^2-adj	−0.1298	−0.0842	−0.0862	−0.0757	−0.0861	−0.2478	−0.1284
n	346	340	340	332	340	138	323
df	283	276	274	268	274	83	260

Notes: $*p < 0.1$; $**p < 0.05$; $***p < 0.01$ significance level

3.3 Lags

In Table III we present a model with country-specific effects (no time-fixed effects), where explanatory variables are taken with lags. The use of lagged regressors allows us to refer to Granger causality (Granger, 1969).

The models imply that GDP per capita is always significant even when considered with a 10-year lag. In fact, higher GDP per capita permits agents to accumulate greater savings in public and private pension funds. Higher savings, in turn, bring about a better quality of life and the affordability of medical treatment, which may have long-lasting effects on agents' health. Considering that men's life expectancy is more sensitive to socioeconomic factors, this explains such a long-lasting effect.

The Gini coefficient, the difference between women and men's unemployment rates and the percentage of renewable energy are significant up to the four-year lag, implying that these factors have temporal effects on the gender longevity gap. The rural population coefficient remains significant up to the two-year lag.

Significant medium-term 4-5-years lag in the share of woman in parliament could relate to the fact that most political and economic reforms start yielding results after a transitional period. Four-year lags may also be determined by the political cycles of parliamentary elections. This result can be explained in the following way: According to Edlund and Pande (2002) women's political views are on average more "left" compared to men. "Left" re-distributional policies may provide a sort of insurance against income losses due to divorce. Indeed, "left" policies may also be correlated with better labor protection, more affordable medical care, numerous environmental factors – not controlled for in our model – and measures of social (in)equality, which are not captured by the Gini coefficient. "Left," policies as most of socioeconomic factors, may affect men's longevities more than woman longevities.

4. Robustness

In this section we present robustness checks with country-fixed effects. Table IV presents the results of a number of these checks. The first model presents the estimated results based on different data for life expectancy. Instead of life expectancy at birth, we used the life expectancies at age 20–24 for gender longevity ratio calculation. In this case, the results are very similar to the life expectancies at birth in Table I. One difference is the coefficient corresponding to the share of rural population; it is lower and statistically insignificant at the 10 percent significance level. Another difference is that the percentage of women in parliaments became significant, implying a U-shape impact on the gender longevity gap. The minimum point is achieved at the 45 percent point.

In Models 2 and 3 we use the same data as in Table I, but evaluate different functional forms. In Model 2, we use the logarithm of the longevity ratio.

Namely, calculated as:

$$\tilde{Y} = \log\left(\frac{\text{female life expectancy}}{\text{male life expectancy}}\right). \tag{3}$$

In Model 3, the logarithm is also taken of a number of explanatory variables: GDP per capita, in 2011 prices, Gini coefficient, alcohol consumption and percentage of renewable energy. Differences between male and female unemployment ratios as well as sector specific employments and Voice&Accountability contain negative values; therefore, we leave them unmodified. Because of the properties of the logarithmic function, the logarithms of women's share in parliament and their square are proportional to each other, which lead to the multicollinearity of the model; therefore, neither of them is modified. The results roughly coincide with those presented in Table I.

