

THE ROLE OF DEPENDENCY RATIO IN MEDIATING FERTILITY RATE AND LIFE EXPECTANCY ON HAPPINESS

Sotya Fevriera*, Jessica Joy Soemirat

Faculty of Economics and Bussiness, Universitas Kristen Satya Wacana, Salatiga, Indonesia

*Corresponding author: sotya.fevriera@uksw.edu

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ABSTRACT

Studies on the determinants of happiness rarely consider age structure. This study examines whether the dependency ratio links fertility rate and life expectancy to national happiness, alongside economic and cultural factors. We use cross-sectional data for 92 countries in 2024 from the World Development Indicators, the World Happiness Report (three-year average life evaluation), and the Culture Factor Group, and estimate a path model by maximum likelihood with robust standard errors. GDP per capita, individualism, and indulgence are positively associated with happiness, as is uncertainty avoidance at the 10% level, while motivation toward achievement and success is negatively associated with it (−0.005 points per index point). Power distance and long-term orientation show no significant association. A one-percentage-point higher dependency ratio is associated with a 0.020-point lower happiness score. One additional birth per woman is associated with an 11.3-percentage-point higher dependency ratio and, through it, a 0.23-point lower happiness score. The indirect association of life expectancy is much smaller (−0.010 points per year) and significant only at the 10% level. Age structure therefore appears alongside income and culture in explaining cross-country differences in happiness. Because the data are cross-sectional and relevant variables are omitted, the results are conditional associations, not causal effects.

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1. INTRODUCTION

Happiness is not only a matter of pleasure. It also reflects life satisfaction, mental health, and the ability to carry out daily activities. The happiness index is one indicator of subjective well-being, that is, how people value their overall quality of life (Chakraborty et al., 2026). Happiness is associated with productivity: happier individuals tend to be more productive and more motivated at work (Charles-Leija et al., 2023), whereas poor mental health reduces productivity and, in some cases, the ability to work (Oliveira et al., 2023). Happiness is therefore a development issue as well as an individual one. It is also related to the fulfillment of basic needs and lifestyle, such as sleep, nutritious food, exercise, and work-life balance (Arbiansyah et al., 2026; Pluut & Wonder, 2020).

In development studies, welfare is commonly measured by GDP or income per capita (Ortiz-Ospina et al., 2024), because higher income is expected to raise people's ability to meet their needs and, with it, their happiness (Popescu & Mourão, 2025). Cross-country data point in the same direction: high-income countries such as Finland, Denmark, and Iceland rank at the top of the happiness index with scores above 7, whereas low-income countries, particularly in Africa, tend to score below 4 (Helliwell et al., 2026). The pattern is not uniform, however. Costa Rica and Mexico report happiness that is high relative to their income, whereas the United States and the United Kingdom report happiness that is lower than their income would suggest (Helliwell et al., 2026). This may reflect social, cultural, and psychological factors such as inequality, social pressure, job satisfaction, freedom in decision-making, and social capital (Diener et al., 1999; Helliwell et al., 2026). Easterlin (1974) and Mudunna et al. (2022) debate how income growth is related to happiness over time and across countries. Income is therefore not the only determinant of cross-country differences, and once basic needs are met, non-economic factors such as health, environment, and social relationships also matter (Titisari & Santoso, 2025). The World Happiness Report (2026) explains cross-country differences in life evaluations mainly by GDP per capita, social support, healthy life expectancy, freedom to make life choices, generosity, and perceptions of corruption (Helliwell et al., 2026). Our model focuses on income, the dependency ratio, and culture; social support, freedom, generosity, and corruption are not included.

Age structure is a further candidate. The age dependency ratio is the ratio of people younger than 15 or older than 64 to the working-age population aged 15 to 64 (World Bank, 2026a). A higher ratio means that each working-age person supports more dependents, a situation often described as the sandwich generation (BPS Surabaya, 2026). The sandwich generation may have to work harder to earn income and do domestic work, which can reduce leisure time and happiness, and may therefore experience significant economic and emotional stress. At the household level, Fang (2022) finds that a higher dependency ratio worsens the mental health of the workforce in China. Blanchflower et al. (2023) report a U-shaped relationship between age and life satisfaction, with lower satisfaction among people of working age than among the young and the old. At the aggregate level, Ramos-Herrera & Sosvilla-Rivero (2020) find that population aging puts pressure on fiscal sustainability in euro area countries, so the dependency ratio has implications at both the micro and macro levels. These mechanisms operate at the household level, whereas our analysis uses country averages of happiness, which also include children and older people who are themselves part of the dependent population. Inferring individual-level mechanisms from country-level associations may suffer from the ecological fallacy Acemoglu et al. (2005), so our results should be read as cross-country associations only.

