

Intertemporal analysis of well-being and its contributing factors: Cross-country evidence

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Abstract: Tracking well-being over time has the potential to shape public policies based on informed decision-making and reallocating scarce resources for balanced, sustainable and inclusive development. Using four waves of the World Values Survey (WVS) data between 1999 and 2022 for 48 countries, we estimate intertemporal changes in well-being and its contributing factors by using a multidimensional well-being index (MDWI). Our findings reveal that well-being has increased over time in most countries. We observe notable intra- and inter-country differences in the contribution of various domains to overall well-being. In general, the health domain contributes the most to well-being, followed by social capital, finance, safety, governance, science and technology, and religion. However, in the North American region, social capital is the highest contributing domain to overall well-being. Finally, five overarching policy implications are discussed that are expected to enhance the overall well-being of the countries under investigation.

Keywords: Multidimensional well-being; intertemporal analysis; domain contribution; cross-country; sustainable development goals (SDGs)

1. Introduction

Since the introduction of the United Nations Sustainable Development Goals (UN-SDGs), enhancing human well-being has attracted renewed interest and a sense of urgency (De Neve and Sachs, 2020; United Nations, 2015). Consequently, the analysis of determinants and correlates of human well-being has gained substantial research and policy interest, particularly over the last decade (Ahmadiani et al., 2022; Moro-Egido et al., 2022; Rudolf & Bethmann, 2023). Numerous studies have highlighted the role of income or per capita gross domestic product (GDP) in enhancing well-being (e.g., see Diener et al., 1985; Tauseef, 2022). This is because income has been considered a measure of access to economic resources, and higher incomes are associated with higher levels of affordability of necessities and, consequently, higher levels of happiness and well-being (Aliyev et al., 2022; Osberg & Sharpe, 2005). Additionally, over the last two decades, a notable growth in per capita GDP has been observed in almost all countries across the globe, with remarkable progress in reducing extreme poverty and hunger and improvement in health and education outcomes, as well as the overall standard of living of people in most developing countries, particularly in South Asia and Sub-Saharan Africa (World Bank, 2022).

However, Easterlin's (1974) paradox suggests that while well-being can be positively correlated with the level of income at a given point in time, income is not significantly related to well-being over time (Ahmadiani et al., 2022; Smith & Wesselbaum, 2023). This observation is

particularly evident in developed countries, such as the United States, Luxembourg, Ireland and Australia (Easterlin, 2013). As Easterlin (2003, 2010) further explains, once basic well-being in terms of food, clothing, and housing is achieved, a further increase in income does not significantly affect well-being (see Tay & Diener, 2011).

Therefore, it is interesting to explore how these global developments that have taken place over two decades have contributed to the well-being of people over time. Furthermore, if income does not necessarily increase well-being, what other aspects contribute to well-being in the long run? A detailed review of the literature in Section 2 reveals that a comprehensive study of changes in well-being and its contributing factors over time at a cross-country level is still lacking. In this study, we address this gap in the literature by examining intertemporal changes in well-being and its contributing factors for 48 countries (20 developed and 28 developing) in five regions: Asia and the Pacific, Europe, Africa, North America and South America. The specific objectives of this study are: (1) to estimate the intertemporal changes in well-being during 1999–2022 at the cross-country level; and (2) to examine the changes in the factors that contribute to well-being over time across countries. For this purpose, we construct a multidimensional well-being index (MDWI) using four waves (Wave-4: 1999–2004; Wave-5: 2005–2009; Wave-6: 2010–2014; and Wave-7: 2017–2022) of the World Values Survey (WVS). We also highlight the differences in factors that affect well-being across countries at different levels of economic development.

Osberg and Sharpe (2003) note that the periodic measurement of well-being is the best way to understand well-being dynamics and thereby facilitate policymakers and governments in formulating policies to promote the well-being of their citizens. Such information facilitates citizens and policymakers in organizing their perceptions of social and economic outcomes and allows them to make better political and public policy decisions based on their own evaluations of outcomes (Osberg & Sharpe, 2003). In addition, decision-makers and citizens can use these insights to assess the success and failure of public policy and make informed decisions that help to reallocate scarce resources (Costanza et al., 2016; Sharipova & Kudebayeva, 2023). Hence, tracking well-being and its contributing factors is crucial for any country.

Nonetheless, there are several indexes that periodically measure well-being globally and at the individual country level, such as the World Happiness Index known as the World Happiness Report (WHR), the OECD Better Life Index, the Australian Unity Well-being Index and the Gross National Happiness (GNH) Index (Cummins et al., 2003; OECD, 2011; Ura et al., 2012; WHR, 2015). However, our approach to constructing the MDWI is significantly different from the existing indexes, which are constructed using a distinct number of domains and indicators. For example, the OECD Better Life Index is constructed using 11 domains and 20 indicators, while the GNH is constructed using nine domains and 33 indicators, and the Australian Unity Well-being Index is constructed using seven domains and seven indicators. Additionally, these indexes incorporate self-rated life satisfaction as a domain/indicator and utilize equal or arbitrary weights for the indicators while constructing the indexes.

In contrast, the MDWI used in this study is constructed following the Oxford Poverty and Human Development Initiative's (OPHI) multidimensional poverty index (MPI) framework proposed by Alkire and Foster (2011) for poverty analysis. The MPI offers an intuitive approach to the measurement of fundamentally multidimensional concepts, such as poverty and well-being. The MPI approach involves identifying various dimensions affecting the multi-dimensional concept, identifying various indicators for each dimension, setting up deprivation or sufficiency cut-offs and obtaining deprivation or sufficiency scores based on the weighted indicators (see Section 3.2 for additional discussion). Although Bhutan's GNH Index is based on

the MPI framework, it uses equal weights for each indicator. Several researchers have criticized the use of arbitrary or equal weights while constructing multidimensional indexes because equal or arbitrary weights are not free from value judgment and biases (e.g. see Jayasinghe et al., 2021; Nussbaumer et al., 2013). Therefore, considering the unique social, cultural, and economic diversity of each country, the MDWI constructed in this study uses the Principal Component Analysis (PCA)-based weights, a data-oriented procedure, and is not affected by value judgments (Decancq & Lugo, 2013). The significance of the PCA-based weighting scheme is that it enables researchers, policy-makers and governments to understand the relative importance of each domain/indicator of well-being, which will help to inform policy-making. Finally, we not only measure the level of well-being in each country under consideration, but also provide a detailed analysis of which domains contribute more (or less) to overall well-being, which will allow targeted interventions for specific domains in each country to enhance the well-being of its citizens. Thus, the methods we employ in this study are significantly different from those of the previous cross-country studies, hence making a unique contribution to the existing literature on well-being and its contributing factors.

Nonetheless, this study is expected to make five key contributions to the well-being literature. First, it provides one of the first systematic intertemporal cross-country analyses of multidimensional well-being, covering 48 developed and developing countries across five regions over the period 1999–2022. Second, it constructs a novel Multidimensional Well-Being Index (MDWI) using four waves of the World Values Survey, enabling consistent international and temporal comparisons. Third, the study advances methodology by applying the Alkire–Foster multidimensional framework to well-being measurement and employing PCA-based weights, thereby avoiding arbitrary weighting and identifying the relative importance of well-being domains. Fourth, it explicitly examines heterogeneity in well-being levels and drivers between developed and developing economies, highlighting context-specific pathways to well-being. Finally, by decomposing well-being into its contributing domains, the study delivers policy-relevant insights that support targeted, evidence-based interventions for the countries under consideration.

Our findings reveal that countries across the globe enjoy moderate to moderately high levels of well-being in general, and, in general, well-being has slightly increased in most countries, with a few exceptions. The domain contribution to the MDWI varies in the countries under investigation in this study. In most countries, the health domain makes the largest contribution, followed by social capital, finance, safety, governance, and science and technology. The religion domain's contribution is minimal in all countries. Irrespective of the regions' and countries' income levels, the average contribution of various domains to the MDWI exhibits a similar pattern of variations in all regions.

The rest of this article is organized as follows. In Section 2, we present a review of the literature on available cross-country studies. Section 3 presents the data source and the procedure for constructing the MDWI. We present and discuss the intertemporal changes in the MDWI and domains' contributions by regions and countries' economic development in Section 4. A detailed policy discussion based on our analysis is presented in Section 5, followed by some concluding comments in Section 6.

2. Review of the literature

A growing body of cross-country research has examined the determinants of well-being, using either life satisfaction or happiness as a measure of well-being, and often using large-scale (cross-sectional or panel) international surveys/data. These studies reveal both commonalities and

divergences in well-being outcomes across diverse socioeconomic and cultural contexts. The studies also provide important insights for understanding the multidimensional nature of well-being and its drivers, which is the central focus of the present study.

Early cross-sectional analyses highlight the significance of individual-level factors in shaping subjective well-being, also known as life satisfaction or happiness (Diener et al., 2000). Borooah (2006), for instance, utilised data from the WVS Wave-4 across 80 countries and found that factors such as a moderate standard of living, good health, employment and strong social relationships were significantly and positively associated with higher happiness levels. Similarly, Bonini (2008), employing hierarchical linear regression on the same WVS dataset, explored the variability of life satisfaction across countries. The study underscored that in addition to personal characteristics such as education, income, and marital status, national-level factors such as wealth endowment and environmental quality play critical roles in shaping life satisfaction across countries.

Adding a macroeconomic dimension, Ram (2009) examined the relationship between happiness and income and government expenditure using data from 73 countries over two time periods, 2006 and 2007. The findings affirmed a positive association between public spending and happiness, reinforcing the view that institutional factors influence happiness at the country level. This link between national prosperity and well-being was further substantiated by Sacks et al. (2010), whose analysis of pooled cross-sectional WVS data in 126 countries between 1980 and 2004 demonstrated a strong positive correlation between GDP per capita and average life satisfaction. These findings were echoed by Haddad et al. (2022), who used Gallup World Poll 2016 data to show that belonging to a higher-income class group corresponds to greater life satisfaction, particularly in developing countries.

Beyond cross-sectional designs, panel data studies offer more nuanced insights into the dynamic nature of well-being. For example, Pedersen and Schmidt (2011), drawing on the European Community Household Panel between 1994 and 2001, identified income and health as robust predictors of life satisfaction over time, while unemployment had a persistently adverse effect in the European countries. Similarly, Welsch and Kühling (2016) analysed two waves of the European Social Survey, for 2002 and 2010, across 25 OECD countries, revealing that macroeconomic instability, such as declining GDP growth and rising unemployment, significantly negatively impacts well-being. These findings emphasize the importance of both economic resilience and social protection mechanisms in sustaining population well-being.

More recently, Kang and Rhee (2021) used panel data from 134 countries between 2005 and 2017 to explore the effects of income inequality and redistribution on national happiness. The study found that higher income inequality significantly reduces well-being in highly unequal societies, while the impact is negligible in more equitable countries. This suggests a threshold effect where inequality becomes harmful only beyond certain levels, a consideration highly relevant to multidimensional well-being assessments.

In summary, the existing cross-country studies lack the multifaceted and context-sensitive nature of well-being. The studies highlight the influence of individual, societal and institutional factors in shaping life satisfaction or happiness and underscore the value of using both cross-sectional and longitudinal data for capturing temporal and spatial variations. However, most existing studies rely on unidimensional indicators such as life satisfaction or happiness, potentially overlooking broader aspects of human well-being. Furthermore, as discussed above, the existing cross-country studies have often used different measures of well-being (life satisfaction or happiness), various data and methodologies, and determinants of well-being; moreover, the studies do not provide opportunities for comparing well-being and its

contributing factors over time and across countries. These critical observations through a detailed review of literature motivate the current study, which employs a novel multidimensional well-being index to examine intertemporal changes and the contributions of various factors across both developing and developed countries. The study hypothesises/anticipates that the MDWI will be a valid and robust measure of well-being, which will be used to track well-being and its contributing factors across the globe for informed policy decision-making process.

3. Data and methodology

This section presents the data and methodology used for empirical analysis.

3.1 Data

The empirical analysis of this study uses WVS data to measure and track well-being and its contributing factors between 1999 and 2022. The WVS is one of the largest surveys in the world, collecting nationally representative data from more than 100 countries worldwide (Bartolini & Sarracino, 2015; Lim et al., 2020). The data provide information on various aspects of subjective indicators, ranging from self-reported life satisfaction to political, economic, religious, social, cultural, and ethical beliefs of people (Bartolini & Sarracino, 2015; Lim et al., 2020). Moreover, the survey covers a range of objective indicators of well-being, such as income class, employment, and education that are essential in the economic studies of well-being analyses (Salinas-Jiménez et al., 2011). The richness of this data allows for robust, controlled analyses across countries (Teerakapibal, 2020). Because of the reliability of the WVS, researchers have been widely utilizing these data (e.g., see Bartolini & Sarracino, 2015; Lim et al., 2020; Pitlik & Rode, 2016; Sacks et al., 2010). Table 1 (below) presents a summary of data availability.

For our analysis, we used four recent waves of the WVS: Wave-4: 1999–2004; Wave-5: 2005–2009; Wave-6: 2010–2014; and Wave-7: 2017–2022. These data are cross-sectional by nature. We selected countries containing at least two waves of WVS data from Wave 4 to Wave 7. A total of 48 countries were chosen: 19 from Asia and the Pacific, 12 from Europe, seven from Africa, three from North America, and seven from South America. As seen in Table 1, the WVS contains data for Waves 5, 6, and 7 in Australia, while for Bangladesh, the available waves were only Waves 4 and 7.

3.2 The construction of the MDWI

Following the bottom-up theory of well-being, which postulates that overall well-being is determined by the satisfaction of different life domains, we construct the MDWI using a similar principle of MPI (Alkire & Foster, 2011; Cummins et al., 2003). However, the MPI provides information on multidimensional poverty – that is, the higher the value of the MPI, the greater the multidimensional poverty persists (e.g., see Alkire and Foster, 2011; Jayasinghe et al., 2021; Nussbaumer et al., 2013). In principle, the MPI identifies the dimensions and indicators of poverty, selects the deprivation cut-off and calculates the multidimensional poverty ranges between 0 and 1 (e.g. see Alkire and Santos, 2014). The construction of our MDWI follows the same principle, but instead of the ‘deprivation cut-off’, we calculate the ‘sufficiency cut-off’ and the MDWI values range between 0 and 1, where a higher MDWI value represents a higher level of well-being (e.g. see Hasan et al., 2024). The construction of the index follows a six-step process as explained below.¹

¹ The mathematical equations of the six-step procedure for the construction of the MDWI are presented and described in Appendix A.

Table 1. Countries and WVS waves used in this study

Asia and the Pacific	Available waves	Europe	Available waves	Africa	Available waves	North America	Available waves	South America	Available waves
Australia	5, 6, 7	Armenia	6, 7	Egypt	4, 5, 6, 7	Canada	4, 5, 7	Argentina	4, 5, 6, 7
Bangladesh	4, 7	Cyprus	5, 6, 7	Libya	6, 7	Mexico	4, 5, 6, 7	Brazil	5, 6, 7
China	4, 5, 6, 7	Germany	5, 6, 7	Morocco	4, 5, 6, 7	USA	4, 5, 6, 7	Chile	4, 5, 6, 7
Hong Kong	5, 6, 7	Netherlands	5, 6, 7	Nigeria	4, 6, 7	-	-	Colombia	6, 7
Indonesia	4, 5, 7	Romania	5, 6, 7	South Africa	4, 5, 6	-	-	Ecuador	6, 7
Iran	4, 5, 7	Russia	5, 6	Tunisia	6, 7	-	-	Peru	4, 5, 6, 7
Iraq	4, 5, 6, 7	Slovenia	4, 5, 6	Zimbabwe	4, 6, 7	-	-	Uruguay	5, 6, 7
Japan	4, 5, 6, 7	Spain	5, 6	-	-	-	-	-	-
Jordan	4, 5, 6, 7	Sweden	4, 5, 6, 7	-	-	-	-	-	-
Kyrgyzstan	4, 6, 7	Turkey	5, 6, 7	-	-	-	-	-	-
Lebanon	6, 7	Ukraine	5, 7	-	-	-	-	-	-
Malaysia	5, 6, 7	UK	-	-	-	-	-	-	-
New Zealand	6, 7	-	-	-	-	-	-	-	-
Philippines	4, 6, 7	-	-	-	-	-	-	-	-
Singapore	6, 7	-	-	-	-	-	-	-	-
South Korea	4, 5, 6, 7	-	-	-	-	-	-	-	-
Taiwan	5, 6, 7	-	-	-	-	-	-	-	-
Thailand	5, 6, 7	-	-	-	-	-	-	-	-
Vietnam	4, 5, 7	-	-	-	-	-	-	-	-

Note. Source: Authors' compilation.

3.2.1 Step 1: Identifying the domains and indicators (variables)

The selection of domains and indicators (variables) in this study was informed by Cummins et al. (2003), Hasan et al. (2024), OECD (2011) and Ura et al. (2012). The list of the number of domains/indicators in the literature is inconclusive (Cummins, 1996). The multidimensional well-being literature largely incorporates material well-being, health, finance, social capital, safety, governance and environment as major domains that significantly contribute to well-being (Cummins et al., 2003; OECD, 2011; Ura et al., 2012). Guided by both theoretical relevance and data availability, we select seven important domains – health, finance, social capital, safety, governance, religion, and science and technology – and 25 corresponding indicators associated with the seven domains. We hypothesize that the selected domains and associated indicators adequately capture the multidimensional nature of the well-being of each country under investigation. Detailed information on the selected domains, associated indicators, availability of the domains and indicators across the WVS waves, measurement scales of the indicators, sufficiency thresholds, and supporting literature regarding including the indicators in each domain are presented in Table 2 (below).

As can be seen in Column (1) of Table 2, health is represented by self-assessed health and sufficient access to food and medicine, variables frequently linked to better health outcomes (see Collomb et al., 2012; Senasu et al., 2019; Ura et al., 2012). We expect these to meaningfully capture health-related well-being. The supporting literature regarding the selection of these domains and indicators is presented in Column (5) of Table 2. Similarly, we expect that financial well-being can be measured through satisfaction with finances, saving behaviour and the employment status of both respondents and their spouses, drawing evidence that economic security enhances well-being (Brown et al., 2012; Chen et al., 2021; Sacks et al., 2010; Tang et al., 2018; Van Praag et al., 2003).²

Ura et al. (2012) highlight that cultural belonging fosters social connectedness and trust, enhancing well-being. In this context, trust becomes a cultural resource, developed, transmitted and sustained through shared experiences and collective identities (Collomb et al., 2012; Ura et al., 2012). Moreover, Koç and Turan (2021) and Yucel and Yuan (2016) show that digital forms of communication, such as social media, are used to connect with close networks and reflect culturally embedded patterns of maintaining trust and social ties in modern societies. Likewise, Jayasinghe et al. (2021) emphasize that cultural practices often mediate how individuals build and sustain trust with family, friends and the wider community. Therefore, indicators such as the frequency of social interactions (including through digital platforms), the importance of familial and friendship bonds and levels of trust in others and institutions are expressions of social capital, and we anticipate that they reflect the cultural underpinnings of how well-being is experienced and sustained.