Table III.
Lagged independent variables

Regressors	Lag = 1	Lag = 2	Lag = 3	Lag = 4	Lag = 5	Lag = 10
GDP/cap 2011 prices	−1.6499*** (0.4734)	−1.4292*** (0.4103)	−1.5409*** (0.4461)	−1.0020* (0.5112)	−1.8619*** (0.3894)	−1.7317* (0.8871)
Gini coefficient	0.0334*** (0.0123)	0.0340*** (0.0120)	0.0380*** (0.0126)	0.0314** (0.0159)	0.0130 (0.0167)	0.0052 (0.0182)
Rural population	0.0714* (0.0379)	0.0675* (0.0344)	0.0507 (0.0340)	0.0451 (0.0370)	0.0290 (0.0419)	−0.0203 (0.0514)
Diff. unemployment	0.0653*** (0.0223)	0.0588*** (0.0226)	0.0561*** (0.0169)	0.0494** (0.0188)	0.0105 (0.0206)	0.0201 (0.0295)
Diff. services empl.	0.0089 (0.0137)	0.0047 (0.0158)	0.0162 (0.0157)	0.0152 (0.0195)	0.0204 (0.0220)	−0.0018 (0.0316)
Diff. industry empl.	0.0048 (0.0145)	0.0240 (0.0166)	0.0222 (0.0164)	0.0337* (0.0179)	0.0219 (0.0139)	0.0398 (0.0386)
Women in parliament	−0.0197 (0.0189)	0.0052 (0.0189)	−0.0177 (0.0180)	−0.0566** (0.0238)	−0.0523* (0.0220)	−0.0585 (0.0472)
Wom.parliament^2	0.0001 (0.0004)	−0.0005 (0.0005)	0.0000 (0.0005)	0.0009* (0.0005)	0.0007 (0.0005)	0.0014 (0.0014)
Alcohol consumption	0.0734* (0.0437)	0.0561 (0.0334)	0.0122 (0.0290)	−0.0251 (0.0385)	−0.0033 (0.0323)	0.0043 (0.0362)
Voice&Accountability	−0.3141 (0.2351)	−0.0650 (0.2566)	0.1423 (0.2328)	0.2885 (2318)	0.3362 (0.2337)	−0.3815 (0.2779)
Renewable energy	−0.0188* (0.0130)	−0.0145 (0.0133)	−0.0246* (0.0131)	−0.0316** (0.0140)	−0.0243 (0.0166)	0.0113 (0.0303)
R^2	0.4096	0.3956	0.4226	0.4373	0.4509	0.4012
R^2-adj	0.3122	0.2956	0.3254	0.3314	0.3333	−0.0264
n	340	339	334	304	273	109
df	291	290	285	255	224	63

Notes: Dependent variable: longevity difference, fixed country-specific effects. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$ significance level

Table IV. Robustness check

Regressors	1 LE 20–24 years+	2 Log-linear	3 Log-log	4 Developed countries	5 Developing countries	6 Developed lag = 4 years
GDP/cap 2011 prices	−1.4650** (0.6385)	−0.0245*** (0.0068)	−0.0129* (0.0066)	−2.3093*** (0.5564)	−2.5129*** (0.8873)	−1.9457*** (0.2940)
Gini coefficient	0.0402*** (0.0150)	0.0005*** (0.0002)	0.0146** (0.0062)	0.0339 (0.0222)	0.0363* (0.0193)	−0.0160 (0.0282)
Rural population	0.0399 (0.0483)	0.0011* (0.0006)	0.0267*** (0.0100)	0.1375*** (0.0378)	0.1643** (0.0667)	0.0641*** (0.0213)
Diff. unemployment	0.0820*** (0.0140)	0.0012*** (0.0004)	0.0013*** (0.0004)	0.0425 (0.0337)	0.1913*** (0.0142)	0.0015 (0.0306)
Diff. services empl.	0.0134 (0.0152)	0.0001 (0.0002)	0.0000 (0.0002)	0.0257 (0.0170)	0.0501* (0.0242)	0.0629 (0.0446)
Diff. industry empl.	0.0156 (0.0134)	0.0002 (0.0002)	0.0002 (0.0002)	0.0067 (0.0076)	0.0542 (0.0332)	0.0308 (0.0478)
Women in parliament	−0.0813*** (0.0270)	−0.0006* (0.0003)	−0.0006* (0.0003)	0.0026 (0.0254)	−0.0436 (0.0481)	−0.1234** (0.0507)
Wom.parliament^2	0.0009* (0.0005)	$9.30*10^{-6}$ ($6.09*10^{-6}$)	$9.44*10^{-6}$* ($5.04*10^{-6}$)	0.0003 (0.0005)	−0.0006 (0.0013)	0.0021** (0.0009)
Alcohol consumption	0.0673 (0.04990)	0.0010* (0.0006)	0.0101* (0.0060)	0.1462*** (0.0347)	0.0193 (0.0283)	−0.0121 (0.0618)
Voice&Accountability	−0.0920 (0.3561)	−0.0043 (0.0034)	−0.0013 (0.0043)	−0.4567* (0.2691)	0.4184 (0.4027)	0.4590 (0.6690)
Renewable energy	−0.0531*** (0.0134)	−0.0005*** (0.0001)	−0.0024 (0.0021)	−0.0465*** (0.0119)	−0.0207 (0.0237)	−0.0396*** (0.0078)
R^2	0.5588	0.4867	0.4411	0.5148	0.6794	0.8901
R^2-adj	0.4741	0.4166	0.3776	0.4254	0.5563	0.6842
n	323	340	340	213	127	134
df	274	291	291	176	104	103