The dependency ratio is itself shaped by fertility rate and life expectancy (Navarro & Skirbekk, 2025; Pflaumer, 2023). A higher fertility rate increases the number of children, and a higher life expectancy increases the number of older people, both of whom belong to the dependent population. More children raise the economic needs that parents must meet, from basic needs to education, and more older people raise health and care costs. These conditions may be associated with lower subjective well-being through greater economic pressure and less time to enjoy life.

Culture may also matter. Diener et al. (1999) and Titisari & Santoso (2025) show that societal values and norms are related to how people evaluate their lives. Hofstede (2011) describes six cultural dimensions: power distance, individualism, motivation toward achievement and success, uncertainty avoidance, long-term orientation, and indulgence (The Culture Factor Group, 2026). Differences in these dimensions are associated with differences in happiness across countries (Rajkumar, 2023).

A large literature links income, family structure, and age structure to well-being. Pupavac et al. (2020) relate the happiness index to GDP per capita, social support, life expectancy, individual freedom, and perceptions of corruption. Sanz et al. (2016) relate happiness to development, freedom, and equality. Akgün et al. (2023) relate it to macroeconomic indicators (GDP per capita, inflation, government spending, taxes, and social contributions and benefits) and labor market indicators (the employment rate and the share of the inactive population). Margolis and Myrskylä (2015) study how

parental well-being relates to further childbearing, while Bloom et al. (2015) show that changes in age structure shape economic performance through the demographic dividend. Other studies link fertility rate or life expectancy to happiness (Balbo & Arpino, 2016; Blanchflower et al., 2023; Helliwell et al., 2026; Kohler, 2015; Mencarini et al., 2018; Pupavac et al., 2020), the dependency ratio to happiness (O'Connor, 2017), and fertility rate or life expectancy to the dependency ratio (Navarro & Skirbekk, 2025; Pflaumer, 2023), while Bidisha et al. (2020) link the dependency ratio to economic growth. To our knowledge, few studies have examined the dependency ratio as a channel linking fertility rate and life expectancy to happiness, although related studies examine age structure and well-being (Blanchflower et al., 2023; Fang, 2022). Taken together, these strands suggest that the dependency ratio may link fertility rate and life expectancy to happiness, and this study tests that possibility.

This study examines the association of income (GDP per capita), the dependency ratio, and cultural dimensions with happiness, and whether the dependency ratio links fertility rate and life expectancy to happiness. We test twelve hypotheses. The first hypothesis is that GDP per capita is positively associated with happiness. The second is that the dependency ratio is negatively associated with happiness. The third is that life expectancy is positively associated with the dependency ratio, and the fourth is that fertility rate is positively associated with the dependency ratio. The fifth and sixth are that life expectancy and fertility rate, respectively, are negatively associated with happiness indirectly, through the dependency ratio. The seventh is that power distance is negatively associated with happiness, because societies that accept unequal distribution of power tend to report lower happiness (Juhász, 2026; Rajkumar, 2023; Steel et al., 2018). The eighth is that individualism is positively associated with happiness (Juhász, 2026; Rajkumar, 2023; Steel et al., 2018). The ninth is that motivation toward achievement and success, the label the Culture Factor Group uses for Hofstede's masculinity dimension, is negatively associated with happiness, since happier nations tend to emphasize femininity over achievement and competition (Steel et al., 2018) and masculinity is negatively related to national well-being in richer countries (Arrindell et al., 1997). The tenth is that uncertainty avoidance is negatively associated with happiness (Arrindell et al., 1997; Juhász, 2026; Steel et al., 2018). The eleventh is that long-term orientation is positively associated with happiness (Graafland, 2020; Rajkumar, 2023), and the twelfth is that indulgence is positively associated with it (Juhász, 2026; Li et al., 2022; Rajkumar, 2023). The evidence on culture is not uniform, however: Juhász (2026) finds no significant association for masculinity or long-term orientation, and Rajkumar (2023) finds none for masculinity, so these hypotheses are tested rather than assumed. The results clarify whether age structure belongs alongside income and culture in explaining cross-country differences in happiness.

2. RESEARCH METHODS

This research data comes from 92 countries in 2024. The number of countries is determined by data availability, after merging the cultural scores of The Culture Factor Group with the World Happiness Report and the World Development Indicators and dropping countries with missing values on any variable, 92 countries remain. Because the sample is limited to countries covered by all three sources, it may not be representative of all countries, and the results should be generalized with caution (see the limitations). Happiness index data is taken from the life evaluation score from the World Happiness Report (2026); per capita GDP, dependency ratio, life expectancy, and fertility rate data are from the World Development Indicators (World Bank, 2026b), while 6 cultural dimensions (power distance, individualism, motivation towards achievement and success, uncertainty avoidance, long-term orientation, and indulgence) are taken from The Culture Factor Group (2026).