² The spousal employment indicator is available only in the final WVS wave and applies exclusively to respondents who report having a spouse or partner. For respondents who are single, widowed, divorced, or whose marital status is not reported, this indicator is considered not applicable and does not affect their sufficiency score. Accordingly, individuals are assessed using the indicators relevant to their reported household context. Because spousal employment information is available only in some waves, this indicator is included only when observed and weighted accordingly. As with other indicators, cross-country comparisons within each wave remain consistent, and intertemporal comparisons are conducted with explicit acknowledgement of indicator availability.

Table 2. Domains, respective indicators with sufficiency cut-offs

Domains and indicators	Availability domains and indicators in various waves	Scale of measurement	Sufficiency threshold (cut-off) if	Literature supporting the selection of indicators
(1)	(2)	(3)	(4)	(5)
D1: Health				
I1: Self-reported health status	7,6,5,4	5-Point Likert	Has met at least 4 out of 5	Ura et al., 2012
I2: Not often gone without food	7,6	4-Point Likert	Has met at least 3 out of 4	Senasu et al., 2019
I3: Not often gone without medicine	7,6	4-Point Likert	Has met at least 3 out of 4	Collomb et al., 2012
D2: Finance				
I4: Self-rated financial satisfaction	7,6,5,4	10-Point Likert	Has met at least 7 out of 10	Van Praag et al., 2003
I5: Did you save last year	7,6,5,4	Yes or No	Has responded to yes	Chen et al., 2021
I6: Whether the respondent is employed	7,6,5,4	Yes or No	Has responded to yes	Tang et al., 2018
I7: Whether the spouse is employed	7	Yes or No	Has responded to yes	Esche, 2020
D3: Social Capital				
I8: Frequency of using social media	7,6	5-Point Likert	Has met at least 4 out of 5	Koç & Turan, 2021
I9: Importance of family	7,6,5,4	4-Point Likert	Has met at least 3 out of 4	Jayasinghe et al., 2021a
I10: Importance of friends	7,6,5,4	4-Point Likert	Has met at least 3 out of 4	Yucel & Yuan, 2016
I11: Whether most people can be trusted	7,6,5,4	Yes or No	Has responded to yes	Collomb et al., 2012
I12: Trust in different groups of people	7,6,5	4-Point Likert	Has met at least 3 out of 4	Dolan et al., 2008
D4: Safety				
I13: Not felt unsafe at home	7,6	4-Point Likert	Has met at least 3 out of 4	Pease, 2001
I14: Feeling of security	7,6	4-Point Likert	Has met at least 3 out of 4	Dolan et al., 2008
I15: Frequency of various crimes	7,6	4-Point Likert	Has met at least 3 out of 4	Brown et al., 2012
I16: Ever been a victim of crime	7,6	Yes or No	Has responded to no	Hasan et al., 2024
D5: Governance				
I17: How often do you vote	7,6	4-Point Likert	Has met at least 3 out of 4	Ura et al., 2012
I18: Importance of honest election	7,6	4-Point Likert	Has met at least 3 out of 4	Graham & Pettinato, 2001
I19: Government performance	7,6,5,4	10-Point Likert	Has met at least 7 out of 10	Ura et al., 2012
D6: Religion				
I20: Importance of God	7,6,5,4	10-Point Likert	Has met at least 7 out of 10	Dilmaghani, 2018
I21: Attendance at religious services	7,6,5,4	7-Point Likert	Has met at least 6 out of 7	Sinnewe et al., 2015
I22: Frequency of prayer	7,6,4	8-Point Likert	Has met at least 7 out of 8	Devine et al., 2019
D7: Science and Technology				
I23: Technology makes the world better	7,6,5	10-Point Likert	Has met at least 7 out of 10	Koç & Turan, 2021
I24: Technology makes life better	7,6,5	10-Point Likert	Has met at least 7 out of 10	Koç & Turan, 2021
I25: Technology creates opportunities	7,6,5	10-Point Likert	Has met at least 7 out of 10	Hasan et al., 2024

Note. Source: Authors' compilation.

As for the domain of safety, we include the perceptions of personal security, feelings of safety at home and experience with a lower/no frequency of crime, as prior research confirms their impact on well-being (Botha, 2016; Brown et al., 2012; Dolan et al., 2008; Pease, 2001). Additionally, Botha (2016) advocates that good governance is a crucial element for the stable democracy of a country, which in turn enhances overall well-being. Hence, a proxy of people's political participation in the form of their voting behaviour (how often they vote), political freedom in the form of people's opinion on the importance of honest election and self-rated satisfaction with the government's performance are added as the indicators of governance domain (Graham & Pettinato, 2001; Ura et al., 2012). We anticipate that these indicators capture important bottom-up, citizen-reported aspects of governance, such as political participation, perceived electoral integrity, and satisfaction with government performance, which are relevant to well-being (Graham & Pettinato, 2001; Ura et al., 2012). While these measures do not fully encompass the institutional dimensions of governance, such as state capacity or accountability, they provide meaningful proxies for how individuals experience and evaluate governance in their daily lives. This emphasis on participatory and perception-based indicators aligns with the bottom-up conceptualization of well-being adopted in this study and represents a deliberate focus on citizens' lived experiences of governance rather than institutional assessments alone.

Similar to governance, we anticipate that religion is represented by the importance of God, prayer frequency and attendance at religious services, as spirituality and religious engagement are often linked to higher well-being, particularly in culturally devout societies (Devine et al., 2019; Dilmaghani, 2018; Kortt et al., 2015; Sinnewe et al., 2015). Finally, to reflect the role of science and technology, we include self-rated perceptions of technology's impact on life quality, opportunity creation and societal advancement, acknowledging technology's growing relevance for well-being (Hasan et al., 2024; Koç and Turan, 2021). In general, the indicators included in the study capture the respondents' self-reported experiences, perceptions, and evaluations of key life domains. While some indicators reflect observable behaviours or events (e.g., attendance at religious services or experiences of crime), others capture perceived adequacy or satisfaction, which are central to well-being but do not necessarily correspond to objective conditions. For instance, in the safety domain, I13 captures the respondents' feelings of safety based on their experience. Overall, we hypothesize that each domain, through associated indicators, provides a meaningful and contextually grounded contribution to understanding multidimensional well-being. Consistent with the bottom-up theory of well-being, the MDWI prioritises individuals' subjective assessments of how adequately their needs are met across domains, recognising that perceived adequacy and objective circumstances may diverge. Accordingly, the MDWI should be interpreted as a quantitative aggregation of well-being experiences rather than an objective measure of living conditions. This distinction is particularly relevant for indicators such as financial satisfaction or perceived safety, where subjective adequacy may differ from objective hardship or risk.

It is worthwhile to note that there is a clearly established relationship between well-being and above-discussed indicators based on regression analysis in the literature. For an illustration, Health indicators (self-rated health, food adequacy, and access to medicine) are supported by Tang et al. (2018), who used linear regression and found a positive and significant association with life satisfaction. Financial indicators (financial satisfaction, savings, employment, and spouse's employment) are supported by Van Praag et al. (2003), Chen et al. (2021), Frijters et al. (2004), and Esche (2020), employing random-effects, ordered logit, panel, and fixed-effects models, all showing significant associations with life satisfaction, with unemployment exerting a negative effect. Social capital indicators (social media use, importance of family and friends, and

interpersonal trust) are based on Koç and Turan (2020), Jayasinghe et al. (2021a), and Helliwell and Putnam (2004), who applied partial least squares, ordered logit, and linear regressions and reported consistently positive relationships. Safety indicators (perceived insecurity and crime victimisation) follow Kudebayeva and Sharipova (2025) and Powdthavee (2005), using Oaxaca-Blinder decompositions and ordered logit models, found negative and significant associations with subjective well-being. Governance indicators (voting, honest elections, and government performance) draw on Frey and Stutzer (2000) and Helliwell and Putnam (2004), who employed linear and ordered probit regressions and found positive effects on happiness and life satisfaction. Religious indicators (importance of God, religious attendance, and prayer) are informed by Helliwell and Putnam (2004) and Clark and Lelkes (2005), using linear and ordered logit models that show positive and significant associations. Finally, science and technology indicators reflect evidence from Frey et al. (2007), who applied linear and ordered probit models and found positive links between technology-related attitudes and life satisfaction.³

It is also worth mentioning that not all waves of the WVS have contained the same number of indicators. While the number of domains and indicators varies across WVS waves, it remains the same for all countries within a given wave. Additionally, the same set of available indicators is consistently applied across all countries in each wave. This ensures cross-country comparability within waves. Comparability across waves is achieved by maintaining a consistent domain structure and applying identical construction procedures and weighting methods in each wave, while transparently accounting for differences in indicator availability over time. For instance, as presented in Column (2) of Table 2, in Wave-4, we use five domains: (1) health, (2) finance, (3) social capital, (4) governance, and (5) religion; in Wave-5 data, we use six domains, the same domains as in Wave-4, plus science and technology; in Wave-6 and Wave-7, we use seven domains, the same domains as in Wave-5, plus safety domain. Similarly, we use 25 indicators in Wave-7, 24 in Wave-6, 14 in Wave-5 and 11 in Wave-4. For example, self-rated health status (indicator I1 of domain health) is available in all waves (4, 5, 6 and 7) of the WVS. However, the value of the MDWI does not depend just on the number of indicators, but also on the relative weights of each indicator (Hasan et al., 2024).⁴

3.2.2 Step 2: Assigning weights

We use a PCA-based weighting scheme, which plays a critical role in developing the MDWI by offering an objective, data-driven approach to assigning weights to individual indicators that is free from biases (Decancq & Lugo, 2013; Vyas & Kumaranayake, 2006). Unlike arbitrary or equal weighting methods, PCA identifies the underlying structure of the data and assigns weights based on the level of contribution of each indicator to the total variance (Vyas & Kumaranayake, 2006). Therefore, the significance of the PCA-based weighting scheme is that it highlights the relative importance of each indicator and domain. This is crucial because each country under consideration in this study possesses unique socioeconomic characteristics, which change the preferences of the individuals, dictating how they value each indicator differently over time. It is worth mentioning that the total weight of all indicators adds up to 1.

³ A summary of the studies that guided the selection of the indicators is presented in Appendix C.

⁴ A detailed example is presented in Appendix B, demonstrating that the MDWI values do not depend only on the number of associated indicators but also depend on the relative weights of each indicator.

3.2.3 Step 3: Determining the sufficiency (cut-off) threshold matrix

The indicators used in the MDWI are measured using a combination of bipolar scales (e.g., dissatisfaction to satisfaction), unipolar scales (e.g., frequency or intensity), and dichotomous responses. These scale types are not assumed to be directly comparable, as they capture different evaluative processes and psychological reference points (see, e.g., Davern et al., 2007; Forgeard et al., 2011). Accordingly, the MDWI does not assume cardinal equivalence across scales. Instead, sufficiency thresholds are defined at the level of the original response categories to reflect theoretically and empirically grounded notions of adequacy, and are only subsequently expressed as percentages to facilitate aggregation across indicators with heterogeneous measurement scales (e.g. Cummins et al., 2003; Forgeard et al., 2011). Prior well-being research suggests that perceived adequacy is commonly achieved within the upper range of response scales, typically between 60% and 80% (Cummins et al., 2003; Renn et al., 2009; Tiliouine et al., 2006). Therefore, rather than adopting a single paradigmatic cut-off (e.g., 60 per cent), we apply indicator-specific thresholds within this range to reflect differences in scale structure and substantive meaning, consistent with a sufficiency-based, bottom-up approach (Forgeard et al., 2011; Varga et al., 2024).

Columns (3) to (4) of Table 2 outline each indicator's measurement scale and sufficiency threshold. Consistent with Cummins et al. (2003), responses were standardized to percentages using the formula as $\frac{\text{Self reported scale score}}{\text{Max value score}} \times 100$ to assign the sufficiency (cut-off) threshold. For instance, financial satisfaction (I4) is measured using a bipolar 10-point scale (how satisfied are you with your financial status on a scale of 1 = completely dissatisfied to 10 = completely satisfied), with a neutral mid-point between 5 and 6. Consistent with the sufficiency framework, responses 7 and above are interpreted as indicating perceived financial adequacy rather than mere neutrality. Responses below this threshold are not treated as neutral but as reflecting insufficient perceived adequacy, recognising that subjective satisfaction may diverge from objective financial stability (Davern et al., 2007; Forgeard et al., 2011). Therefore, if someone's response was seven, it is converted to 70 per cent ($\frac{7}{10} \times 100 = 70\%$). Similarly, for a five-point Likert scale response (for instance, I1: self-reported health status where 1-least satisfied to 5-highly satisfied), an individual who reported at least 4 or more out of 5 was considered to have met the sufficiency threshold (Hasan et al., 2024).

Following Ura et al. (2012), we follow a slightly distinct approach for I21 (attendance at religious services) and I22 (how often do you pray) to select the sufficiency threshold. The literature suggests that attending religious activities at least once a week is a reasonable sufficiency threshold (Ura et al., 2012). Hence, for the indicators I21 (measured on a seven-point Likert scale) and I22 (measured on an eight-point Likert scale), individuals who attend religious activities and pray at least once a week or more (six or more out of seven for I21 and seven or more out of eight for I22) have been considered for the sufficiency threshold. Relatedly, some indicators were measured in 'yes' or 'no' dichotomous responses (for example, I5–I7 and I16). For I5–I7, the sufficiency threshold was determined by who responded 'yes', while for I16, the sufficiency was determined by who responded 'no' (Hasan et al., 2024).

The MDWI approach incorporates the utility of negative indicators, a concept that is increasingly being discussed in the literature (e.g., see Forgeard et al., 2011). This is incorporated through the indicator satisfaction (or dissatisfaction). For example, in I13: whether someone felt unsafe at home, and in I16: whether someone has ever been a victim of crime (Column 1 of Table 2), the 'yes' response indicates the negative effects on the well-being of the respondent, which will lead to a reduction in the MDWI values. On the other hand, I4: self-rated financial satisfaction

is measured on a scale of 1–10, where 1 is not satisfied at all and 10 is extremely satisfied. The formulation of the sufficiency cut-off considers, in this particular indicator, a neutral (0 for the responses less than 7) to a positive sufficiency (1 for the responses 7 and above).

It is worth noting that the choice of sufficiency threshold involves normative judgment and that alternative thresholds may yield different distributions of well-being. However, such normativity is inherent in well-being measurement and reflects the evaluative nature of subjective experience (Davern et al., 2007; Forgeard et al., 2011).

3.2.4 Step 4: Calculating the proportion of people meeting indicator sufficiency thresholds (H)

After determining the sufficiency matrix in Step 3, we established the sufficiency threshold to determine whether a person has attained adequate achievement in that aspect of well-being. This is also known as the headcount (H) ratio. We used a binary scoring approach, such that individuals were assigned a value of 1 if they met the sufficiency threshold (sufficient), and 0 if they did not (insufficient). Once each individual's status across indicators was determined, a weighted sum of sufficiencies was calculated using the user-written command in STATA-17 software to reflect the proportion of total well-being that they possessed. Following the multidimensional sufficiency framework, individuals are identified as multidimensionally well if their weighted sufficiency score meets or exceeds the well-being cut-off (k). In this study, we adopt a cut-off, $k = 33\%$, meaning that an individual must achieve sufficiency in at least one-third of the total weighted indicators to be classified as multidimensionally well. This threshold is consistent with established practice in the Alkire-Foster methodology and has been widely used in applications of multidimensional well-being measurement to balance inclusiveness with meaningful adequacy (see, e.g., Hasan et al., 2024; Ura et al., 2012).⁵

3.2.5 Step 5: Calculating the intensity of (degree of achieved) well-being (A)

The intensity of well-being (denoted as A)—hereafter referred to as the degree of achieved well-being—represents the average share of indicators in which multidimensionally well individuals have achieved sufficiency (Alkire & Santos, 2014).⁶ It reflects how broadly individuals meet adequacy across well-being domains, rather than the affective experience or experiential intensity of well-being. To calculate this, we first considered each individual's sufficiency score – that is, how many indicators (out of the total) for which they met the sufficiency threshold. These scores were then summed across all individuals in the sample, and the total was divided by the number of people considered multidimensionally well (i.e. those who met or exceeded the defined well-being cut-off). In doing so, we used the STATA-17 version and the user-written command of the MPI (Pacifico & Poege, 2017).

3.2.6 Step 6: Calculating the MDWI

The MDWI is the product of the headcount ratio (H) and the degree of achieved well-being (A). The MDWI captures the information on both the incidence and the degree of achieved well-being. The value of the MDWI ranges between 0 and 1; the higher the value, the greater the level of well-being. We estimate the degree of achieved well-being (A), headcount ratio (H), MDWIs and the

⁵ We acknowledge that the selection of k involves normative judgment; however, prior research shows that relative comparisons and domain contribution patterns are generally robust to reasonable variation in this cut-off (see, e.g., Alkire & Foster, 2011; Decanq & Lugo, 2013).

⁶ The term “intensity” is restrained from the multidimensional poverty and well-being literature to denote the breadth of sufficiency achievements. It does not refer to emotional or experiential intensity as used in psychometric or affective measurement.

contribution of each domain/indicator to the MDWI using STATA-17 software and the user-written commands for the multidimensional poverty index by Pacifico and Poege (2017). In addition to the MDWI values, the domain and indicator contribution values are also generated by the MPI command in STATA (see Pacifico & Poege, 2017). For instance, if the health domain's contribution is 0.25, this implies that the health domain contributes 25 per cent to the MDWI (e.g. see Hasan et al., 2024).

3.3 Check the robustness of the calculated MDWI

We also carried out an analysis to check the robustness of the MDWI values with the other well-being measures in the literature. Our findings were in line with those reported in the World Happiness Report, commonly known as WHR, based on Gallup World Poll data. In particular, the WHR found that European countries generally enjoy moderate to high levels of well-being, except for Ukraine and Russia. Over time, well-being increases in the European region. In Asia and the Pacific, New Zealand, Australia, Taiwan, China and Singapore rank in the top 50 and enjoy moderately high well-being. None of the African countries is ranked in the top 50, and they experience low to moderate levels of well-being. Canada, Mexico and the United States are ranked in the top 25 and enjoy a moderately high level of well-being in North America. Among South American countries, Chile, Brazil, Uruguay, Colombia, Argentina and Ecuador are ranked in the top 50 and enjoy moderate well-being (WHR, 2013–2022). Our cross-country analysis based on MDWI provides similar insights.

In addition, the OECD Better Life Index also ranked Australia, Canada and the Netherlands as enjoying a moderately high level of well-being compared with other countries (OECD, 2020). Our estimates show similar observations. Moreover, by constructing the Good African Society Index (GASI), Botha (2016) showed that among the 45 African countries, Egypt and Morocco enjoy similar levels of well-being (ranked fourth and fifth in Africa) and greater than that of South Africa. Our MDWI exhibits similar results.