Notes: Fixed country-specific effects. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$ significance level

Next, we split our sample into two sub-samples: "developing" countries: Chili, Mexico and Turkey and the countries of the ex-Warsaw Pact Treaty of Friendship – excluding East Germany. Germany as well as other Western OECD and/or EU countries is placed in the sub-sample of "developed" countries. Models 4 and 5 present estimates for these two subgroups. The results are similar. Although the Gini coefficient is significant at the 10 percent significance level for developing countries only, the corresponding estimate for developed countries is very similar in size. The difference in unemployment rates is statistically significant in developing countries only, while alcohol consumption and renewable energy are statistically significant in developed countries. Nevertheless, the signs of the coefficients are the same. The insignificant coefficient for alcohol in developing countries can be attributed to a considerable portion of unrecorded alcohol consumption (World Health Organization, 2014).

When the sample is split into "developed" and "developing" countries, the percentage of women in parliaments is insignificant and their signs become unstable. However, if we consider explanatory variables with a lag of four years, the coefficients corresponding to the percentage of women in parliaments become significant at a 5 percent significance level (Model 6). In Model 6, we present estimates for developed countries only. In fact, the estimates for developing countries with a four-year lag are similar.

5. Conclusions

In this paper, we analyzed the relation between the socioeconomic environment in developed countries (OECD and EU) and the gender longevity gap. We found that a smaller gender longevity gap is associated with higher income (measured as GDP per capita), lower income inequality, lower per capita alcohol consumption, a higher level of urbanization and better environmental conditions. Higher female unemployment rates are associated with a larger gender longevity gap; higher male unemployment reduces it. However, the allocation of males and females among economic sectors does not play a statistically significant role. A few models indicate that the effect of the number of women in parliaments on the gender longevity gap has a U-shape effect; a minimum of around 45 percent, depending on the exact functional form, with 50 percent always belonging to the 95% confidence interval. The effect is the strongest if the corresponding explanatory variables are used with a four-year lag, the approximate length of political cycles. This result indicates that men are the main beneficiaries of a more equitable gender representation in politics, but the effects are not immediate.

As our findings for developed countries sometimes contradict other studies of large pools of countries, (those comprising mainly developing countries), such as Clark and Peck (2012), we suggest future cross-country research in this field include a focus on different sets of developing countries: CIS, MENA, Latin America, South East Asia, Sub-Saharan Africa. These regions provide diverse cultural and historical backgrounds and diverse economic challenges, which may affect not only country-specific fixed effects, but also the slopes of the socioeconomic factors. A comparison of these results could provide a clearer understanding of the dynamics of the gender longevity gap.

Notes

1. Namely: Latvia, Lithuania, Estonia, Slovakia, Poland, Czech Republic, Slovenia, Chili, Poland, Hungary, Bulgaria, Turkey, Croatia and Mexico.
2. For comparison, combustible renewables are also common in the poorest African countries, where their usage represents mainly insufficient access to fossil fuels.