The year 2024 was chosen because, when the research was conducted, some data for 2025 had not yet been released by the World Bank. The happiness index ranges from 0 (not happy) to 10 (happiest). The World Happiness Report explains differences in this index by several dimensions, viz. logarithm of GDP per capita, social support, healthy life expectancy, freedom to make choices, generosity and perceptions of corruption (World Happiness Report, 2026). We employ the three-

year average score and do not use the annual score because some countries do not have an annual score for 2024, so using the annual score would reduce the number of countries.

For the cultural dimensions, the range is from 0 (weakest) to 100 (strongest). Since a country's culture is considered to be stable or difficult to change in the short period or to remain stable in the long period (Beugelsdijk et al., 2015; Hofstede, 2011), their scores are constant over time. Further, Purchasing Power Parity (PPP) was chosen to adjust for differences in price levels among countries, so that the per capita GDP can describe countries' purchasing power and living standards.

Based on Figure 1, these regression models can be arranged:

$$Happy_i = \beta_0 + \beta_1 GDPcap_i + \beta_2 Depend_i + \sum_k \beta_k Culture_{k,i} + e_i \dots \dots \dots (1)$$

$$Depend_i = \gamma_0 + \gamma_1 LifeExp_i + \gamma_2 Fertil_i + u_i \dots \dots \dots (2)$$

where β_0 and γ_0 are the constants of models (1) and (2); i is the index for countries, $i = \{1, \dots, 92\}$; Happy is the life evaluation score; GDPcap is per capita GDP, PPP (current international \$); Depend is the age dependency ratio (% of working-age population); Culture_k is the k^{th} cultural dimension, with $k = \{\text{PowerD, Indiv, MotivAS, UAvoid, LongOr, Indulge}\}$; LifeExp is life expectancy at birth, total (years); Fertil is the fertility rate, total (births per woman); β_1 , β_2 , and β_k are the regression coefficients of GDPcap, Depend, and the k^{th} cultural dimension; γ_1 and γ_2 are the regression coefficients of LifeExp and Fertil; and e and u are the errors of models (1) and (2), respectively.

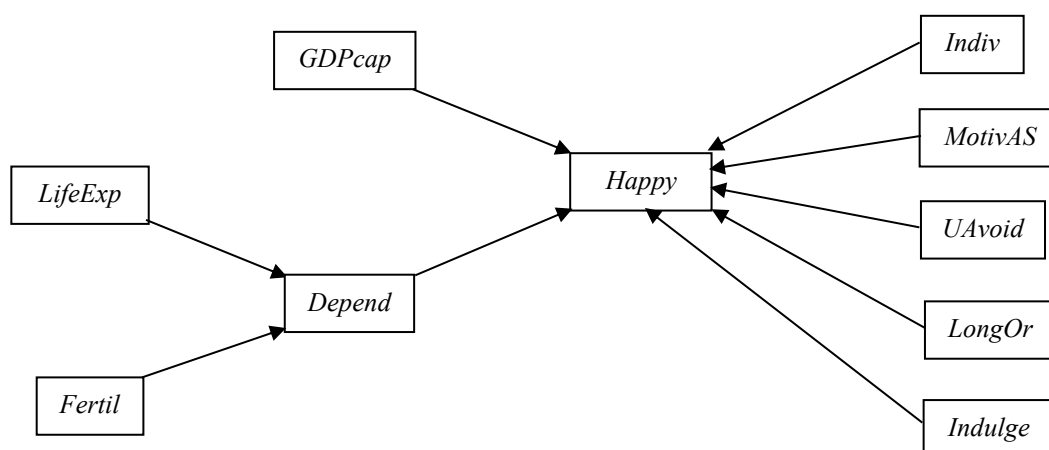


Figure 1. Research Framework
Source: Authors (2026)

This study uses path analysis to estimate the direct and indirect effects of LifeExp and Fertil on Happy. Path analysis is a subset of structural equation modeling (SEM) that does not use latent variables (constructs or factors) (Wang & Wang, 2020). Path analysis models estimated using the maximum likelihood method require a sufficiently large sample size. A small sample size biases the maximum likelihood estimator (Koshyk et al., 2025; Pituch & Stevens, 2016). The ratio of sample size to the number of free parameters is commonly recommended to be at least 5 (Kenny, 2024; Wang & Wang, 2020). Based on models (1) and (2), there are 12 free parameters to be estimated (10 path coefficients and 2 error variances, excluding intercepts). Thus, the ratio of the sample size (92) to the number of free parameters (12) is 7.67, greater than 5. Therefore, although the sample size in this study is not big, it meets this rule of thumb, which is only a rough guide and not a guarantee of reliable estimates, so the results should be interpreted with caution. Small sample sizes can still be used for models without latent variables because, for models whose units are limited in number, such as countries, large sample sizes are unrealistic. In this study, the sample size of 92 countries was limited by the availability of data for the variables in models (1) and (2).