Furthermore, using the International Well-being Index (IWI), Cummins et al. (2003) showed that for developed nations (Australia and Austria), average life satisfaction ranges from 70 per cent to 80 per cent SM. On the other hand, for developing nations such as Algeria, the score ranges from 60–70 per cent SM (Tiliouine et al., 2006). We generated averages of MDWI values for developed and developing countries and across waves of the WVS, and depicted their distributions using histograms. As seen in Figures 1–4 (below), across the waves, the distribution of the average MDWI values is approximately normally distributed with a concentration of 0.6–0.7 (60–70% SM) for developing and 0.7–0.8 (70–80% SM) for developed countries. This evidence suggests that the MDWI constructed in this study provides a robust measure for well-being that aligns with the existing research.

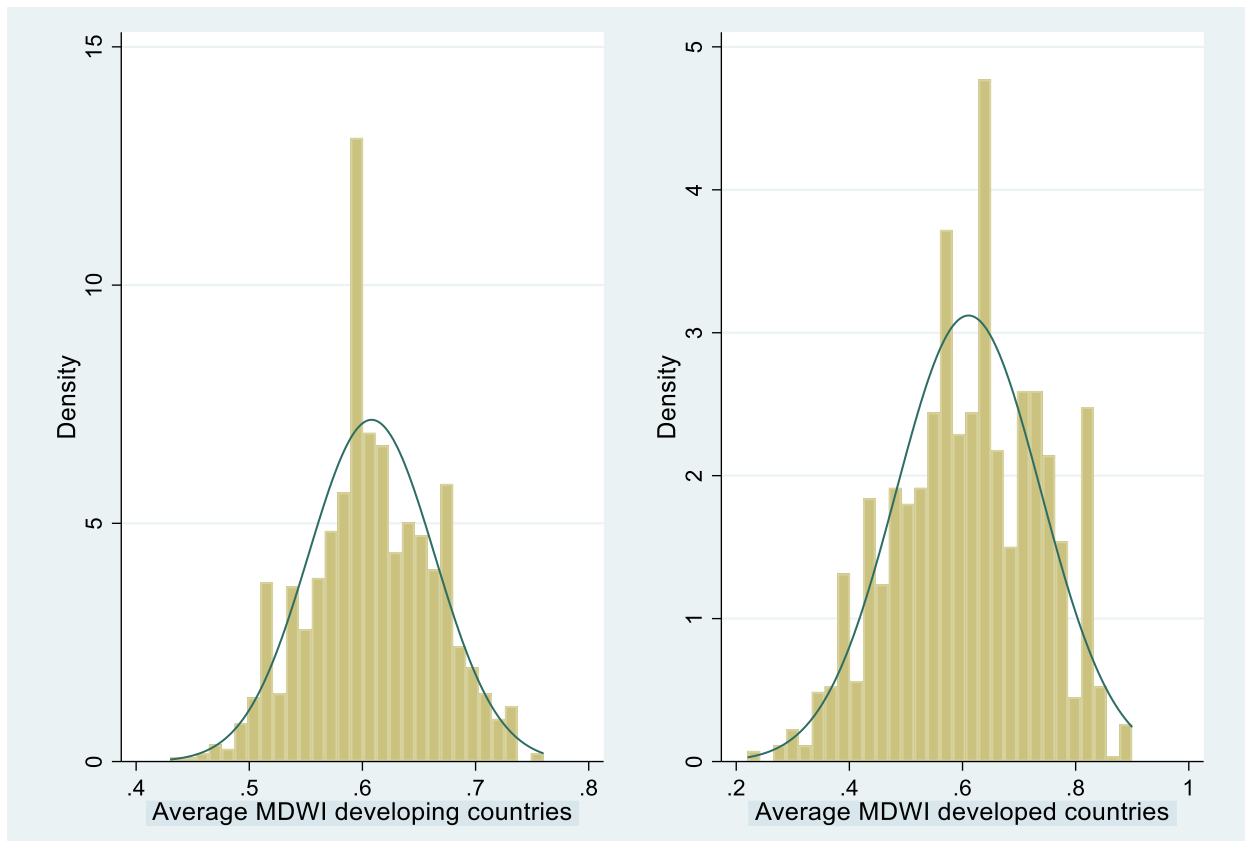


Figure 1. The distribution of MDWI average values by developing and developed countries, WVS Wave-4

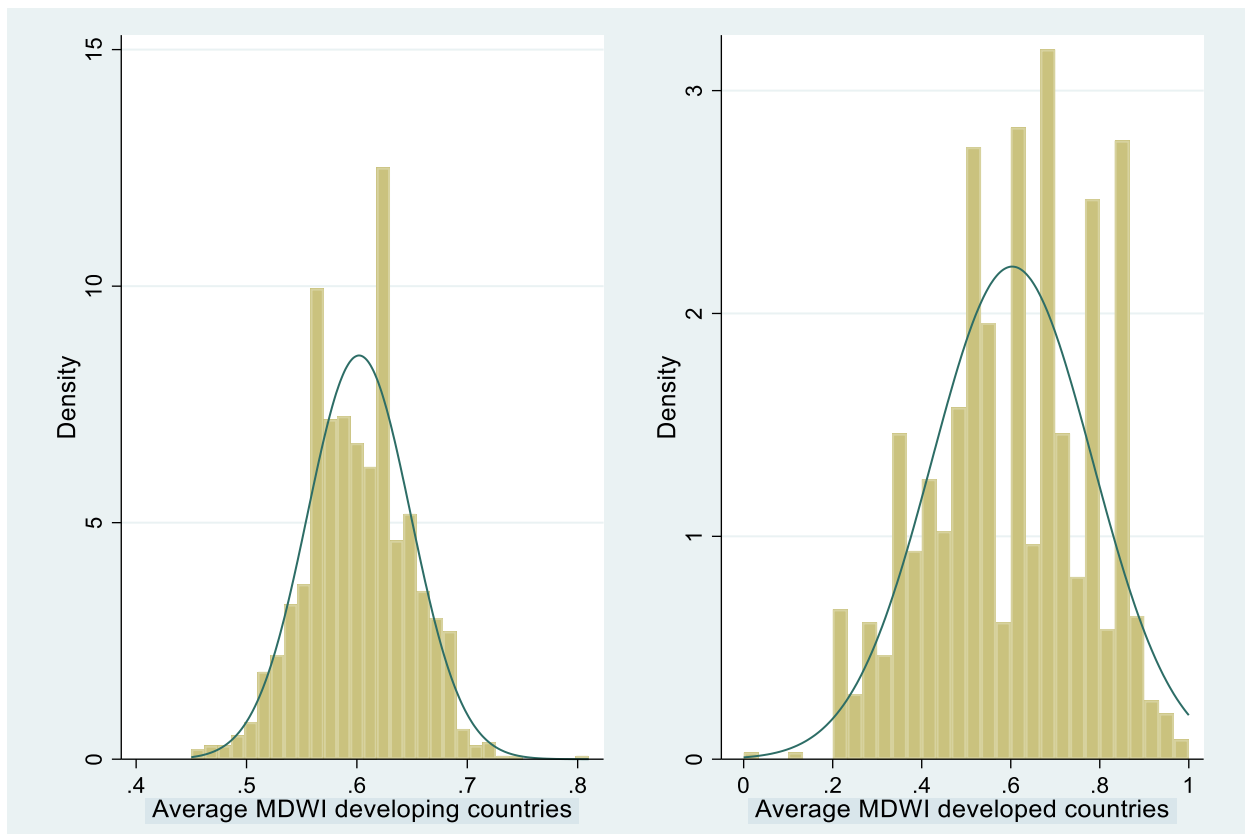


Figure 2. The distribution of MDWI average values by developing and developed countries, WVS Wave-5

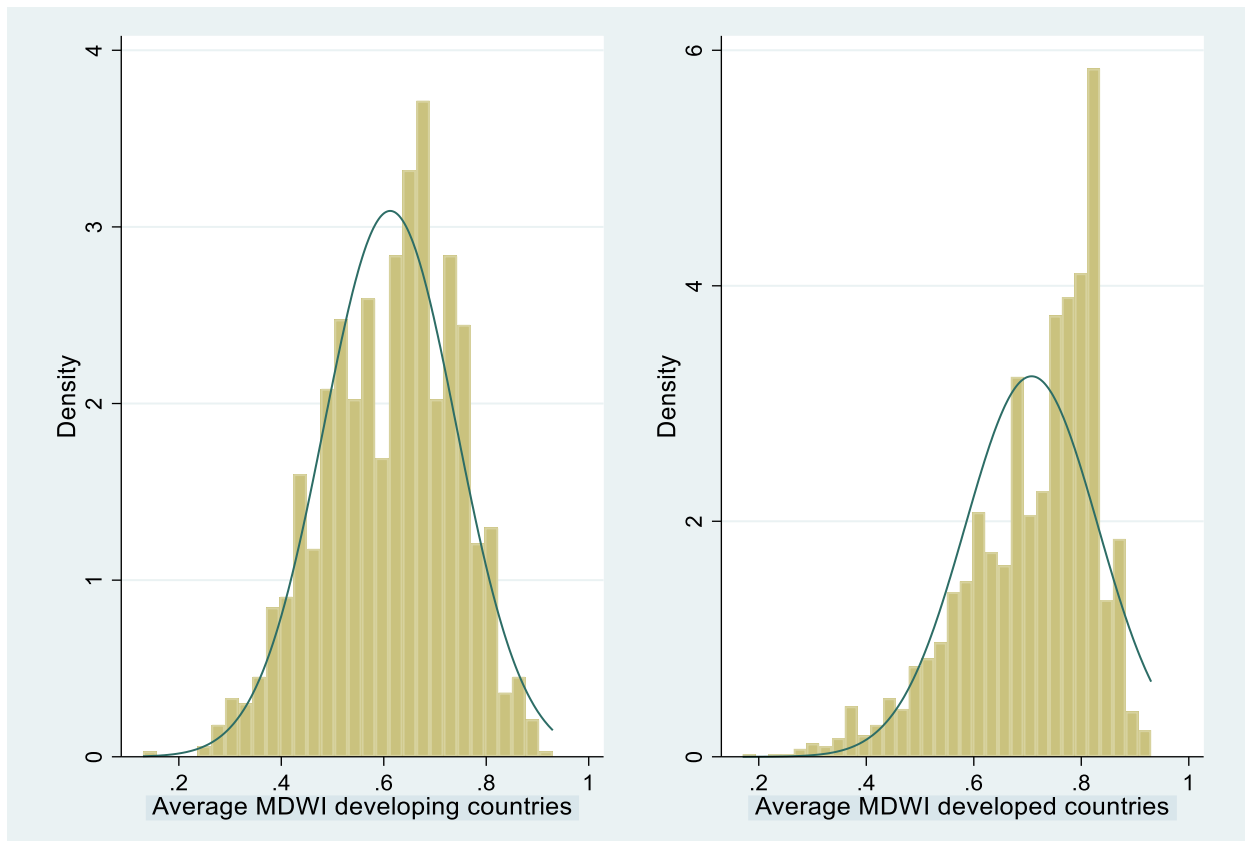


Figure 3. The distribution of MDWI average values by developing and developed countries, WVS Wave-6

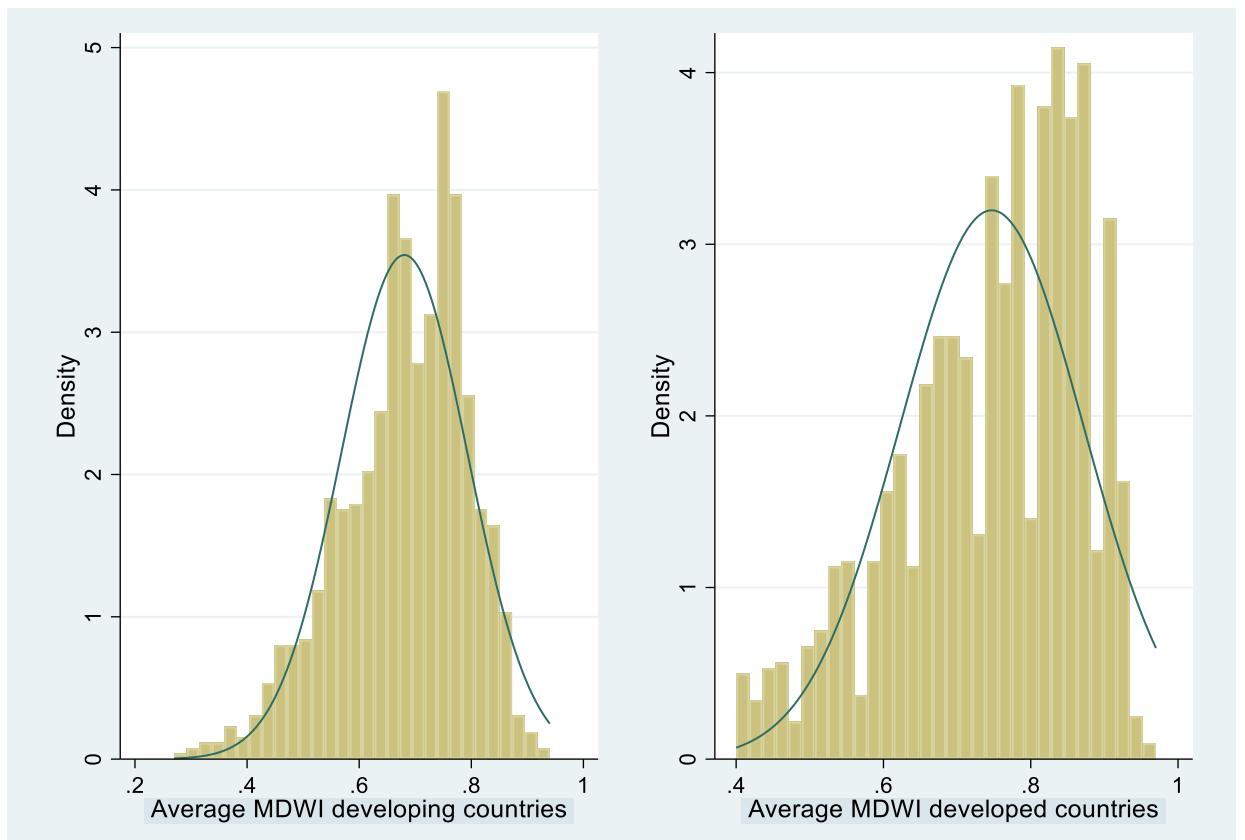


Figure 4. The distribution of MDWI average values by developing and developed countries, WVS Wave-7

4. Results and discussion

In what follows, we first present and discuss the intertemporal changes in well-being across regions and countries. We then present and discuss the domain's contribution to the MDWI by country and region. For a nuanced understanding of how the domain contributions vary by a country's level of economic development, we also compare the changes in domains' average contribution by region and based on a country's income levels.

4.1 Changes in well-being by country and region

Table 3 (below) presents the intertemporal changes in the MDWIs in Columns (10)–(13), the headcount ratio (H) in Columns (2)–(5), and the degree of achieved well-being (A) in Columns (6)–(9) by an individual country and region based on the six steps described in Section 3.2. The H values indicate the proportion of people who met the sufficiency threshold in the number of indicators out of the total number of indicators. The A values represent the proportion of people who enjoy better well-being outcomes in respective waves and countries (Hasan et al., 2024). The MDWI is the product of H and A, and these values are generated by the user-written MPI command in STATA-17 software.

It is worth noting that the MDWI is designed as a subjective, perception-based measure of multidimensional well-being. Specifically, the MDWI captures individuals' self-assessed sufficiency across life domains, following the bottom-up theory.⁷ Therefore, the MDWI reflects how well people believe their needs are met within the domains/indicators under consideration of this study, and does not necessarily imply people's objective conditions, such as their standard of living.

Additionally, MDWI trends over time should be interpreted as changes in how individuals perceive their well-being in relation to the domains/indicators, rather than as a definitive measure of objective or absolute well-being. The MDWI reflects evolving subjective experiences, which may be shaped by both personal circumstances and broader contextual factors, such as economic crises, policy changes or sociopolitical instability. This aligns with the literature on well-being that recognizes individual perceptions are influenced by both internal evaluation and external realities (Diener et al., 2009). While the MDWI may not directly measure the objective impacts of external shocks – for example, inflation or pandemics – it does capture how people feel about their lives in response to those events. Therefore, the observed trends are meaningful because subjective well-being itself is a critical dimension of the equality of life, increasingly used in public policy evaluations (Forgeard et al., 2011; OECD, 2013).

Overall, the selected 48 countries enjoy moderate (MDWI > 0.40) to moderately high (MDWI < 0.80) levels of well-being. In general, and over time, well-being has increased in almost all countries under investigation in this study, with a few exceptions. Country-specific changes in well-being by region are discussed in the following subsections.

⁷ The objective of the MDWI is not to estimate causal or associative relationships between individual indicators and well-being, but to provide a construct-valid representation of experienced well-being as a multidimensional phenomenon. In this context, indicators are selected because they are recognised as intrinsic dimensions of well-being, not because they predict an external well-being variable.