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Corresponding author
Igor Fedotenkov can be contacted at: igor.fedotenkov@gmail.com

Appendix 1

	Mean	Min.	Max.	SD	Source of data
Life expectancy at birth, female (years)	83.14	78.00	87.05	2.278	WB World Development Indicators
Life expectancy at birth, male (years)	77.55	69.10	81.30	3.485	WB World Development Indicators
Gender gap of life expectancy (years)	5.594	3.200	10.70	1.793	Own calculations
Life expectancy at birth, average (years)	80.34	74.25	83.92	2.804	OECD data
GDP per capita, 2011 prices (dollars)	3.636×10^4	1.649×10^4	9.390×10^4	1.481×10^4	WB World Development Indicators
Gini coefficient	32.30	25.59	48.07	4.885	WB World Development Indicators
Women in parliament (%)	26.53	9.500	43.60	10.20	WB World Development Indicators
Employment in services, male (%)	60.02	39.51	72.18	8.274	WB World Development Indicators
Employment in services, female (%)	12.11	12.11	23.74	5.009	WB World Development Indicators
Employment in industry, male (%)	32.51	17.49	49.12	6.744	WB World Development Indicators
Employment in industry, female (%)	82.87	52.70	91.70	8.902	WB World Development Indicators
Rural population (%)	23.17	2.142	50.35	12.38	WB World Development Indicators
Unemployment, male (%)	8.174	3.616	21.81	4.231	WB World Development Indicators
Unemployment, female (%)	8.412	3.113	28.84	5.182	WB World Development Indicators
Alcohol consumption (liters per capita)	9.464	1.450	15.19	2.866	World Health Organization
Voice and accountability (ranges from −2.5 to 2.5)	1.064	−0.374	1.702	0.464	WB Worldwide Governance Indicators
Renewable energy (%)	20.67	2.838	76.42	15.66	WB World Development Indicators
Greenhouse gas emissions (kt of CO_2 equivalent per capita)	1.164×10^{-2}	5.435×10^{-3}	3.351×10^{-2}	6.221×10^{-3}	WB World Development Indicators
Combust. renewables (%)	20.67	28.38	76.42	15.66	WB World Development Indicators
Smoking women (% of adults)	23.64	6.2	54.0	7.63	WB World Development Indicators
Smoking men (% of adults)	35.24	15.2	62.2	10.30	WB World Development Indicators

Table AI. Descriptive statistics

Appendix 2

Table AII. Dependent variable: female longevity, fixed country-specific effects

Regressors	1	2	3	4	5	6
GDP/cap 2011 prices	3.5236*** (1.3564)	2.95106*** (1.0731)	2.6003*** (0.9673)	2.5608*** (0.8996)	2.3044*** (0.9295)	5.6823*** (1.4469)
Gini coefficient	−0.0542* (0.0314)	−0.0352 (0.0244)	−0.0426* (0.0217)	−0.0219 (0.0214)	−0.0373* (0.0213)	0.0021 (0.0206)
Rural population	−0.1465** (0.0672)	−0.1734*** (0.0477)	−0.2080*** (0.0481)	−0.1824*** (0.0411)	−0.2229** (0.0449)	−0.0966 (0.0646)
Women, unemployment	0.0517* (0.0312)	0.0332*** (0.0272)	0.0222 (0.0256)	0.0345 (0.0263)	0.0274 (0.0239)	0.0218 (0.0225)
Women, services	0.0883*** (0.0262)	0.0976*** (0.0257)	0.0878*** (0.0198)	0.1004*** (0.0205)	0.0882*** (0.0186)	0.0646** (0.0248)
Women, industry	−0.2098*** (0.0320)	−0.1890*** (0.0292)	−0.1575*** (0.0239)	−0.1849*** (0.0270)	−0.1433*** (0.0267)	−0.1648*** (0.0442)
Women in parliament	0.0404 (0.0261)	0.0318 (0.0281)	0.0531* (0.0292)	0.0223 (0.0271)	0.0382 (0.0302)	0.0488 (0.0349)
Wom.parliament^2	−0.0008 (0.0005)	−0.0006 (0.0006)	−0.0010** (0.0005)	−0.0004 (0.0006)	−0.0006 (0.0005)	−0.0009 (0.0007)
Alcohol consumption		−0.0595 (0.0634)	−0.0480 (0.0655)	−0.0381 (0.0638)	−0.0316 (0.0718)	−0.2824*** (0.0748)
Voice&Accountability			0.9714** (0.3938)	0.7691** (0.3569)	0.9010** (0.3860)	−0.0801 ((0.6579)
Renewable energy			0.0590*** (0.0173)			0.0047 (0.0161)
Greenhouse gases				−53.0540** (22.9468)		
Combust. renewables					0.1075*** (0.0269)	
Smoking, % of women						−0.0994*** (0.0337)
R^2	0.7874	0.7958	0.8151	0.8051	0.8210	0.8813
n	346	340	340	332	340	138
df	300	293	291	283	291	89