Models (1) and (2) are estimated with heteroscedasticity-robust standard errors, so that statistical inference remains valid even if the error variances are not constant. The indirect effect of LifeExp (Fertil) on Happy through Depend is the product of the coefficient of LifeExp (Fertil) on Depend and the coefficient of Depend on Happy. The standard errors of the indirect effects are obtained with the delta method, and an indirect effect is statistically significant at the 5% level if its 95% confidence interval does not include zero. The 95% confidence interval is $[-0.021, 0.001]$ for life expectancy and $[-0.371, -0.089]$ for fertility rate. All p-values are two-sided, and significance is assessed at the 1%, 5%, and 10% levels.

Analysis of the goodness of fit of path models estimated with robust standard errors is performed using two indicators which are the Standardized Root Mean Squared Residual (SRMR) and the coefficient of determination (CD), often known as R^2 . Additionally, if models (1) and (2) are estimated without robust standard errors, the goodness of fit value can be obtained in the form of the Comparative Fit Index (CFI).

SRMR is the root mean square of the residuals (the difference between observed and estimated values from the model) standardized to the Z value. Therefore, the smaller the SRMR value, the better the model's fit to the observed data. The model is considered an acceptable fit if the SRMR is 0.08 or lower (Hu & Bentler, 1999; Vučković et al., 2026), and values up to 0.1 are also regarded as acceptable (Pituch & Stevens, 2016; Wang & Wang, 2020). Meanwhile, the closer the CD value to 1, the greater the proportion of the dependent variables explained by the two models. The model is strong, moderate, and weak when the CD value is 0.75, 0.5, and 0.25, respectively (Guillén-Gámez et al., 2024; Hair Jr. et al., 2019). Further, the range of CFI is 0 to 1. The greater the value, the better the model fits the data. A model is considered good if the CFI score is at least 0.9 (Hu & Bentler, 1999; Yang et al., 2026; Zegeye et al., 2026) and fits the data perfectly if the value is 1 (Wang & Wang, 2020).

The goodness of fit of the model is assessed using the SRMR, CD, and CFI, together with the R^2 of each equation. The SRMR is 0.056, which is below the threshold of 0.08 and therefore indicates an acceptable fit between the model and the observed data. The CD is 0.817, which exceeds 0.75, so the two equations jointly explain a strong proportion of the variation in the dependent variables. The CFI is 1.000, which exceeds the minimum of 0.9 and, as the maximum value of the index, indicates a perfect fit. At the equation level, the R^2 of the dependency ratio equation is 0.486, slightly below the moderate level of 0.5, while the R^2 of the happiness equation is 0.717, above the moderate level and slightly below the strong level of 0.75.

3. RESULTS AND DISCUSSION

3.1. RESULTS

Table 1 presents the estimates of models (1) and (2) with robust standard errors. The estimation results show that the hypothesis that life expectancy (LifeExp) has a positive association with Depend is supported, because the two-sided p-value (0.026) is smaller than $\alpha = 0.05$. Thus, life expectancy has a positive and statistically significant association with the dependency ratio at the 5% level. A regression coefficient of 0.497 means that a country whose life expectancy is one year higher than that of another country has a dependency ratio that is about 0.497 percentage points higher, holding other variables constant. These results support the findings of Navarro & Skirbekk (2025) and Pflaumer (2023).

The hypothesis that fertility rate (Fertil) has a positive association with Depend is supported, because the two-sided p-value (less than 0.001) is smaller than $\alpha = 0.01$. Hence, the fertility rate has a positive and statistically significant association with the dependency ratio at the 1% level. The regression coefficient of 11.3241 indicates that a country whose fertility rate is 1 birth per woman higher than that of another country has a dependency ratio that is about 11.32 percentage points higher, holding other variables constant. This finding aligns with the research results of Navarro & Skirbekk (2025) and Pflaumer (2023).