Table 3. Intertemporal changes in the degree of achieved well-being (A), headcount ratio (H) and MDWI

Region and country	Headcount ratio (H)				Degree of achieved well-being (A)				MDWI			
	W4	W5	W6	W7	W4	W5	W6	W7	W4	W5	W6	W7
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Asia and the Pacific												
Australia	-	0.937	0.981	0.990	-	0.641	0.690	0.728	-	0.601	0.677	0.720
Bangladesh	0.910	-	-	0.964	0.593	-	-	0.586	0.539	-	-	0.565
China	0.939	0.889	0.970	0.994	0.589	0.564	0.598	0.668	0.553	0.502	0.580	0.663
Hong Kong	-	0.793	0.953	0.963	-	0.576	0.606	0.653	-	0.456	0.578	0.611
Indonesia	0.982	0.974	-	0.996	0.643	0.642	-	0.628	0.632	0.625	-	0.628
Iran	0.946	0.962	-	0.970	0.574	0.616	-	0.569	0.543	0.593	-	0.552
Iraq	0.987	0.897	0.927	0.894	0.623	0.573	0.594	0.551	0.615	0.514	0.551	0.492
Japan	0.934	0.883	0.918	0.957	0.581	0.579	0.560	0.588	0.543	0.511	0.514	0.563
Jordan	0.946	0.961	0.987	0.989	0.605	0.671	0.605	0.647	0.572	0.645	0.597	0.640
Kyrgyzstan	0.870	-	0.981	0.998	0.547	-	0.615	0.690	0.475	-	0.604	0.689
Lebanon	-	-	0.931	0.991	-	-	0.590	0.656	-	-	0.549	0.649
Malaysia	-	0.973	0.993	0.977	-	0.631	0.678	0.655	-	0.614	0.673	0.640
New Zealand	-	-	0.971	0.980	-	-	0.692	0.708	-	-	0.672	0.693
Philippines	0.991	-	0.972	0.983	0.611	-	0.559	0.570	0.605	-	0.544	0.560
Singapore	-	-	0.988	0.994	-	-	0.671	0.721	-	-	0.663	0.717
South Korea	0.919	0.889	0.974	0.998	0.605	0.579	0.624	0.700	0.556	0.512	0.607	0.698
Taiwan	-	0.931	0.980	0.984	-	0.589	0.628	0.660	-	0.549	0.615	0.650
Thailand	-	0.956	0.982	0.969	-	0.628	0.579	0.627	-	0.601	0.569	0.607
Vietnam	0.843	0.950	-	0.995	0.544	0.603	-	0.691	0.459	0.573	-	0.691
Europe												
Armenia	-	-	0.832	0.979	-	-	0.506	0.590	-	-	0.421	0.577
Cyprus	-	0.925	0.956	0.993	-	0.568	0.582	0.649	-	0.526	0.557	0.644
Germany	-	0.822	0.985	0.993	-	0.570	0.648	0.701	-	0.469	0.638	0.696
Great Britain	-	0.934	-	0.964	-	0.623	-	0.676	-	0.582	-	0.652
Netherlands	-	0.925	0.991	0.993	-	0.612	0.699	0.750	-	0.566	0.693	0.744

Region and country	Headcount ratio (H)				Degree of achieved well-being (A)				MDWI			
	W4	W5	W6	W7	W4	W5	W6	W7	W4	W5	W6	W7
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Romania	-	0.738	0.901	0.939	-	0.542	0.566	0.641	-	0.400	0.510	0.602
Russia	-	0.740	0.894	0.965	-	0.510	0.530	0.609	-	0.377	0.474	0.588
Slovenia	-	0.805	0.978	-	-	0.562	0.604	-	-	0.452	0.591	-
Spain	0.893	0.901	0.965	-	0.636	0.584	0.594	-	0.568	0.526	0.573	-
Sweden	-	0.969	0.987	-	-	0.689	0.699	-	-	0.668	0.689	-
Turkey	0.862	0.941	0.970	0.968	0.544	0.556	0.589	0.693	0.469	0.524	0.571	0.618
Ukraine	-	0.702	0.945	0.948	-	0.522	0.553	0.601	-	0.367	0.523	0.569
Africa												
Egypt	0.917	0.931	0.811	0.926	0.616	0.567	0.549	0.581	0.565	0.528	0.446	0.538
Libya	-	-	0.996	0.995	-	-	0.650	0.654	-	-	0.647	0.650
Morocco	0.940	0.950	0.891	0.981	0.604	0.577	0.565	0.608	0.568	0.549	0.504	0.596
Nigeria	0.998	-	0.988	0.977	0.763	-	0.597	0.601	0.762	-	0.589	0.587
South Africa	0.953	0.953	0.953	-	0.632	0.656	0.596	-	0.602	0.625	0.568	-
Tunisia	-	-	0.956	0.949	-	-	0.595	0.589	-	-	0.569	0.559
Zimbabwe	0.879	-	0.984	0.925	0.556	-	0.571	0.514	0.489	-	0.562	0.475
North America												
Canada	0.964	0.963	-	0.971	0.676	0.658	-	0.703	0.652	0.634	-	0.682
Mexico	0.929	0.924	0.978	0.942	0.634	0.596	0.602	0.559	0.589	0.550	0.589	0.527
United States	0.970	0.948	0.954	0.964	0.723	0.663	0.685	0.681	0.702	0.628	0.653	0.656
South America												
Argentina	0.881	0.930	0.960	0.974	0.565	0.589	0.614	0.634	0.489	0.548	0.589	0.617
Brazil	-	0.924	0.976	0.959	-	0.559	0.602	0.577	-	0.517	0.588	0.553
Chile	0.887	0.815	0.937	0.931	0.583	0.548	0.580	0.602	0.517	0.447	0.544	0.561
Colombia	-	-	0.969	0.968	-	-	0.580	0.581	-	-	0.562	0.563
Ecuador	-	-	0.978	0.952	-	-	0.603	0.581	-	-	0.589	0.553
Peru	0.815	0.782	0.883	0.897	0.565	0.511	0.525	0.515	0.461	0.399	0.463	0.462
Uruguay	-	0.897	0.958	0.969	-	0.559	0.611	0.630	-	0.501	0.586	0.611

Note. Source: Authors' calculations. All the values are significant at 5% level of significance. W4 indicates Wave-4, W5=Wave-5, etc., of the WVS.

4.1.1 Asia and the Pacific countries

As can be seen in Columns (10)–(13) of Table 3, in general, countries in Asia and the Pacific region enjoy low to moderately high levels of well-being, ranging from MDWI = 0.456 (Hong Kong: Wave-5) to MDWI = 0.720 (Australia: Wave-7). Well-being increased in Australia, Bangladesh, China, Hong Kong, Japan, Jordan, Kyrgyzstan, Lebanon, New Zealand, Singapore, South Korea, Taiwan and Vietnam. The increase in MDWI is attributed to the increased headcount ratio (H) (Columns (2)–(5) of Table 3), and an increase in the proportion of people enjoying higher degree of well-being (A), (Columns (6)–(9) of Table 3) because these countries made significant economic progress over the last two decades and experienced positive economic growth (World Bank, 2022), which helped to improve their overall standard of living. On the other hand, the MDWI decreased in Iran, Iraq, Malaysia, the Philippines and Thailand, with some fluctuations that could be attributed to the Iraq war and continued safety and security concerns in these countries. These estimates conform to the WHR (2013–2019) and the OECD Better Life Index.

4.1.2 European countries

All the European countries, as presented in Table 3 (Columns (10)–(13)), enjoy a moderately high level of well-being (MDWI > 0.60), and well-being has increased over time (except in Spain during 2008), ranging from MDWI = 0.377 (Wave-5 in Ukraine) to MDWI = 0.744 (Wave-7 in the Netherlands). We observe that, compared with other regions, people in the European region enjoy slightly higher well-being. This is because of increased headcount and degree of achieved well-being (Columns (2)–(9)) over time, and the strong social security and social safety nets (SSN) (more than about 25 per cent of GDP is allocated for SSN) across Europe (Eurostat, 2021). These estimates are consistent with the 2013 OECD Better Life Index.

4.1.3 African countries

The seven selected African countries, as seen in Table 3 (Columns (10)–(13)), enjoy low to moderately high levels of well-being, ranging from MDWI = 0.489 (Zimbabwe: Wave-4) to MDWI = 0.650 (Libya: Wave-7). The MDWI has fluctuated marginally in Egypt, Morocco and South Africa, decreased in Nigeria, Tunisia and Zimbabwe, and increased in Libya. Countries such as Egypt, Libya and Morocco experienced a slight increase in the MDWI (as the headcount and degree of achieved well-being increased over time), which is attributed to positive economic growth in the Sub-Saharan region over time (World Bank, 2022). The countries where it decreased, such as Nigeria, South Africa and Zimbabwe, have been suffering from high inflation rates (World Bank, 2022). In general, people in the African region enjoy slightly lower levels of well-being compared with the other regions, except in Libya. These estimated MDWI values are consistent with the WHR and the Good African Society Index.

4.1.4 North American countries

As seen in Table 3 (Columns (10)–(13)), in North American countries, similar to European countries, the headcount ratio and degree of achieved well-being increased, so the populations generally enjoy a moderately high level of well-being compared with other regions. In general, the MDWI in Canada increased while it marginally decreased in Mexico and the United States. The enjoyment of a slightly higher level of well-being in these countries can be attributed to the effect of strong social security and social safety nets (in 2018, more than 34 per cent of the population received SSN benefits in the United States) (King, 2022). However, it is also observed

that, in Mexico and the United States, well-being has been in a declining trend over time. Our estimates are consistent with the WHR and the OECD Better Life Index.

4.1.5 South American countries

South American countries generally enjoy a moderate level of well-being, as presented in Table 3 (Columns (10)–(13)). Over time, the MDWI has increased in Argentina, Colombia, and Uruguay, while it decreased in Ecuador and fluctuated in Brazil, Chile, and Peru, due to the varying trends in headcount and the degree of achieved well-being. Generally, South American countries experience slightly lower levels of well-being compared to European and North American countries.

Overall, in countries where a high proportion of people enjoy a higher degree of achieved well-being (A) and have sufficiency in a higher number of indicators (H) because of a higher standard of living, social security, and better law and order situations, the MDWI has increased in these countries over time. In contrast, in countries where a low proportion of people enjoy a lower degree of achieved well-being (A) and have sufficiency in a lower number of indicators (H) because of concerns regarding safety and security, low standard of living, and high inflation, the MDWI has decreased in these countries over time. However, as explained in Section 3.3, our overall findings align with those of the WHR, the OECD Better Life Index, the GASI and the IWI. Thus, the constructed MDWI suggests a reliable measure of well-being, which produces globally comparable results with other available indexes. Therefore, the MDWI can be utilised as a base for tracking and measuring well-being, especially for tracking its contributing factors for policy purposes. In Section 4.2, we present and discuss the changes in an individual domain's contribution by country across regions. We also present and discuss the average of a domain's contribution by region for a nuanced understanding of whether the average of a domain's contribution follows a similar trend to the country's level of economic development.

4.2 Changes in individual domains' contribution by region and country

In this section, we present and discuss the intertemporal changes in an individual domain's contribution to the MDWI. It is worth mentioning that no previous study has undertaken such a comprehensive analysis of the contribution of domains to well-being. Hence, a comparative analysis is not possible. However, we compared our results within the region considered for the study. It is worth noting that an individual domain's contribution is presented in absolute values, and all the domains' contribution to a particular wave adds up to 1. However, the interpretations are made based on percentages multiplying the absolute domain contributions by 100. Furthermore, researchers and policymakers should practice caution when interpreting domain contribution estimates in this study, as these values are descriptive and do not imply causal relationships between individual domains and the MDWI. Our analyses provide information on each indicator's contribution to the MDWI for further policy guidelines.

In addition, further precautions are required in explaining the declining trend in domain/indicator contributions from negative to positive or neutral to positive. Our MDWI is a product of the headcount (H) and degree of achieved well-being (A) ratios. The headcount ratio represents the sufficiency proportion in all indicators. The degree of achieved well-being ratio indicates the proportion of people who met the sufficiency standard in all indicators. Therefore, if the sufficiency threshold declines (from 1 to 0), it will reduce the intensity ratio, and hence the overall well-being and contribution of that domain. As explained by O'Rourke and Cooper (2010) and Forgeard et al. (2011), a negative-to-positive measure reduced loneliness or stress and offers complementary insights by focusing on the alleviation of distress. On the other hand, our MDWI

indicator, such as a drop in the sufficiency of financial satisfaction, may not equate to financial hardship, but rather to a decline in perceived adequacy. The domains' contributions to the MDWI are explained below by regions.

Tables 4 and 5 present the various domains' contribution to the MDWI by waves and their average contribution by region.

4.2.1 Asia and the Pacific countries

As can be seen in Tables 4 and 5, the domain contributions vary over time in Asia and the Pacific region: health is the largest contributor (20–40 per cent) in almost all waves (Columns (2)–(5) of Table 4), followed by social capital (20–40 per cent) (Columns (6)–(9) of Table 4), finance (20–30 per cent) (Columns (10)–(13) of Table 4), safety (10–20 per cent) (Columns (2)–(5) of Table 5), governance (5–15 per cent) (Columns (6)–(9) of Table 5), science and technology (5–15 per cent) (Columns (14)–(17) of Table 5) and religion (5–10 per cent) (Columns (10)–(13) of Table 5). The health domain's contribution to the MDWI exhibits a fluctuating trend in countries such as Australia, China, Hong Kong, Iran, Japan, Jordan, Kyrgyzstan, Malaysia, the Philippines, South Korea and Thailand; increases in Iraq, Thailand and Vietnam; and decreases in Indonesia, Lebanon, New Zealand and Singapore.

Fluctuations are observed in the finance domain's contribution to the MDWI in most countries, while it increases in Lebanon, New Zealand and Singapore and decreases in Indonesia, Iran, Iraq and Vietnam. In general, the social capital domain's contribution to the MDWI decreases in most countries, while it fluctuates in Iraq and Malaysia and increases in Lebanon and New Zealand. Over time, the safety domain's contribution to the MDWI has increased in most countries and decreased in China, Hong Kong and Taiwan. The governance domain's contribution to the MDWI fluctuates over time; it increases in China, Indonesia, Iraq, Japan, Kyrgyzstan, Lebanon, Malaysia, New Zealand, South Korea and Vietnam, while it decreases in Hong Kong and Singapore. The contributions of religion, and science and technology domains remain more or less the same, with a declining trend across countries. Overall, the changes in the domain contribution to the MDWI in the Asia and Pacific region exhibit a similar pattern to other regions.

4.2.2 European countries

In Europe, similar to Asia and the Pacific, the health (Columns (2)–(5) of Table 4) domain contributes the most, followed by social capital (Columns (10)–(13) of Table 4), finance (Columns (6)–(9) of Table 4), safety (Columns (2)–(5) of Table 5), governance (Columns (6)–(9) of Table 5), science and technology (Columns (14)–(17) of Table 5), and religion (Columns (10)–(13) of Table 5). The contribution of the health domain varies over time and by country; it decreases in Armenia and increases in Romania, Slovenia, Sweden, the United Kingdom and Ukraine. The contributions of the domains of social capital and religion have declined in all countries, while the contribution of safety has increased all over Europe. Over time, fluctuations are observed in the contributions of the finance, governance and science and technology domains to the MDWI.

Table 4. Changes in health, finance and social capital domains' contribution by country and region

Region and country	Health				Finance				Social capital			
	W4	W5	W6	W7	W4	W5	W6	W7	W4	W5	W6	W7
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Asia and the Pacific												
Australia	-	0.202	0.355	0.328	-	0.245	0.129	0.200	-	0.340	0.209	0.178
Bangladesh	0.166	-	-	0.266	0.302	-	-	0.184	0.287	-	-	0.158
China	0.199	0.192	0.363	0.307	0.338	0.264	0.174	0.191	0.463	0.333	0.211	0.222
Hong Kong	-	0.222	0.348	0.317	-	0.386	0.146	0.242	-	0.342	0.202	0.199
Indonesia	0.210	0.172	-	0.172	0.356	0.204	-	0.187	0.435	0.308	-	0.128
Iran	0.217	0.196	-	0.219	0.300	0.241	-	0.091	0.483	0.343	-	0.244
Iraq	0.190	0.195	0.302	0.309	0.168	0.171	0.119	0.069	0.380	0.436	0.201	0.257
Japan	0.181	0.200	0.317	0.283	0.350	0.236	0.143	0.204	0.468	0.321	0.217	0.192
Jordan	0.235	0.229	0.306	0.279	0.176	0.112	0.071	0.131	0.396	0.337	0.191	0.192
Kyrgyzstan	0.203	-	0.282	0.256	0.333	-	0.110	0.176	0.460	-	0.202	0.168
Lebanon	-	-	0.349	0.272	-	-	0.136	0.153	-	-	0.165	0.181
Malaysia	-	0.246	0.351	0.276	-	0.233	0.148	0.197	-	0.242	0.155	0.194
New Zealand	-	-	0.397	0.311	-	-	0.159	0.201	-	-	0.175	0.209
Philippines	0.130	-	0.204	0.161	0.214	-	0.133	0.186	0.308	-	0.188	0.188
Singapore	-	-	0.344	0.302	-	-	0.130	0.179	-	-	0.183	0.179
South Korea	0.253	0.200	0.400	0.334	0.278	0.235	0.122	0.174	0.389	0.321	0.183	0.167
Taiwan	-	0.215	0.326	0.286	-	0.244	0.125	0.166	-	0.297	0.198	0.179
Thailand	-	0.178	0.293	0.313	-	0.241	0.132	0.172	-	0.300	0.180	0.196
Vietnam	0.188	0.159	-	0.231	0.309	0.234	-	0.198	0.425	0.323	-	0.188
Averages	0.197	0.200	0.329	0.275	0.284	0.234	0.132	0.174	0.409	0.326	0.191	0.190
Europe												
Armenia	-	-	0.267	0.226	-	-	0.097	0.134	-	-	0.215	0.193
Cyprus	-	0.232	0.351	0.313	-	0.208	0.117	0.162	-	0.293	0.189	0.179
Germany	-	0.207	0.330	0.274	-	0.280	0.149	0.184	-	0.332	0.199	0.179
Great Britain	-	0.198	-	0.328	-	0.240	-	0.135	-	0.442	-	0.220

Region and country	Health				Finance				Social capital			
	W4	W5	W6	W7	W4	W5	W6	W7	W4	W5	W6	W7
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Netherlands	-	0.199	0.375	0.320	-	0.275	0.140	0.203	-	0.431	0.194	0.194
Romania	-	0.230	0.308	0.340	-	0.196	0.114	0.174	-	0.285	0.158	0.161
Russia	-	0.155	0.301	0.284	-	0.233	0.120	0.169	-	0.493	0.223	0.180
Slovenia		0.195	0.371	-	-	0.289	0.142	-		0.305	0.186	-
Spain	0.260	0.225	0.380	-	0.320	0.237	0.121	-	0.342	0.316	0.192	-
Sweden	-	0.186	0.367	-	-	0.275	0.148	-		0.343	0.217	-
Turkey	0.226	0.172	0.304	0.295	0.191	0.166	0.106	0.147	0.395	0.302	0.205	0.201
Ukraine	-	0.192	0.218	0.274	-	0.198	0.141	0.149	-	0.359	0.219	0.208
Averages	0.243	0.199	0.325	0.295	0.256	0.236	0.127	0.162	0.369	0.355	0.200	0.191
Africa												
Egypt	0.202	0.177	0.378	0.294	0.265	0.134	0.089	0.136	0.366	0.330	0.228	0.183
Libya	-	-	0.278	0.236	-	-	0.135	0.175	-	-	0.172	0.190
Morocco	0.188	0.218	0.368	0.255	0.261	0.201	0.140	0.153	0.347	0.292	0.187	0.204
Nigeria	0.188	-	0.229	0.231	0.317	-	0.134	0.167	0.295	-	0.194	0.178
South Africa	0.203	0.191	0.302	-	0.298	0.204	0.134	-	0.318	0.238	0.184	-
Tunisia	-	-	0.347	0.247	-	-	0.105	0.169	-	-	0.180	0.189
Zimbabwe	0.225	-	0.252	0.153	0.283	-	0.120	0.142	0.274	-	0.178	0.196
Averages	0.201	0.195	0.308	0.236	0.285	0.180	0.122	0.157	0.320	0.287	0.189	0.190
North America												
Canada	0.214	0.192	-	0.317	0.328	0.242	-	0.172	0.343	0.312	-	0.199
Mexico	0.176	0.163	0.262	0.245	0.307	0.250	0.136	0.194	0.304	0.254	0.154	0.186
United States	0.214	0.241	0.395	0.310	0.326	0.221	0.133	0.174	0.332	0.316	0.186	0.199
Averages	0.201	0.199	0.329	0.291	0.320	0.238	0.135	0.180	0.326	0.294	0.170	0.195
South America												
Argentina	0.197	0.199	0.340	0.315	0.258	0.244	0.085	0.182	0.372	0.376	0.204	0.206
Brazil	-	0.168	0.304	0.289	-	0.188	0.123	0.184	-	0.292	0.157	0.188

Region and country	Health				Finance				Social capital			
	W4	W5	W6	W7	W4	W5	W6	W7	W4	W5	W6	W7
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Chile	0.209	0.222	0.317	0.327	0.271	0.215	0.132	0.191	0.356	0.257	0.190	0.199
Colombia	-	-	0.271	0.231	-	-	0.145	0.175	-	-	0.151	0.180
Ecuador	-	-	0.275	0.255	-	-	0.132	0.171	-	-	0.164	0.174
Peru	0.160	0.150	0.222	0.211	0.265	0.248	0.156	0.242	0.342	0.261	0.153	0.169
Uruguay	-	0.214	0.354	0.321	-	.198	0.148	0.121	-	0.326	0.180	0.198
Averages	0.189	0.191	0.298	0.278	0.265	0.219	0.132	0.181	0.357	0.302	0.171	0.188

Note. Source: Authors' calculations. Note: W4 = Wave-4, W5 = Wave-5, W6 = Wave-6 and W7 = Wave-7 of the WVS.