Notes: $*p < 0.1$; $**p < 0.05$; $***p < 0.01$ significance level

Table AIII.
Dependent variable: male longevity, fixed country-specific effects

Regressors	1	2	3	4	5	6
GDP/cap 2011 prices	9.1057*** (2.5148)	8.3186*** (1.9545)	7.2653*** (1.712)	8.1675*** (1.9017)	6.6462*** (1.6792)	10.9403*** (2.4271)
Gini coefficient	−0.0941*** (0.0346)	−0.0805** (0.0316)	−0.0903*** (0.0288)	−0.0681** (0.0317)	−0.0782*** (0.0267)	−0.0551* (0.0308)
Rural population	−0.2581*** (0.0875)	−0.2708*** (0.0663)	−0.3015*** (0.0700)	−0.2819*** (0.0738)	−0.3265*** (0.0662)	−0.1094 (0.1378)
Men, unemployment	0.1216* (0.0698)	0.0906 (0.0624)	0.0943 (0.0542)	0.0919 (0.0610)	0.0824 (0.0527)	0.1207*** (0.0433)
Men, services	0.0676*** (0.0765)	0.1012 (0.0670)	0.0647 (0.0634)	0.0919 (0.0632)	0.0566 (0.0607)	−0.0378 (0.1196)
Men, industry	−0.0362 (0.0315)	−0.0193 (0.0290)	−0.0115 (0.0269)	−0.0227 (0.0289)	−0.0136 (0.0276)	−0.0022 (0.0857)
Women in parliament	0.1190*** (0.0408)	0.1041** (0.0447)	0.1377*** (0.0451)	0.0942** (0.0420)	0.1111*** (0.0386)	0.0860* (0.0502)
Wom.parliament^2	−0.0015* (0.0008)	−0.0012 (0.0008)	−0.0021** (0.0009)	−0.0009 (0.0007)	−0.0013** (0.0006)	−0.0011 (0.0011)
Alcohol consumption		−0.1239 (0.1024)	−0.1060 (0.1014)	−0.0969 (0.0991)	−0.0773 (0.1101)	−0.4364*** (0.1020)
Voice&Accountability			1.1946** (0.3765)	0.9689** (0.3841)	1.0696*** (0.3793)	−0.0677 (0.8658)
Renewable energy			0.1061*** (0.0265)			0.0360 (0.0239)
Greenhouse gases				−80.6964** (36.0027)		
Combust. renewables					0.1817*** (0.0399)	
Smoking, % of men						−0.1151* (0.0642)
R^2	0.7318	0.7545	0.7878	0.7567	0.7964	0.8464
n	346	340	340	332	340	138
df	300	293	291	283	291	89

Notes: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$ significance level