Table 1. The Direct Effects Estimation

Structural Equation Model				
Number of obs = 92				
Estimation Method = maximum likelihood				
Log pseudolikelihood = -4,112.2835				
Structural	Coefficient	Robust Standard Error	z	p-value
Depend				
LifeExp	0.4970	0.2244	2.22	0.026**
Fertil	11.3241	1.4411	7.86	<0.001***
_cons	-5.1645	19.2231	-0.27	0.788
Happy				
Depend	-0.0203	0.0058	-3.51	<0.001***
GDPcap	8.41e-06	2.85e-06	2.95	0.003***
PowerD	0.0005	0.0035	0.14	0.889
Indiv	0.0146	0.0043	3.41	<0.001***
MotivAS	-0.0046	0.0022	-2.06	0.039**
UAvoid	0.0056	0.0029	1.95	0.051*
LongOr	0.0050	0.0037	1.35	0.177
Indulge	0.0131	0.0028	4.69	<0.001***
_cons	5.1175	0.5482	9.33	<0.001
var(e.Depend)	55.3107	12.7558		
var(e.Happy)	0.2586	0.0343		

Notes: All p-values are two-sided. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.
Source: Processed data (2026)

Next, the hypothesis that the dependency ratio (Depend) has a negative association with Happy is supported, because the two-sided p-value (less than 0.001) is smaller than $\alpha = 0.01$. Therefore, the dependency ratio has a negative and statistically significant association with happiness at the 1% level. A regression coefficient of -0.0203 shows that a country whose dependency ratio is 1 percentage point higher than that of another country has a happiness score that is 0.0203 points lower, holding other variables constant. This finding is in line with the argument of Bidisha et al. (2020) and O'Connor (2017) that a high dependency ratio is a burden on the economy.

The hypothesis that per capita GDP (GDPcap) has a positive association with happiness (Happy) is supported, because the two-sided p-value (0.003) is smaller than $\alpha = 0.01$, so per capita income has a positive and statistically significant association with happiness at the 1% level. The regression coefficient of 8.41e-06 implies that a country whose GDP per capita is US\$10,000 higher than that of another country has a happiness score that is about 0.084 points higher, holding other variables constant. This finding supports the conclusion by Akgün et al. (2023) and Pupavac et al. (2020).

Furthermore, the hypothesis that power distance (PowerD) has a negative association with Happy is not supported, because the two-sided p-value (0.889) is greater than $\alpha = 0.1$. Power distance therefore has no statistically significant association with happiness in this sample. This result does not support the findings of Juhász (2026) and Rajkumar (2023).

The hypothesis that individualism (Indiv) has a positive association with Happy is supported, because the two-sided p-value (less than 0.001) is smaller than $\alpha = 0.01$. Thus, individualism has a positive and statistically significant association with happiness at the 1% level. The regression coefficient of 0.0146 indicates that a country whose individualism score is 1 point higher than that of other countries has a happiness score that is 0.0146 points higher, holding other variables constant. Thus, this result strengthens the findings of Juhász (2026) and Rajkumar (2023).

The hypothesis that motivation towards achievement and success (MotivAS) has a negative association with Happy is supported, because the two-sided p-value (0.039) is smaller than $\alpha = 0.05$. Hence, motivation towards achievement and success has a negative and

statistically significant association with happiness at the 5% level. The regression coefficient of -0.0046 shows that a country whose motivation towards achievement and success score is 1 point higher than that of other countries has a happiness score that is 0.0046 points lower, holding other variables constant. This result differs from Juhász (2026) and Rajkumar (2023), who found no significant association for masculinity. Micro-level studies on students' academic stress (McDonald, 2018) and on the job stress of peer support workers (Chu et al., 2026) point in a similar direction, but they examine different constructs and populations. They are therefore only suggestive and do not directly corroborate a country-level association.

The hypothesis that uncertainty avoidance (UAVoid) has a negative association with Happy is not supported. The regression coefficient is positive (0.0056) and is significant only at the 10% level (two-sided p -value = 0.051), which is the opposite of the hypothesized direction. The coefficient indicates that a country whose uncertainty avoidance score is 1 point higher than that of other countries has a happiness score that is 0.0056 points higher, holding other variables constant. This result is not in line with the findings of Juhász (2026) and Rajkumar (2023).

Further, the hypothesis that long-term orientation (LongOr) has a positive association with Happy is not supported, because the two-sided p -value (0.177) is greater than $\alpha = 0.1$. Long-term orientation therefore has no statistically significant association with happiness in this sample. This result is in line with Juhász (2026), who likewise did not find a positive association.

The hypothesis that indulgence (Indulge) has a positive association with Happy is supported, because the two-sided p -value (less than 0.001) is smaller than $\alpha = 0.01$. Hence, indulgence has a positive and statistically significant association with happiness at the 1% level. The regression coefficient of 0.0131 means that a country whose indulgence score is 1 point higher than that of other countries has a happiness score that is 0.0131 points higher, holding other variables constant. This result supports the discovery by Juhász (2026) and Rajkumar (2023).