Table 5. Changes in the safety, governance, religion and technology domains' contribution by country and region

Region and country	Safety				Governance				Religion				Science and technology			
	W4	W5	W6	W7	W4	W5	W6	W7	W4	W5	W6	W7	W4	W5	W6	W7
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Asia and the Pacific																
Australia	-	-	0.103	0.120	-	0.041	0.108	0.089	-	0.051	0.032	0.046	-	0.121	0.065	0.041
Bangladesh	-	-	-	0.152	0.059	-	-	0.122	0.186	-	-	0.060	-	-	-	-
China	-	-	0.122	0.110	0.000	0.037	0.053	0.095	0.000	0.020	0.011	0.009	-	0.155	0.066	0.067
Hong Kong	-	-	0.128	0.111	-	-	0.096	0.052	-	0.050	0.023	0.025	-	-	0.054	0.055
Indonesia	-	-	-	0.172	0.000	0.030	-	0.121	0.000	0.138	-	0.117	-	0.147	-	0.102
Iran	-	-	-	0.184	0.000	-	-	0.118	0.000	0.220	-	0.081	-	-	-	0.063
Iraq	-	-	0.113	0.180	-	-	0.087	0.110	0.262	0.199	0.097	0.019	-	-	0.081	0.055
Japan	-	-	0.135	0.150	0.000	0.052	0.094	0.112	0.001	-	0.027	0.014	-	0.099	0.066	0.045
Jordan	-	-	0.131	0.180	0.148	0.060	0.114	0.098	0.045	0.103	0.120	0.082	-	0.159	0.067	0.038
Kyrgyzstan	-	-	0.133	0.173	0.000	-	0.083	0.096	0.004	-	0.093	0.054	-	-	0.096	0.077
Lebanon	-	-	0.121	0.168	-	-	0.068	0.094	-	-	0.101	0.068	-	-	0.060	0.066
Malaysia	-	-	0.114	0.122	-	0.052	0.069	0.100	-	0.146	0.098	0.047	-	0.081	0.064	0.064
New Zealand	-	-	0.117	0.125	-	-	0.065	0.092	-	-	0.031	0.014	-	-	0.056	0.048

Region and country	Safety				Governance				Religion				Science and technology			
	W4	W5	W6	W7	W4	W5	W6	W7	W4	W5	W6	W7	W4	W5	W6	W7
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Philippines	-	-	0.145	0.190	-	-	0.105	0.123	0.348	-	0.132	0.091	-	-	0.092	0.060
Singapore	-	-	0.114	0.159	-	-	0.101	0.095	-	-	0.064	0.041	-	-	0.064	0.045
South Korea	-	-	0.118	0.160	0.000	0.052	0.053	0.096	0.080	0.092	0.053	0.017	-	0.100	0.072	0.053
Taiwan	-	-	0.119	0.095	-	0.045	0.109	0.095	-	0.052	0.041	0.028	-	0.147	0.083	0.049
Thailand	-	-	0.129	0.149	-	0.041	0.140	0.101	-	0.119	0.043	0.024	-	0.121	0.082	0.046
Vietnam	-	-	-	0.176	0.000	0.070	-	0.109	0.078	0.041	-	0.023	-	0.173	-	0.075
Averages			0.123	0.151	0.023	0.048	0.090	0.101	0.091	0.103	0.064	0.045	-	0.130	0.071	0.058
Europe																
Armenia	-	-	0.157	0.184	-	-	0.075	0.108	-	-	0.086	0.052	-	-	0.103	0.102
Cyprus	-	-	0.124	0.154	-	0.043	0.080	0.098	-	0.102	0.068	0.038	-	0.122	0.071	0.057
Germany	-	-	0.123	0.151	-	0.044	0.106	0.096	-	0.039	0.020	0.019	-	0.098	0.073	0.096
Great Britain	-	-		0.135	-	0.048	-	0.095	-	0.071		0.018	-	-	-	0.070
Netherlands	-	-	0.115	0.140	-	0.044	0.102	0.085	-	0.052	0.021	0.011	-	-	0.053	0.046
Romania	-	-	0.135	0.154	-	0.040	0.113	0.066	-	0.112	0.098	0.051	-	0.138	0.074	0.053
Russia	-	-	0.144	0.175	-	0.036	0.069	0.104	-	0.084	0.044	0.030	-	-	0.099	0.058
Slovenia	-	-	0.135	-		0.029	0.049	-	-	0.052	0.031	-	-	0.129	0.086	-
Spain	-	-	0.132	-	0.000	0.052	0.076	-	0.078	0.046	0.025	-	-	0.125	0.073	-
Sweden	-	-	0.121	-	-	0.046	0.066	-	-	0.020	0.016	-	-	0.130	0.066	-
Turkey	-	-	0.126	0.156	-	0.036	0.068	0.108	0.189	0.141	0.097	0.042	-	0.182	0.094	0.050
Ukraine	-	-	0.137	0.165	-	0.020	0.127	0.104	-	0.075	0.060	0.039	-	0.156	0.099	0.060
Averages			0.132	0.157	0.000	0.040	0.085	0.096	0.134	0.072	0.051	0.033	-	0.135	0.081	0.066
Africa																
Egypt	-	-	0.078	0.181	0.000	-	0.109	0.100	0.168	0.175	0.024	0.067	-	0.184	0.093	0.038
Libya	-	-	0.113	0.153	-	-	0.092	0.094	-	-	0.104	0.090	-	-	0.106	0.062
Morocco	-	-	0.138	0.152	0.000	0.029	0.023	0.103	0.204	0.178	0.081	0.058	-	0.082	0.062	0.074
Nigeria	-	-	0.108	0.129	0.000	-	0.119	0.106	0.199		0.119	0.119	-	-	0.097	0.070
South Africa	-	-	0.112	-	0.000	0.052	0.101		0.180	0.150	0.100	-	-	0.165	0.067	

Region and country	Safety				Governance				Religion				Science and technology			
	W4	W5	W6	W7	W4	W5	W6	W7	W4	W5	W6	W7	W4	W5	W6	W7
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Tunisia	-	-	0.137	0.160	-	-	0.068	0.103	-	-	0.093	0.071	-	-	0.070	0.061
Zimbabwe	-	-	0.137	0.154	0.000	-	0.110	0.125	0.218	-	0.134	0.125	-	-	0.070	0.105
Averages			0.118	0.155	0.000	0.041	0.089	0.105	0.194	0.168	0.094	0.088	-	0.144	0.081	0.068
North America																
Canada	-	-	-	0.140	-	0.046	-	0.080	0.115	0.073	-	0.020	-	0.135	-	0.072
Mexico	-	-	0.135	0.117	-	0.048	0.124	0.113	0.213	0.134	0.100	0.076	-	0.151	0.089	0.068
United States	-	-	0.113	0.136	-	0.036	0.052	0.092	0.128	0.086	0.057	0.029	-	0.099	0.063	0.060
Averages			0.124	0.131	-	0.043	0.088	0.095	0.152	0.098	0.079	0.042	-	0.128	0.076	0.067
South America																
Argentina	-	-	0.120	0.115	-	0.057	0.127	0.088	0.174	0.124	0.058	0.030	-	-	0.066	0.064
Brazil	-	-	0.128	0.118	-	0.041	0.108	0.089	-	0.157	0.112	0.078	-	0.153	0.067	0.057
Chile	-	-	0.118	0.100	-	0.054	0.109	0.105	0.164	0.117	0.073	0.025	-	0.137	0.060	0.053
Colombia	-	-	0.134	0.156	-	-	0.113	0.106	-	-	0.116	0.077	-	-	0.070	0.075
Ecuador	-	-	0.144	0.152	-	-	0.090	0.112	-	-	0.105	0.077	-	-	0.089	0.060
Peru	-	-	0.120	0.124	-	0.035	0.140	0.101	0.233	0.160	0.120	0.080	-	0.146	0.088	0.074
Uruguay	-	-	0.118	0.148	-	0.069	0.075	0.111	-	0.085	0.061	0.033	-	0.109	0.064	0.067
Averages			0.126	0.130	-	0.051	0.109	0.102	0.190	0.129	0.092	0.057	-	0.136	0.072	0.064

Note. Source: Authors' calculations. Note: W4 = Wave-4, W5 = Wave-5, W6 = Wave-6 and W7 = Wave-7 of the WVS.

4.2.3 African countries

In Africa, the health (Columns (2)–(5) of Table 4) domain's contribution to the MDWI has fluctuated but remains the largest contributor. The contributions of the finance (Columns (6)–(9) of Table 4) and social capital (Columns (10)–(13) of Table 4) domains have decreased in countries such as Egypt, South Africa and Zimbabwe but increased in Libya and Tunisia. We also observe that the contributions of the safety (Columns (2)–(5) of Table 5) and governance (Columns (6)–(9) of Table 5) domains to the MDWI have increased in all countries. In contrast, the contributions of the religion (Columns (10)–(13) of Table 5) and science and technology (Columns (14)–(17) of Table 5) domains have decreased in all countries. Even though African countries enjoy slightly lower levels of well-being, the domains' contributions to the MDWI exhibit a similar pattern to the rest of the regions of this study.

4.2.4 North American countries

Unlike the other regions, where health (Columns (2)–(5) of Table 4) is the largest contributing domain, in the North American region, social capital (Columns (10)–(13) of Table 4) is the largest contributor to the MDWI, and it is declining over time in all countries. The contribution of the health domain fluctuates over time in all countries. The contribution of the finance (Columns (6)–(9) of Table 4) domain fluctuates in Mexico and the United States, while it decreases in Canada. The contributions of the safety (Columns (2)–(5) of Table 5) and governance (Columns (6)–(9) of Table 5) domains increased in the United States and Canada but decreased in Mexico. In all North American countries, the contributions of religion (Columns (10)–(13) of Table 5), and science and technology (Columns (14)–(17) of Table 5) have declined.

4.2.5 South American countries

Similar to other regions (except for North America), health (Columns (2)–(5) of Table 4) is the largest contributing domain to the MDWI in South America. The health domain's contribution fluctuates over time in Argentina, Brazil, Peru and Uruguay, increases in Chile and Colombia, and decreases in Ecuador. The contribution of the finance (Columns (6)–(9) of Table 4) domain fluctuates in most countries, while it increases in Colombia and Ecuador and decreases in Uruguay. In most countries of this region, the contribution of the social capital (Columns (10)–(13) of Table 4) domain to the MDWI fluctuates, while it increases in Colombia and Ecuador. The contribution of the safety domain (Columns (2)–(5) of Table 5) decreases in countries such as Argentina, Brazil and Chile, but increases in the rest of the countries. Overall, the contribution of the governance (Columns (6)–(9) of Table 5) domain increased, while the contributions of religion (Columns (10)–(13) of Table 5) and science and technology (Columns (14)–(17) of Table 5) declined over time. In general, the domain contribution to the MDWI exhibits a similar pattern to the rest of the regions under investigation in this study.

4.3 Average changes in domain contribution by region and countries' economic development

In this section, we conduct a graphical analysis to examine how the average domain contribution has changed over time by region and based on countries' levels of income.⁸ The figures were

⁸ According to the World Bank (2022), high-income countries include Australia, Hong Kong, Japan, New Zealand, Singapore, South Korea, Taiwan, Cyprus, Germany, the Netherlands, Romania, Slovenia, Spain, Sweden, the United Kingdom, Canada, the United States, Chile and Uruguay. Upper-middle-income countries include China, Indonesia, Iraq, Malaysia, Thailand, Armenia, Russia, Türkiye, Libya, South Africa, Mexico, Argentina, Brazil, Colombia, Ecuador and Peru; while lower-middle-income countries include Bangladesh, Iran, Jordan, Kyrgyzstan, Lebanon, Philippines,

generated using the average domain contribution by region given in Tables 4 and 5. To generate figures by income group, we grouped the countries by income levels based on the World Bank (2022) classification and obtained averages for each domain contribution.

Figures 5a–b depict the intertemporal changes in the average contribution of the health domain to the MDWI by region and income level.⁹ As can be seen, in all regions and at all income levels, the health domain’s average contribution decreased slightly from 2002 to 2008, peaked in 2013 before declining again in 2018. The drop between 2002 and 2008 was more drastic in Europe than in other regions and high-income countries than in other income groups. In particular, the average contribution of the health domain remained almost unchanged in the lower-middle income group during the period 2002–2008. The changes in the way people feel about health as an important element of their lives are driven by how concerned they are about health-related incidences, such as severe acute respiratory syndrome (SARS) (which took place during 2002–2003), swine flu (which took place in 2009–2010) and Middle East respiratory syndrome (MERS) (which has occurred since 2015) (Piret & Boivin, 2021).

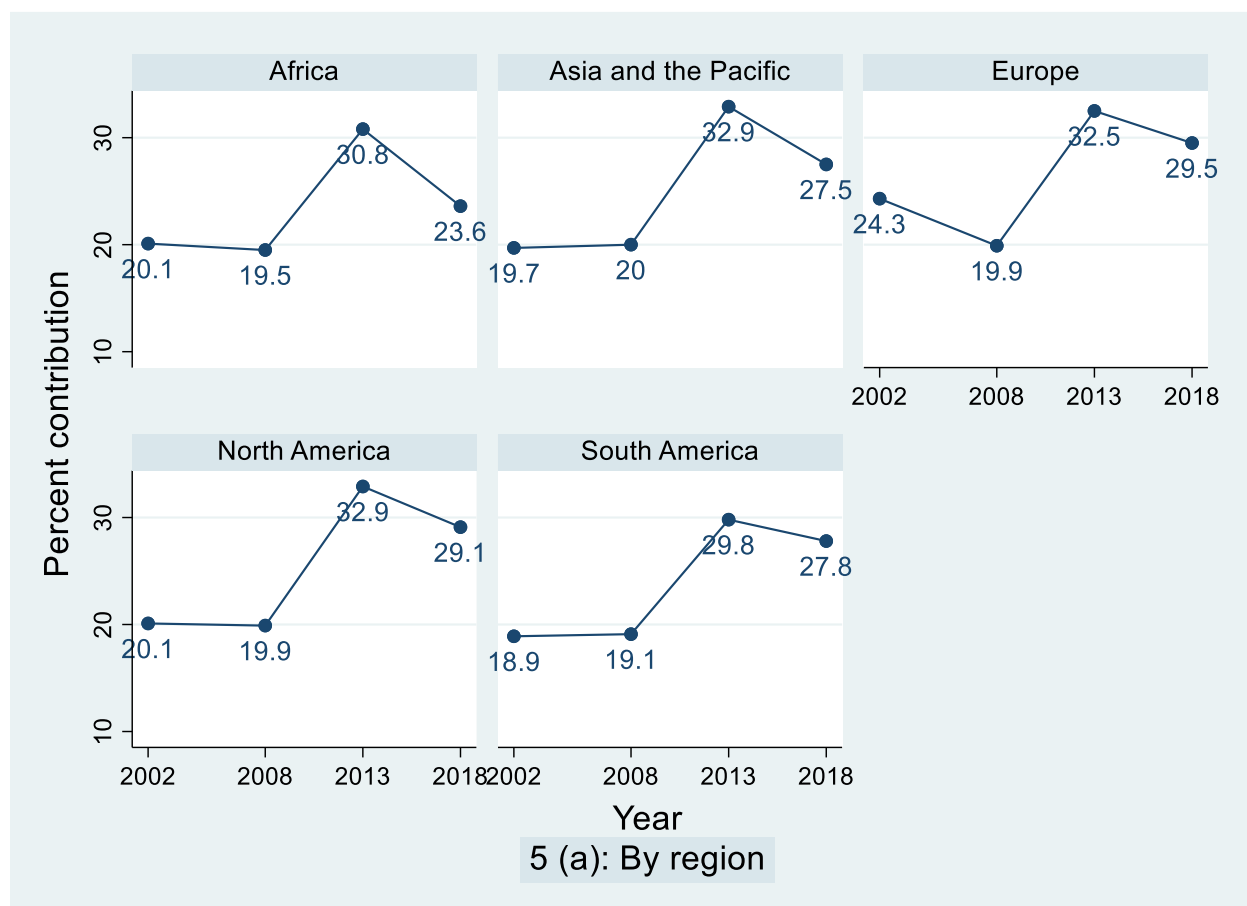


Figure 5a. Intertemporal change in the health domain’s average contribution by region

Vietnam, Ukraine, Egypt, Morocco, Nigeria, Tunisia and Zimbabwe (World Bank, 2022). It is worth noting that, according to the World Bank’s (2022) classification, we do not have any lower-income countries in our analyses.

⁹ It is worth mentioning that we used four different waves of the WVS, which were released between 1999 and 2022, for the countries under investigation. However, most of the countries’ data were released in 2002 (Wave-4), 2008 (Wave-5), 2013 (Wave-6), and 2018 (Wave-7). Therefore, to maintain consistency with the figures, we used the time periods 2002, 2008, 2013 and 2018 for Figures 5–11.

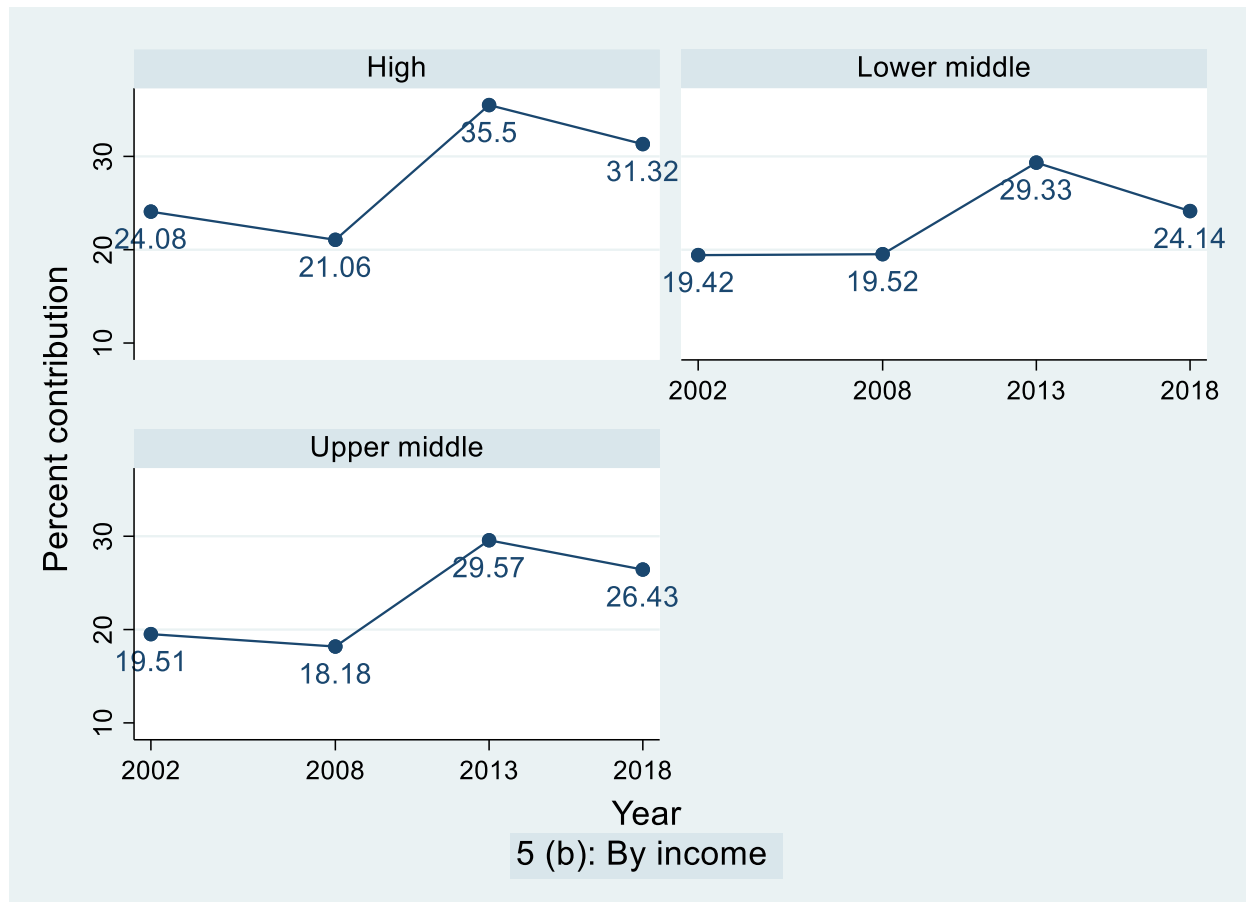


Figure 5b. Intertemporal change in the health domain’s average contribution by income

Whenever people are satisfied with their health (both mental and physical) and have sufficient food and healthcare, the health domain’s contribution to the MDWI increases. To ensure improved health status of the citizens, governments should focus more on providing better and cheaper healthcare facilities and medicine, and ensuring food security, as well as providing mental health support during health-related crises.

As depicted in Figures 6a–b, from 2002 to 2013, the average contribution of the finance domain was declining in all regions. After 2013, it was increasing, irrespective of the region and income level of the countries. This declining trend can be attributed to the 2002–2009 global recession, when people lost their jobs, self-rated financial satisfaction declined and inflation and interest rates increased (Mohseni-Cheraghlou, 2016; World Bank, 2022). This suggests that during those times, (deteriorating) finance contributed little to well-being. It is also evident that the drop between 2002 and 2013 was more drastic in Africa and North America than in other regions, and in the lower-middle income groups than in other income groups, which implies that these groups of countries were affected more than others. After 2013, the world started to recover from the global recession, the employment rate increased, and hence the finance domain appeared to make an increasing contribution to well-being.

Overall, whenever people are satisfied with their financial situation, they can save, and when both the respondent and the spouse are employed, their well-being is enhanced. Policy-makers and governments should formulate policies that attract foreign direct investments (FDI), create public and private partnerships and create job opportunities for every individual who is capable of working and actively seeking a job. In this way, overall financial satisfaction and well-being will increase.

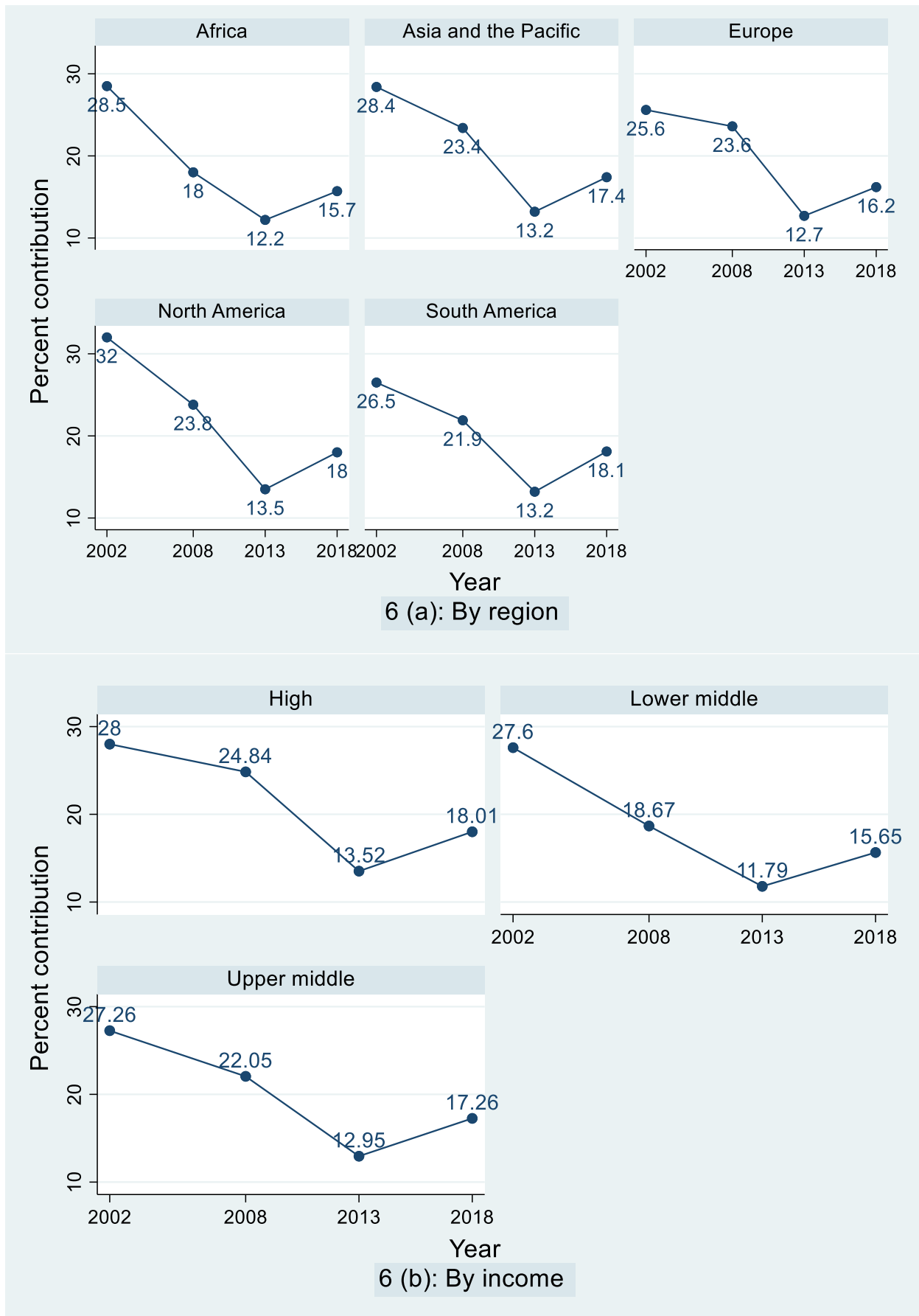


Figure 6. Intertemporal change in the finance domain's average contribution by region and income

In general, the average contribution of the social capital domain has declined across the regions and countries' income levels, as presented in Figures 7a–b. In Asia and the Pacific region, the declining trend was drastic during 2000–2013; in other regions, a drastic decline was observed during 2008–2013. In all income groups, a gradual decline is observed during 2002–2008, and a drastic decline is observed during 2008–2013. This could be due to rapidly changing sociocultural conditions globally (Putnam, 2000); social capital has become less influential in people's well-being over time. However, it has continued to decline in Asia and the Pacific, as well as in high-income countries, even after 2013. This finding should be interpreted alongside evidence of declining aggregate social trust in the United States—as documented by the General Social Survey—recognising that even as overall trust levels fall, variation in social capital remains a key determinant of subjective well-being in high-income and increasingly polarised societies (Helliwell & Putnam, 2004; Putnam, 2000; Smith et al., 2019). In the rest of the regions and income groups, it slightly increased again after 2013.

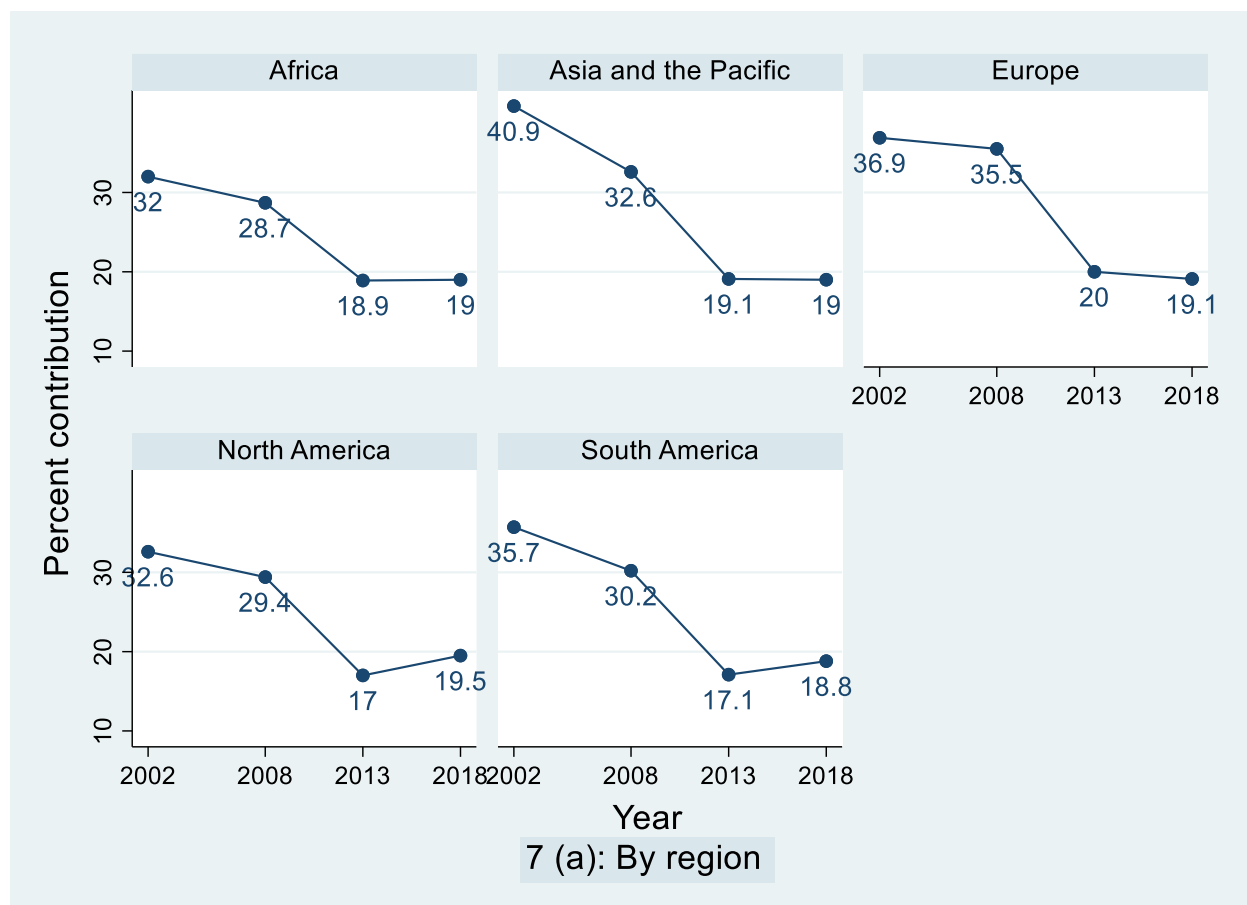


Figure 7a. Intertemporal change in the social capital domain's average contribution by region

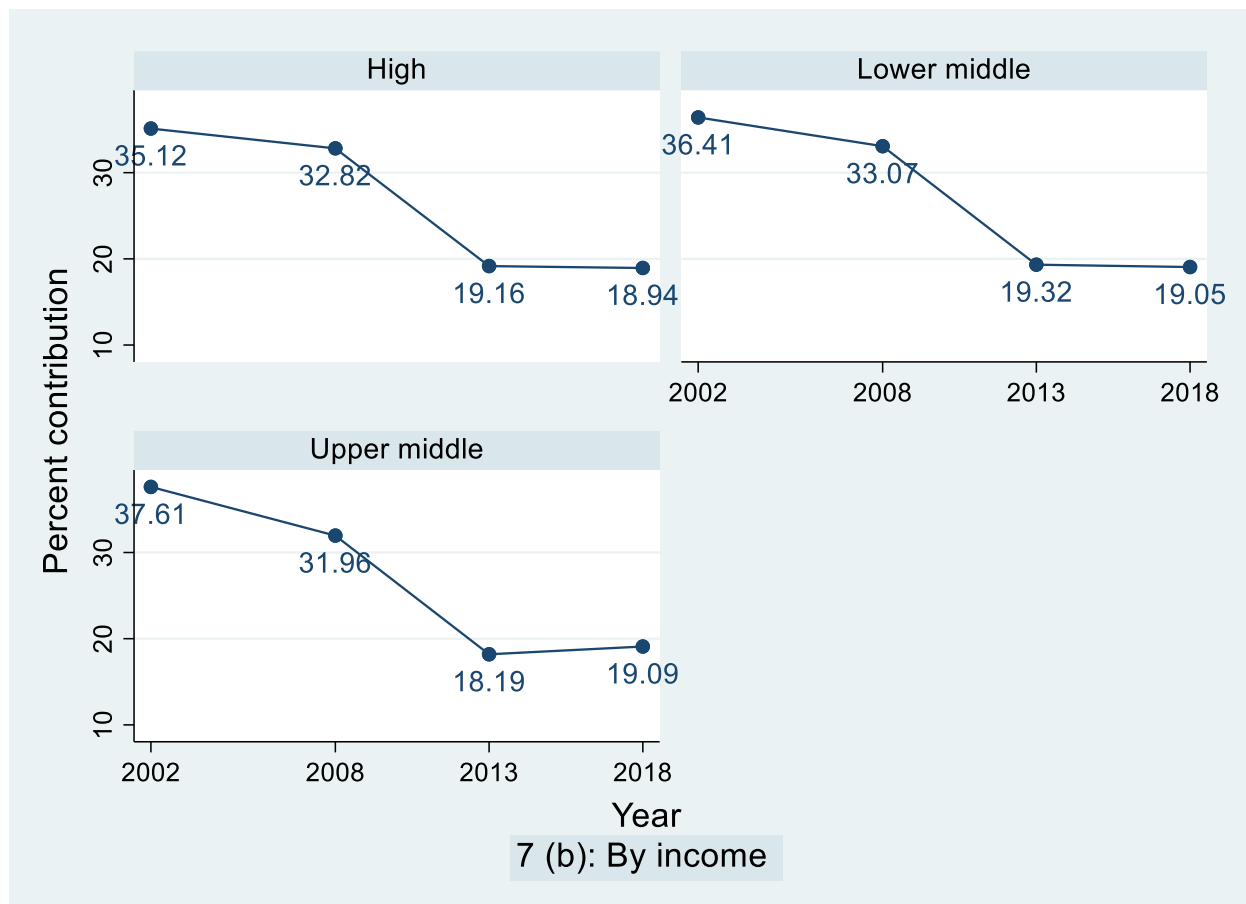


Figure 7b. Intertemporal change in the social capital domain’s average contribution by income

The contribution of the social capital domain and overall well-being could be increased if people communicated frequently with their family/friends/relatives, placed more importance on family and friends, and improved their generalized trust – particularly of people from diverse backgrounds (such as neighbours and government organizations). Therefore, more inter-regional and intra-regional cooperation enhancement policies are required to improve the sufficiency of these indicators of social capital.

The safety domain appeared to be in the dataset from 2013. As can be seen in Figures 8a–b, the average contribution of the safety domain has generally increased globally during the period 2013–2018. A dramatic and drastic increase is observed in Asia and the Pacific, Europe and Africa, as well as in lower-middle-income countries. A gradual increase is observed in North America, South America and high-income and upper-middle-income countries. This reveals that people appear to value their safety more, which can be an effect of increasing crime rates, terrorist activities and wars across the globe (Asaka, 2021). The safety domain’s contribution and overall well-being could be improved if people felt safe at home, having not been victims of crime; this could be achieved by a reduction in the overall crime rate, and an improvement in their feelings of safety. Also, these involve improved law and order situations and inter-regional and intra-regional cooperation. Therefore, policy-makers and governments should formulate policies that improve their respective countries’ overall law and order situation, enhance safety and security, reduce crime, and address issues relating to domestic violence by enhancing inter-regional and intra-regional cooperation.