Overall, the findings that fertility rate and life expectancy are positively associated with the dependency ratio, while the dependency ratio is negatively associated with happiness and per capita income is positively associated with happiness, suggest that demographic structure and economic capacity are important in explaining variations in subjective well-being across countries. Furthermore, individualism, motivation towards achievement and success, and indulgence are significantly associated with happiness, and uncertainty avoidance is associated with it at the 10% level, which suggests a role for culture in explaining variation in societal happiness across countries. Power distance and long-term orientation show no significant association.

Next, Table 2 reports the indirect effects of life expectancy and fertility rate on happiness through the dependency ratio. Both indirect effects are negative because each is the product of a positive effect on the dependency ratio and a negative effect of the dependency ratio on happiness.

Table 2. The Indirect Effects Estimation

Structural	Coefficient	Delta-method std. err.	z	p-value	95% CI
Happy					
LifeExp	-0.0101	0.0055	-1.85	0.064*	[-0.021, 0.001]
Fertil	-0.2299	0.0720	-3.19	0.001***	[-0.371, -0.089]

Notes: All p -values are two-sided. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.
Source: Processed data (2026)

The hypothesis that Fertil has a negative indirect association with Happy through Depend is supported, because the two-sided p -value (0.001) is smaller than $\alpha = 0.01$, and its 95% confidence interval does not include zero. A coefficient of -0.2299 means that a country whose fertility rate is 1 birth per woman higher than that of another country has a happiness

score that is 0.2299 points lower through the dependency ratio, holding other variables constant. The magnitude of the indirect effect is obtained by multiplying the regression coefficient of the direct effect of the fertility rate on the dependency ratio and the regression coefficient of the direct effect of the dependency ratio on happiness: $11.3241 \times -0.0203 = -0.2299$.

It can be concluded from these estimates that higher fertility rates and life expectancy are associated with lower happiness across countries through their association with the dependency ratio, as reflected in the population age structure. The dependency ratio is thus the channel in the model through which these demographic variables are related to happiness. These indirect associations are modest in magnitude, about 0.23 points on the 0 to 10 scale per additional birth per woman and about 0.01 points per additional year of life expectancy, and they should be interpreted as conditional associations and not as causal effects.

Finally, the total effect that represents the whole effect of an independent variable on the dependent variable is the sum of the direct effects displayed in Table 1 and the indirect effects presented in Table 2. Because the model contains no direct path from life expectancy or fertility rate to happiness, their total effects equal their indirect effects (-0.0101 and -0.2299 , respectively), and the total effect of the dependency ratio equals its direct effect (-0.0203).

3.2. DISCUSSION

The Subjective Well-Being (SWB) theory is supported by the positive association of per capita income with happiness. Hence, the ability to fulfill the basic requirements may increase happiness because higher income can enable people to have a higher education, access to health care and higher life quality.

Conversely, the results indicate that a higher dependency ratio is associated with lower happiness. This is consistent with Fang (2022), who finds that a higher household dependency ratio worsens the mental health of the workforce, and with Blanchflower et al. (2023), who report lower life satisfaction among people of working age, who bear the heaviest economic burden and family responsibilities. A larger share of dependents may therefore increase the burden on the working-age population, reduce consumption capacity, and raise economic stress, which is associated with lower subjective well-being (O'Connor, 2017).

Further, the positive associations of fertility and life expectancy with the dependency ratio show that population structure needs to be managed well. A high fertility rate is associated with a high proportion of young people, and a high life expectancy is associated with a high proportion of elderly people. The combination of both makes the dependency ratio high. Since the dependency ratio is significantly and negatively associated with happiness, it is the channel through which the demographic variables are related to happiness in our model. Therefore, the demography management should also include population's quality and productivity and not only population size. Navarro and Skirbekk (2025) find that lower fertility raises old-age dependency over time, so that total dependency ratios become stable in the long term rather than falling. A lower dependency ratio achieved through fewer births may therefore be temporary. Our results suggest that age structure is associated with happiness, but they do not show that managing the dependency ratio will raise happiness. The policy discussion below draws on the literature and goes beyond the associations estimated in this study.

Some countries apply incentive policies and others implement disincentive policies to manage the fertility rate. China used to apply one-child policy (Hesketh et al., 2005). However, responding to changes in demographic structure and reduction in birth rates, in 2016 it was changed into a two-child policy (Zeng & Hesketh, 2016) and in 2021 it was relaxed into a three-child policy. In Iran (Abbasi-Shavazi et al., 2009) and Vietnam (Goodkind, 1995), governments have encouraged families to have a limited number of children by developing various policies on family planning and administrative arrangements.