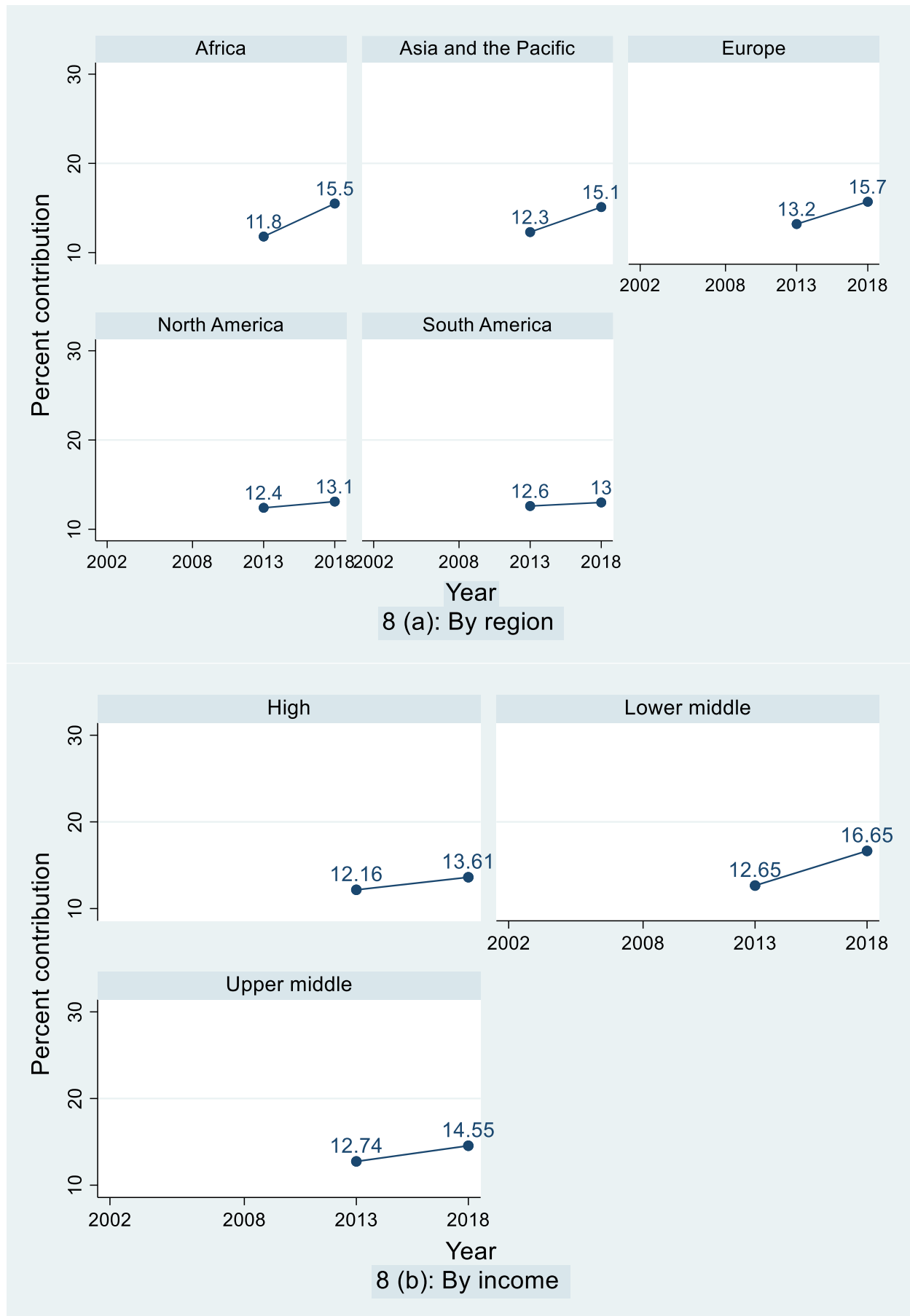


Figure 8. Intertemporal change in the safety domain's average contribution by region and income

The governance domain’s average contribution to the MDWI, as seen in Figures 9a–b, gradually increased in all regions during the period 2002–2013, especially in Asia and the Pacific, Europe, and African regions from 2002 to 2018. In North and South America, we observe an increase from 2008 to 2013 and a gradual decrease in these regions. At all income levels, the average contribution of the governance domain moderately increased over time, with a substantial increase in upper-middle and lower-middle-income countries from 2008 to 2018. The observed increase in the contribution of the governance domain indicates that governance-related perceptions, such as political participation, perceived electoral integrity, and satisfaction with government performance, account for a growing share of variation in the MDWI over time.¹⁰ This could be because people increasingly value governance-related aspects, such as the freedom to choose and vote (Australian Human Rights Commission, 2010), which are important aspects of their well-being. Therefore, governments should ensure good governance and freedom to vote, and organize honest (internal or external influence-free) elections. Consistent with Helliwell et al. (2014), the governance domain in the MDWI reflects perceived effectiveness and institutional trust rather than democratic status per se, which helps explain why governance contributions to subjective well-being may increase even in contexts experiencing democratic erosion.

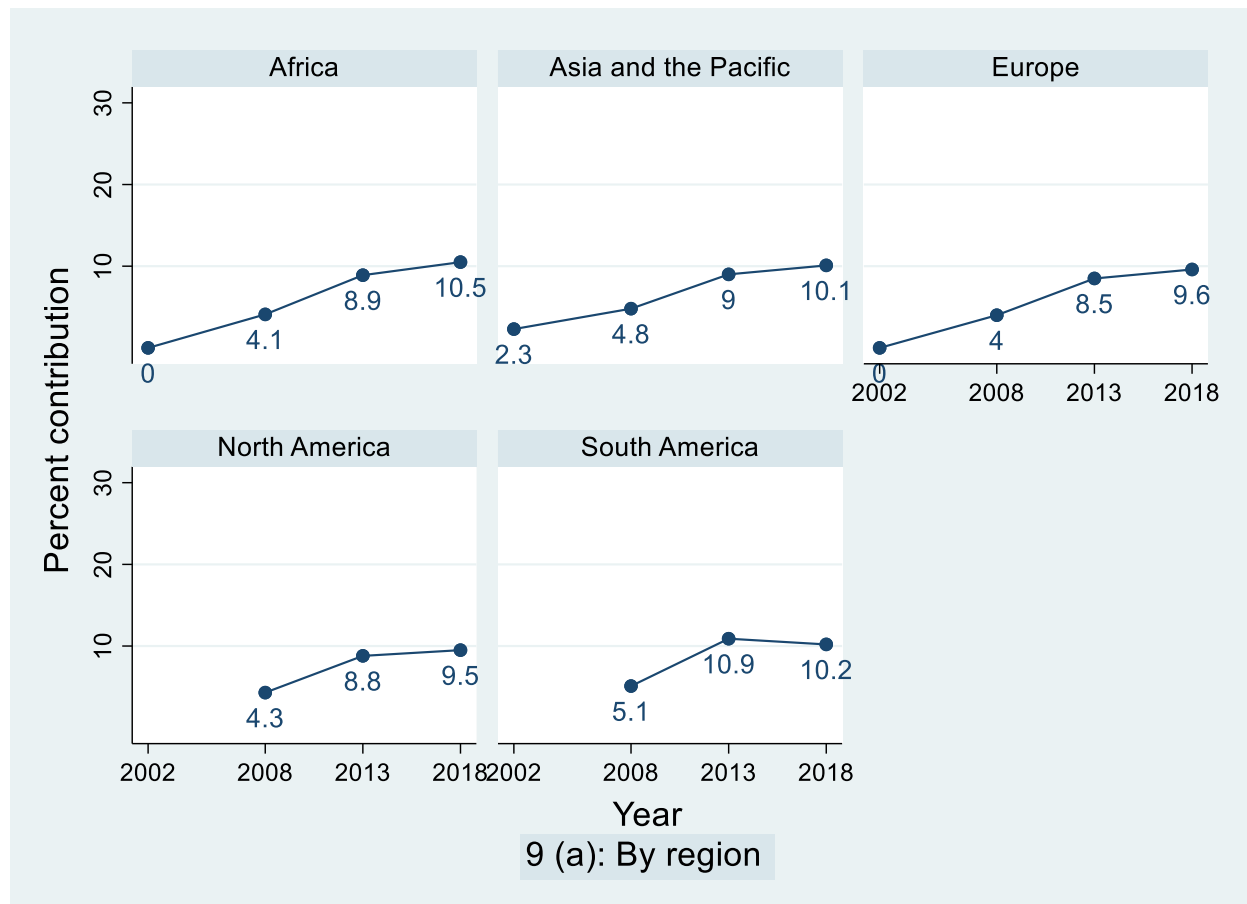


Figure 9a. Intertemporal change in the governance domain’s average contribution by region

¹⁰ This finding does not imply improvements in governance quality but rather suggests that governance-related factors have become more salient for how individuals evaluate their well-being. This interpretation is consistent with prior research indicating that perceived political voice, institutional trust, and democratic participation are closely linked to subjective well-being, particularly in middle-income and transitioning societies (Frey & Stutzer, 2000; Helliwell & Huang, 2008; OECD, 2013). From a policy perspective, the MDWI highlights governance as a domain warranting attention where its relative contribution to well-being is increasing, while remaining cautious about causal interpretation.

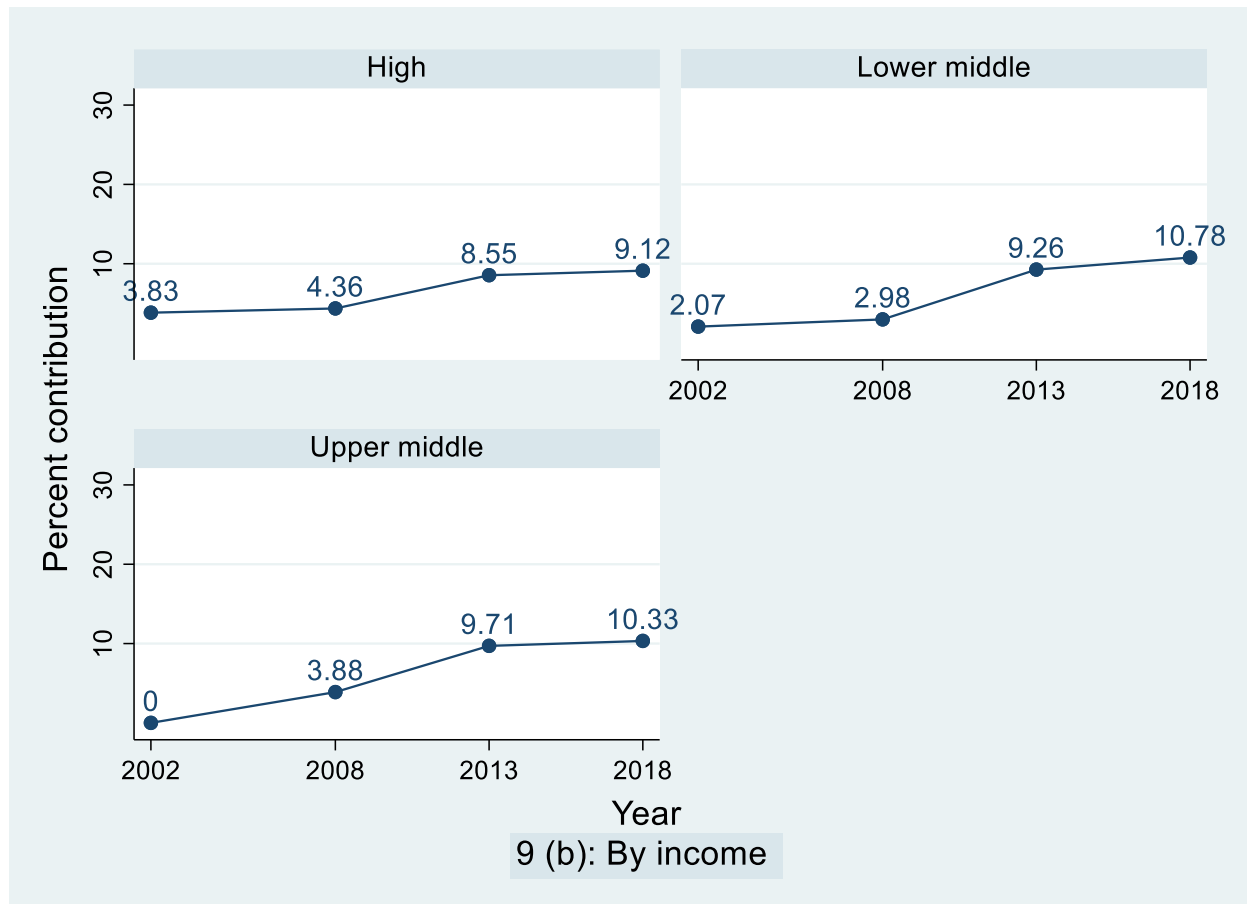


Figure 9b. Intertemporal change in the governance domain’s average contribution by income

Our results suggest that, in general, the average contribution of the religion domain has declined in all regions and income groups, as presented in Figures 10a–b. A dramatic declining trend is observed in Asia and the Pacific (2008–2018), Europe (2002–2018), Africa (2008–2013), and North and South America (2002–2018). This exhibits a moderate declining trend in all income groups during the study period. This is because of the ever-changing world; people consider materialistic things to be more important for well-being than spiritual aspects of life (Strawbridge et al., 1998). However, if people place greater importance on God, pray frequently and attend religious services, the religion domain’s contribution will likely increase, as will overall well-being.

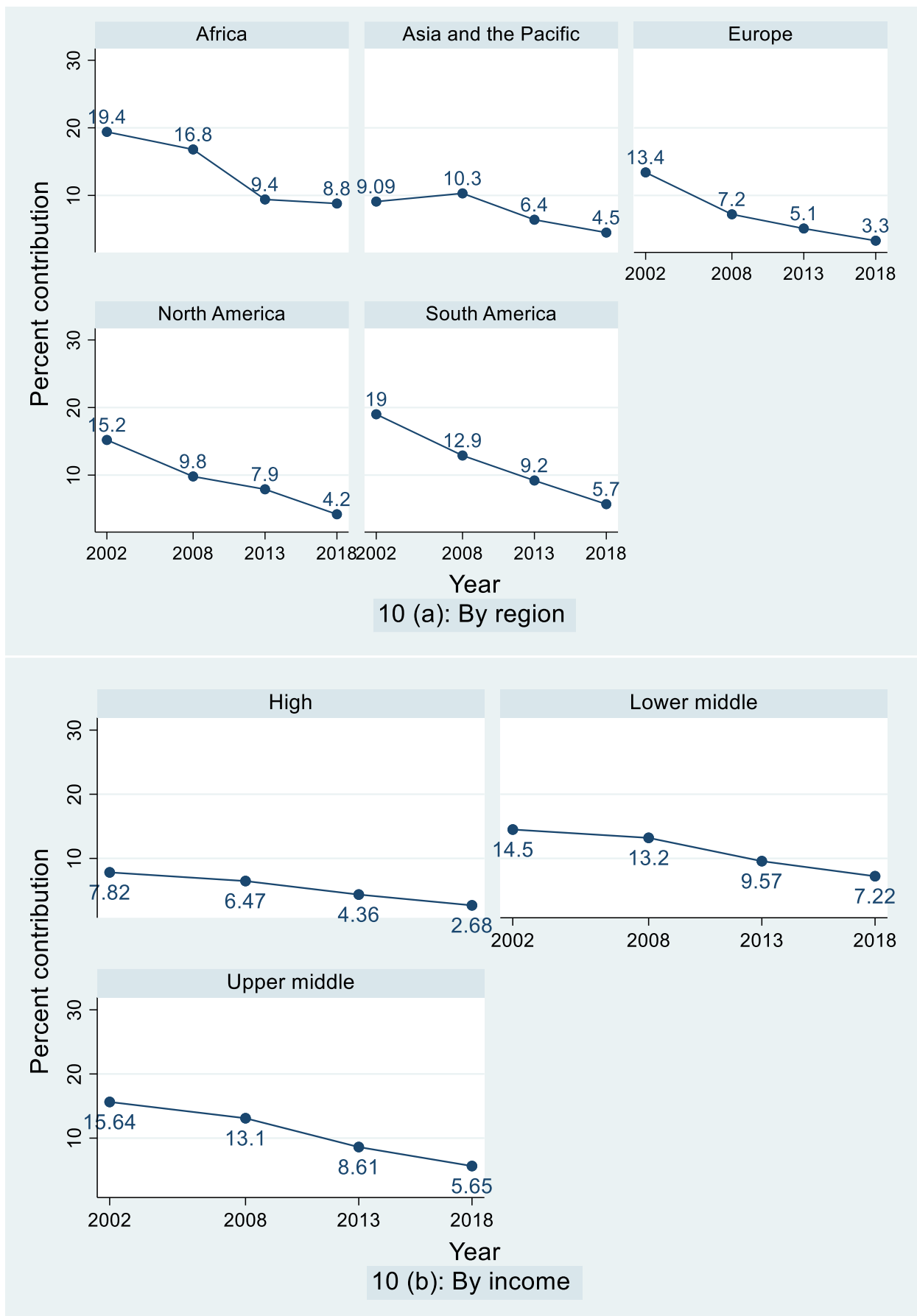


Figure 10. Intertemporal change in the religion domain's average contribution by region and income

It is worth mentioning here that the science and technology domain indicators were available in the dataset beginning in 2008. Our analysis, as depicted in Figures 11a–b, suggests that the average contribution of the technology domain declined remarkably from 2008 to 2013 and gradually declined in all regions. We observe a moderate declining trend in high and upper-middle-income countries over time, while in lower-middle-income countries, a somewhat substantial decline from 2008 to 2013, and then a gradually declining trend can be observed. A higher contribution of the technology domain to well-being in 2008 could be attributed to a period (2002–2008) of widespread availability and adoption of digital technology, which made communications easier, meaning that the domain contributed more to well-being. The decrease in the technology domain’s contribution to the MDWI could be due to the negative effects of digital technology addiction (Stead & Bibby, 2017) after 2008.

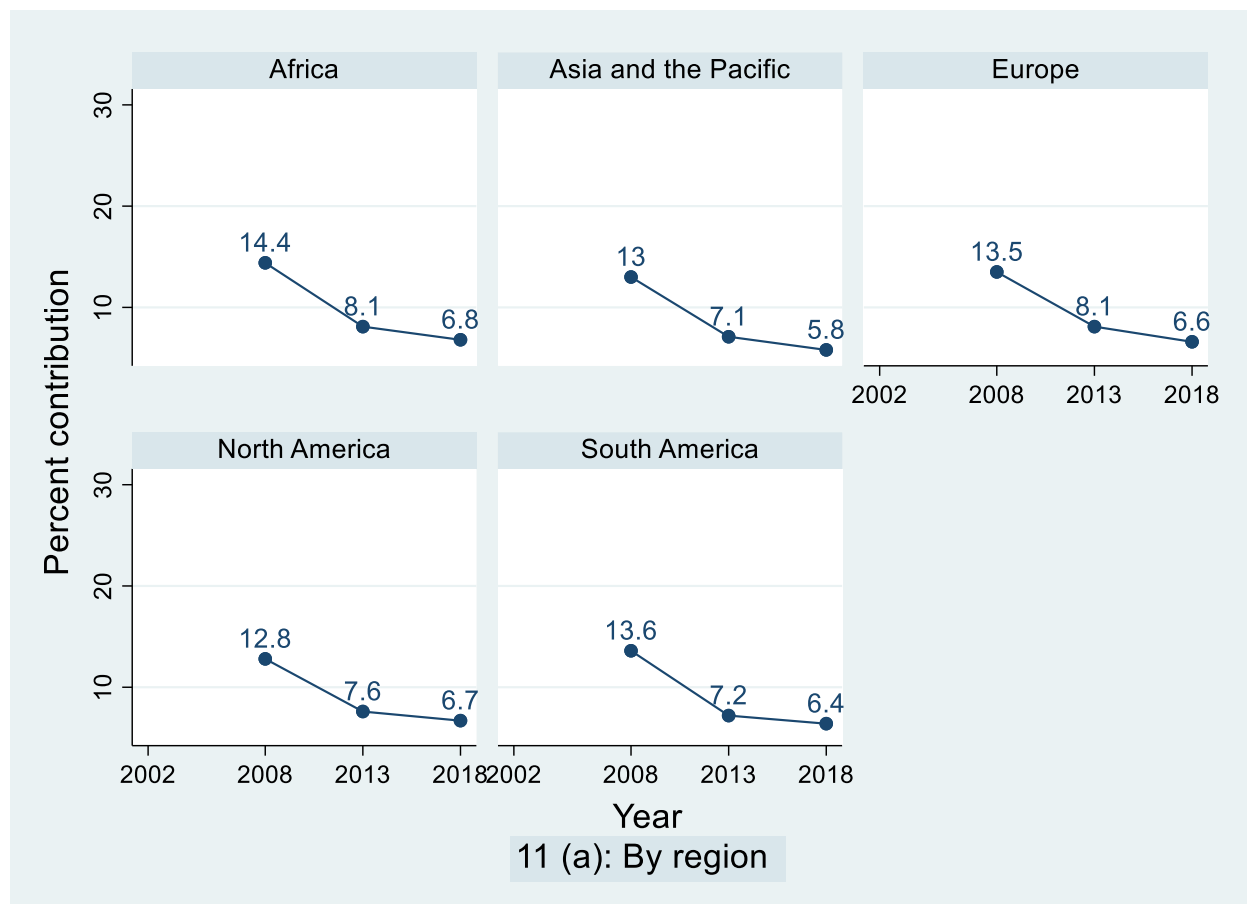


Figure 11a. Intertemporal change in the technology domain’s average contribution by region



Figure 11b. Intertemporal change in the technology domain’s average contribution by income

5. Policy implications

In this study, we have estimated intertemporal changes in well-being and its contributing factors across 48 (20 developed and 28 developing) countries to facilitate monitoring well-being for policy purposes. A key policy advantage of the MDWI lies not only in tracking well-being over time, but in revealing which domains drive changes in well-being across countries and economic development contexts. By decomposing well-being into domain contributions, the MDWI provides policymakers with a diagnostic tool to identify priority areas, monitor shifts in well-being drivers over time, and tailor policies to the specific drivers of well-being in their respective countries.