Nonetheless, some countries have found that policies to control fertility cannot always achieve the goal and even lead to social consequences and debates on individual reproductive rights (Hesketh et al., 2005). Moreover, income is not the determining factor on having children. It is also

affected by the cost of living, education level, and women's participation in the labor market. Thus, rather than interfering directly, improving the quality of human resources, expanding employment opportunities, and strengthening social protection systems may be a more appropriate approach. The association estimated in this study does not justify direct limits on the number of children.

The high life expectancy reflects the success of health development. However, it also has consequences on whether the economic and social system is ready so that the elderly population can live prosperously without being completely dependent on the productive people. In developed countries, this challenge is solved by developing the silver economy such as comprehensive elderly support systems. Norway, Sweden, Switzerland, and Germany provide formal caregiver services, financial assistance, social protection, and long-term care infrastructure. It allows the elderly to maintain their quality of life and reduces the burden on the productive people in their family (OECD, 2023). In Australia, Germany, and the United Kingdom, caregiver policies are designed to maintain caregiver engagement in the labor market through care leave schemes, income compensation, and pension security protections (US Government Accountability Office, 2020).

Nonetheless, this approach is difficult to adopt for less prosperous countries due to their constraints on fiscal and institutional capacity. Therefore, an alternative strategy, such as adjusting the productive life cycle, is needed. With the increase in life expectancy, the retirement age should be reviewed, specifically for those who are quite healthy and are still capable to work. This arrangement is expected to prevent a decline in the welfare of older people. Setting the retirement age carefully and making it more flexible in the pension system can maintain older people's participation in economic activity and sustain their well-being.

The productivity of the elderly can also be increased through retraining activities (reskilling and upskilling) which allow them to contribute to simple work, entrepreneurship, or community-based activities. The involvement of the elderly in socio-economic activities has been shown to reduce financial dependence, and physical and time burdens faced by the productive people (European Union Agency for Fundamental Rights, 2023).

The digitalization of public services also brings difficulties for the elderly with limited digital skills. A digital literacy program should be provided to them. Making inclusive policy that guarantees access to online and offline services for the elderly is crucial. An example of a relatively innovative non-fiscal approach is the Elderly School program in Indonesia, such as the Elderly Golden Age School. This program emphasizes a community-based lifelong learning concept. The goal is to maintain the physical, mental, and social health of the elderly, while encouraging their economic empowerment and social participation at the same time (Hariastuti et al., 2024). Because our sample covers 92 countries, Indonesia is treated as one observation among many, and this example is given for illustration only. Training the elderly to remain active, independent, and productive within their capacity can reduce the financial, caregiving, and emotional burdens borne by the productive people in their family.

Since countries' cultures are considered to be stable, trying to increase happiness by setting public policies to change national culture directly is unrealistic. However, public policies can be designed to support or strengthen cultural dimensions that are positively associated with happiness in our results. Two caveats apply to the cultural results. First, the indulgence index is partly constructed from World Values Survey items, including self-reported happiness (Hofstede, 2011), so part of its association with happiness may be mechanical rather than substantive. Second, cultural scores may be correlated with economic development and institutions, so the cultural coefficients may partly capture differences in development or institutions.

Uncertainty avoidance is positively associated with happiness only at the 10% level, which is opposite to the direction we hypothesized. A possible interpretation, not tested in this study, is that clear rules, institutional stability, and predictability in social and economic life are important for societies that have a high level of uncertainty avoidance, because this culture may become a mechanism of psychological protection that decreases anxiety and insecurity about the future. Policies that reinforce legal certainty, regulatory transparency, economic policy stability, and the

reliability of public institutions may improve public welfare.

The dimensions of individualism and indulgence are also positively associated with happiness. Thus, the SWB theory is again supported. It emphasizes the importance of individual freedom and the ability to enjoy life as key determinants of happiness. Hence, policies that magnify individual freedom, direct participation, strengthen the protection of individual rights, and guarantee freedom of expression may increase happiness. Further, policies balancing the work-life, providing public spaces that support recreational activities, and employment policies prioritizing mental well-being and quality of life may strengthen the indulgence dimension and hence happiness.

On the other hand, happiness is negatively associated with motivation toward achievement and success. Thus, a culture oriented toward achievement and success does not always go together with higher happiness. A possible explanation, not tested in this study, is that if it is not accompanied by a life balance and psychological safety, competitive pressures and productivity demands can outweigh the benefits of material welfare.

Power distance is not significantly associated with happiness. Power inequality does not always translate directly into personal subjective experiences. A possible explanation, not tested in this study, is differences in the institutional context across countries. In countries where the institutions are relatively stable and the welfare systems work, the impact of power distance on happiness may be diminished by social protection mechanisms. Long-term orientation is also not significantly associated with happiness, so we do not draw policy implications from it.

It can be concluded that happiness is a multidimensional phenomenon. It is associated with economic, demographic, and cultural factors. Therefore, increasing happiness may require more than a single approach, and our results are consistent with an approach that takes into account the balance among economic growth, population structure, and sociocultural values developed within a society.

4. CONCLUSION

This study aims to analyze the association of economic, demographic, and cultural factors with the happiness index using cross-country data from 2024 and, specifically, to study the role of the dependency ratio in mediating the relationship between life expectancy and fertility rate with happiness. The results show that economic capacity remains an important correlate of happiness in cross-national analyses, since per capita income is positively and significantly associated with happiness. The study also shows that happiness is associated not only with economic factors but also with demographic structure. The dependency ratio is negatively and significantly associated with happiness, which indicates that the population's age structure is important to explain variations in happiness across countries: the higher the proportion of dependents compared to the working-age population, the greater the economic and social burden borne by the working-age group, which ultimately correlates with lower levels of subjective well-being. Life expectancy and fertility rates, in turn, are positively and significantly associated with the dependency ratio, because these two demographic variables form the age composition of the population and are therefore related to the burden of dependency in society. Through the dependency ratio, both variables are negatively associated with happiness indirectly, and the indirect association of fertility rate (about -0.23 points per additional birth per woman) is larger than that of life expectancy (about -0.01 points per year, significant only at the 10% level). Thus, in our model, the demographic variables are related to happiness through the population's age structure.

Happiness is also associated with cultural values. Individualism and indulgence are positively associated with happiness, and uncertainty avoidance is positively associated with it only at the 10% level and opposite to the hypothesized direction, whereas motivation toward achievement and success is negatively associated with it. Power distance and long-term orientation show no significant association. Hence, happiness is related not only to economic and demographic conditions but also to the value systems and social norms that guide how individuals interpret their lives. This study therefore concludes that country happiness is a multidimensional phenomenon associated with its economic capacity, demographic structure, and cultural values, so a development approach focused merely on economic growth is insufficient to explain variations in subjective well-

being and should consider the demographic dynamics and cultural characteristics in each country. Because the data are cross-sectional and the sample is small, however, the results are conditional associations and not causal effects. They are consistent with policies that manage age structure through human capital, employment, and social protection, rather than through direct limits on births.

This study has several limitations. First, the cross-sectional design for 92 countries in 2024 cannot establish causality, and reverse causality is plausible; for example, life satisfaction may itself be related to childbearing. Second, important variables are omitted, such as education, urbanization, female labor force participation, social support, freedom, generosity, and corruption, which may be correlated with both the dependency ratio and happiness. Third, the cultural indices are time-invariant scores based on older surveys, and the indulgence index is partly built from items related to happiness. Fourth, the sample is limited to countries with data on all variables, including cultural data, which may introduce selection bias, and because country averages are used, the results cannot be interpreted at the individual level (ecological fallacy). Fifth, the sample size is small relative to the number of parameters. Sixth, the model imposes full mediation by design and does not test direct paths from life expectancy and fertility rate to happiness, and the standard errors of the indirect effects are obtained with the delta method and not with a bootstrap. Finally, the total dependency ratio combines young and old dependents, which may relate differently to happiness, GDP per capita enters the model in levels and not in logarithms, regional differences were not controlled for, and multicollinearity among GDP per capita and the cultural dimensions was not assessed.

Future research can be improved by adding variables that could explain variations in life expectancy and fertility rates, such as a global health index. It could also estimate partial mediation with direct paths from life expectancy and fertility rate to happiness, use a logarithmic specification of GDP per capita, examine young-age and old-age dependency separately, control for regional differences, and assess multicollinearity. To address endogeneity, future research could use instrumental-variable (2SLS) estimation, which is usually used when the independent variables in the regression model are correlated with the error term and which solves this problem with instrumental variables that are correlated with the independent variables but not with the error term. However, 2SLS can perform poorly in small samples and with weak instruments, so it is not a remedy for a small sample. If there is no correlation between the independent variables and the error term, 2SLS regression is still valid, but the model should then be estimated using the ordinary least squares (OLS) method because the 2SLS estimator is less efficient (its standard error is larger) than the OLS estimator. A larger sample, for example a panel of countries over time, would also allow more control variables.

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