Five overarching policy insights can be drawn from this study. First, a substantial number of countries (Bangladesh, Iran, Iraq, Japan, Philippines, Egypt, Morocco, Nigeria, South Africa, Tunisia, Zimbabwe, Armenia, Russia, Slovenia, Spain, Ukraine, Mexico, Brazil, Chile, Colombia, Ecuador and Peru) exhibit a low to moderate level of well-being (MDWI < 0.60). In these countries, lower well-being is primarily associated with both a smaller proportion of individuals achieving sufficiency across domains/indicators and lower overall breadth/degree of achieved well-being. From a policy perspective, this suggests that improvements in well-being are likely to require broad-based enhancement of living standards, rather than isolated interventions. The MDWI decomposition suggests that overall living standards can be improved by ensuring necessities such as food security and healthcare, as well as safety and security through regional cooperation and good governance. The governments of these countries should focus more on improving the livelihoods of citizens by ensuring necessities such as food security and healthcare, safety and security, and good governance. To ensure food security and cheaper healthcare, the

government should generate more income-earning opportunities (job creation) and establish cheaper healthcare facilities by employing qualified professionals relevant to health (Hasan et al., 2024). Safety and security can be enhanced by improving the law-and-order situation. Moreover, the governments of these countries should also formulate policies that reduce income inequalities and make economic growth more inclusive, enabling the benefits of economic growth to trickle down to all.

Second, we observed that countries such as Japan, Russia, Spain, Mexico and the United States enjoy moderate well-being over time, even though they have higher per capita GDP (GDP > US\$20,000). The MDWI reveals that, in these contexts, social capital is a comparatively important contributor to overall well-being, indicating that economic prosperity alone does not guarantee higher well-being. In particular, the indicators of the social capital domain suggest that improved relations with family and friends and interpersonal and social trust by intra-regional and inter-regional cooperation have the potential to enhance well-being. As a result, appropriate policies should be adopted to improve the indicators of the social capital domain in these countries.

Third, health is the most important and contributing domain to the MDWI in the countries under investigation in this study. In reality, when people feel healthy (both mentally and physically), have sufficient healthcare and food, employment opportunities and savings for the future, their well-being increases. The World Bank (2024) highlights that even though many countries have made significant improvements in healthcare facilities and reduced rural–urban disparities, they need to do more for the poor to avoid expensive private healthcare. Since health is one of the most important contributing domains to the MDWI, we call for increased attention by policymakers to providing cheaper and readily available public healthcare facilities for underprivileged people. Additionally, governments in all countries should invest in quality and accessible healthcare, in particular by employing qualified doctors, nurses, technicians and other staff, providing new technological equipment to hospitals and undertaking appropriate regulatory measures to minimize the cost of private healthcare (Hasan et al., 2024).

Fourth, the financial domain also contributes substantially to well-being, particularly through perceived financial adequacy and employment-related indicators. Klement and Terlau (2022) note that people’s financial satisfaction can be improved by generating more income-earning opportunities and providing quality education, which is essential for eradicating poverty and enhancing well-being. The MDWI highlights that policies fostering stable employment, income security, and savings capacity are closely linked to improved well-being outcomes. Governments may therefore enhance well-being by promoting inclusive labour markets, investing in education and skills development, and strengthening social protection systems. From a policy-monitoring perspective, changes in the financial domain’s contribution over time can signal whether economic growth is translating into perceived financial security for households.

Fifth, beyond health and finance, the domains of social capital, safety, and governance jointly account for a meaningful share of well-being across countries. The MDWI results indicate that when individuals feel safe, trust others, and perceive governance processes as fair and participatory, their well-being is higher. Policies that improve public safety, reduce violence, enhance trust through education and community-based initiatives, and strengthen participatory governance mechanisms are therefore likely to support well-being improvements. Importantly, the MDWI allows policymakers to observe whether gains in these domains are keeping pace with improvements in material conditions, offering a more comprehensive basis for policy evaluation.

Overall, the MDWI’s ability to decompose well-being into domain contributions over time provides policymakers with actionable, context-sensitive insights that go beyond aggregate well-

being rankings. Rather than prescribing uniform policy responses, the MDWI supports targeted interventions by revealing which domains matter most for well-being in different countries and how these priorities evolve over time.

6. Conclusions

Using four waves of the World Values Survey (Waves 4–7), this study develops and applies a Multidimensional Well-Being Index (MDWI) grounded in the bottom-up theory of well-being and informed by the Alkire–Foster framework. By combining subjective self-assessments with quantitative indicators and employing PCA-based weighting, the MDWI provides a robust and transparent tool for tracking well-being and its domain-level composition across countries and over time. The use of data-driven (PCA-based) weights reflects the socioeconomic and cultural diversity of the countries examined and allows the relative importance of different well-being domains to be empirically identified rather than imposed a priori.

The empirical findings indicate that the countries analysed experience low to moderately high levels of well-being, with overall well-being generally increasing over time, albeit with notable cross-country and regional variation. Across most waves and countries, health emerges as the dominant contributor to well-being, followed by social capital, finance, safety, governance, science and technology, and religion. While the contributions of health and finance fluctuate over time, safety and governance show increasing importance, whereas the relative contributions of social capital, religion, and science and technology tend to decline. Importantly, the domain composition of well-being broadly mirrors patterns of economic development, underscoring the value of examining not only well-being levels but also the structure of well-being across development contexts. The MDWI provides a practical framework for policy monitoring, enabling governments and researchers to identify the domains that drive well-being in various settings and how these drivers evolve over time. With the continued availability of comparable WVS data, the index can be used to support evidence-informed, context-sensitive policy design by highlighting priority domains rather than relying solely on aggregate well-being measures or income-based indicators.

This study contributes to the well-being literature in five ways. First, it offers one of the earliest intertemporal cross-country analyses of multidimensional well-being, spanning 48 countries across five regions from 1999 to 2022. Second, it develops a new Multidimensional Well-Being Index (MDWI) using four waves of the World Values Survey, allowing robust cross-national and over-time comparisons. Third, the study advances measurement practice by applying the Alkire–Foster framework with PCA-based weights, thereby avoiding arbitrary weighting and revealing the relative importance of well-being domains. Fourth, it examines heterogeneity in well-being levels and determinants across developed and developing economies, underscoring context-specific pathways to well-being. Finally, the domain-level decomposition of well-being provides policy-relevant evidence to inform targeted interventions consistent with the Sustainable Development Goals.

Despite its contributions, this study has several limitations that point to directions for future research. First, the number of indicators used to construct the MDWI varies across WVS waves due to data availability, which may affect intertemporal comparability despite the use of a consistent domain structure and uniform construction procedures. This underscores the need for more harmonised longitudinal data that track a stable set of multidimensional well-being indicators over time. Second, although the MDWI captures some adverse experiences, it is limited in its ability to measure negative utility, as the WVS lacks direct indicators of psychological distress such as depression or anxiety. Future studies could address this by integrating mental

health-specific datasets to better capture both positive sufficiency and ill-being. Third, the governance domain relies on perception-based proxies rather than institutional indicators, reflecting data constraints rather than conceptual omission; combining subjective assessments with objective governance measures could provide a more comprehensive view. Finally, as the MDWI is descriptive rather than causal, future research could link it to causal or quasi-experimental analyses to better understand the mechanisms through which domain-level improvements translate into sustained gains in well-being.

Overall, this study contributes to the well-being literature by demonstrating how a multidimensional, decomposable, and intertemporal measure can enhance understanding of both the level and composition of well-being. By moving beyond single-indicator approaches (such as the Gross Domestic Product or self-rated life satisfaction/happiness), the MDWI provides a valuable foundation for advancing comparative well-being research and for informing more targeted and effective well-being-oriented public policy.

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Author contribution statement

Mohammad Rajib Hasan: Conceptualisation, literature review, methodology, data collection, formal analysis, and manuscript preparation (overall write-up). Maneka Jayasinghe: Supervision, conceptual and insightful guidance, critical review, and manuscript finalisation. Eliyathamby A. Selvanathan: Supervision, methodological guidance, critical review, and manuscript revision.

Conflict of interest statement

The authors declare no conflicts of interest that could influence the work reported in this study.

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Data availability statement

Data used in this study are publicly available from the World Values Survey (WVS) and can be accessed at the WVS website at <https://www.worldvaluessurvey.org/WVSDocumentationWV7.jsp>

Ethical approval

This study is based on secondary data collected by the World Values Survey (WVS); therefore, no ethical approval was required.

Informed consent statement

The study utilised publicly available secondary data obtained from international databases. No primary data were collected directly from human participants, and no identifiable personal information was used. Therefore, informed consent was not required for this study.

AI statement

A subscription version of OpenAI's ChatGPT-4 was used to assist with language editing, such as text condensing and readability improvements. The AI tool was not used for data collection, data analysis, statistical modelling, result interpretation, or the generation of research findings. All analyses, interpretations, policy implications, conclusions, and final manuscript content were developed, verified, and approved by the authors, who take full responsibility for the accuracy and integrity of the work.

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Appendices

Appendix A. The mathematical six-step procedure in constructing the MDWI (Adapted from Hasan et al., 2024)

Step 1: Identifying the domains and indicators

We consider d indicators where $n \times d$ is a set of matrices, and $y \in \mathbf{M}^{n,d}$ represents the endowment matrix of n individuals in d dissimilar indicators. Respondent i 's endowment in indicator j is represented by the respondent $i(=1, 2, \dots, n)$ and indicator $j(=1, 2, \dots, d)$, the entry y_{ij} of y . The sufficiency vector of the respondent i across the d indicators is $1 \times d$ row vector where $Y_i = [y_{i1}, y_{i2}, \dots, y_{id}]$ such that $Y = [Y_i]$. The distribution of sufficiency in the variable j across n respondents such that $Y = [Y_j]$ is presented by the $n \times 1$ column vector such that $Y_j = [y_{1j}, y_{2j}, \dots, y_{nj}]'$.

Step 2: Assigning weights

As has been explained in Section 2, we use PCA-based weighting schemes. The PCA-based weighting scheme is a data-driven approach and is free from biases (Decancq and Lugo, 2013). The significance of the PCA-based weighting scheme is that it highlights the relative importance of each indicator and domain. This is crucial because each country under consideration in this study possesses unique socioeconomic characteristics, and these characteristics change the preferences of the individuals, which dictate them to value each indicator differently over time.

Therefore, we assign weights for each indicator as such w_j (with $0 < w_j < 1$), where the weights summed to 1. That is,

$$\sum_{j=1}^d w_j = 1 \text{ or } w\tau = 1 \quad (1)$$

where a row vector of weights is presented as $w = (w_1, w_2, \dots, w_d)$, and the unit column vector is represented by τ .

Step 3: Determining sufficiency matrix

Following Hasan et al. (2024), the threshold is developed for indicator sufficiency as

$$g_{ij} = \begin{cases} w_j \text{ if } y_{ij} \geq Z_j (\text{respondent } i \text{ is sufficient in indicator } j) \\ 0 \text{ if } y_{ij} < Z_j (\text{respondent } i \text{ is not sufficient in indicator } j) \end{cases} \quad (2)$$

where the respondent i 's sufficiency (cut-off) threshold in indicator j and the threshold value of g_{ij} is presented by Z_j . Hence, $G = [g_{ij}]$ is an $n \times d$ matrix, which is also known as the sufficiency matrix. The total sufficiency of each respondent would come from the addition of each row such that $n \times 1$ column vector C , which is $G\tau$, where τ is a unit column vector such that,

$$C = [c_i] = G\tau \quad (3)$$

where $c_i = \sum_{j=1}^d g_{ij}$ represents the sum of total sufficiency endowed by an individual i ($i = 1, 2, \dots, n$).

Step 4: Calculating the proportion of people meeting the indicator sufficiency threshold

The sufficiency threshold of an individual i is determined if the individual meets sufficiency in all indicators such that, c_i is greater than or equal to a defined cut-off value k . That is, the i^{th} element of the indicator sufficient column vector $M = [m_i]$ and corresponding head-count column vector $Q = [q_i]$ are defined as

$$m_i = \begin{cases} c_i & \text{if } c_i \geq k \\ 0 & \text{if } c_i < k \end{cases} \quad (4)$$

$$q_i = \begin{cases} 1 & \text{if } c_i \geq k \\ 0 & \text{if } c_i < k \end{cases} \quad (5)$$

Therefore, in the population size n the sufficiency in the number of indicators of an individual (where $c_i \geq k$) is denoted by

$$q = \tau'Q \quad (6)$$

where τ is a $n \times 1$ unit column vector. Therefore, the headcount ratio (the percent of indicator-sufficient individuals (H)) in a population size n is given by

$$H = \frac{\tau'Q}{n} = \frac{q}{n} \quad (7)$$

The multidimensional indicator sufficiency is also represented by the head-count ratio (H).

Step 5: Calculating the intensity of well-being

The intensity of well-being (A), which represents the sum of all elements in the multidimensional indicator-specific sufficiency and is calculated by the indicator-specific sufficiency vector M divided by the number of indicator-specific sufficient individuals q , such as

$$A = \frac{\tau'M}{\tau'Q} = \frac{\sum_{i=1}^n m_i}{q} \quad (8)$$

Step 6: Calculating the multidimensional well-being index (MDWI)

The MDWI is the product of H and A. That is,

$$MDWI = H \times A \quad (9)$$

The MDWI captures the information on both the incidence and the intensity of well-being as presented in Equation (9). The value of the MDWI ranges between 0 and 1; the higher the value, the greater the level of well-being.

We estimate the intensity ratio (A), headcount ratio (H), MDWIs, and the contribution of each domain/indicator to the MDWI using STATA-17 software and the user-written commands of the multidimensional poverty index by Pacifico and Poegge (2017). Before presenting and discussing our estimates in Section 4, we present a check of the robustness of our calculated MDWI in the next section (Section 3.3).

Appendix B. An explanation/example on how a missing variable may not have an effect on the MDWI values

It is worth noting that the multidimensional index's value depends not only on the number of indicators but also on each indicator's relative weights and sufficiency (see Hasan et al., 2024). This can be explained by the following example:

From Equations (2) – (9) of Appendix A, we can derive the following:

$$MDWI = H * A = \frac{\sum_{i=1}^n m_i}{n} = \frac{\sum_{i=1}^n \sum_{j=1}^d g_{ij}}{n}$$

The above derivation of the MDWI index calculation shows that while the MDWI calculation is affected by the number of indicators, d , the number of indicators is not the only factor that determines the index value. It also depends on whether the household's response to each indicator meets the sufficiency threshold or not (as per the conditions specified in Equations (2) and (4), $c_i \geq k$ and $y_{ij} \geq Z_j$). Please see the hypothetical examples below with the number of indicators, $d=5$, and $d=6$, with arbitrary indicator weights. Weights will change based on the relative importance of each indicator when a new indicator is introduced. As can be seen, even with a higher number of indicators, the index can still be lower if the households do not meet the sufficiency criteria (see the index values in Tables 1–3).

Table B1. MDWI with 5-indicators

d= 5 indicators and n =2 households					
Indicator j =1 to 5	Hypo- thetical weights (w _j)	Household 1		Household 2	
		Sufficiency threshold for each indicator (=1, if household met the threshold, =0 otherwise)	g _{1j} (j=1 to 5)= col (2)*col (3)	Sufficiency threshold for each indicator (=1, if household met the threshold, =0 otherwise)	g _{2j} (j=1 to 5) col (2)*col (5)
(1)	(2)	(3)	(4)	(5)	(6)
Indicator 1	0.10	1	0.10	1	0.10
Indicator 2	0.20	0	0.00	1	0.20
Indicator 3	0.30	1	0.30	1	0.30
Indicator 4	0.25	1	0.25	1	0.25
Indicator 5	0.15	1	0.15	1	0.15
			m₁= $\sum_{j=1}^5 g_{1j}=0.80$		
					m₂= $\sum_{j=1}^5 g_{2j}=1.00$
MDWI = H*A = (m₁+m₂)/2 = (0.80+1.00)/2 = 0.900					

Table 2. MDWI for the same households with 6 indicators, and both households *do not meet the sufficiency criteria for Indicator 6*

d = 6 and n =2 households					
Indicator j =1 to 6	Hypo- thetical weights (w_j)	Household 1		Household 2	
		Sufficiency threshold for each indicator (=1, if household met the threshold, =0 otherwise)	g_{1j} (j=1 to 6) = col (2)*col (3)	Sufficiency threshold for each indicator (=1, if household met the threshold, =0 otherwise)	g_{2j} (j=1 to 6) = col (2)*col (5)
(1)	(2)	(3)	(4)	(5)	(6)
Indicator 1	0.10	1	0.10	1	0.1
Indicator 2	0.05	0	0.00	1	0.05
Indicator 3	0.25	1	0.25	1	0.25
Indicator 4	0.25	1	0.25	1	0.25
Indicator 5	0.15	1	0.15	1	0.15
Indicator 6	0.20	0	0.00	0	0.00
			$m_1 =$ $\sum_{j=1}^6 g_{1j} = 0.75$	$m_2 =$ $\sum_{j=1}^6 g_{2j} = 0.80$	
MDWI = H*A = (m₁+m₂)/2 = (0.75+0.80)/2 =0.775					

Table 3. MDWI for the same households with 6 indicators and both households *do meet the sufficiency criteria for Indicator 6*

Same households with d = 6 and n =2 households					
Indicator j =1 to 6	Hypo- thetical weights (w_j)	Household 1		Household 2	
		Sufficiency threshold for each indicator (=1, if household met the threshold, =0 otherwise)	g_{1j} (j=1 to 6) = col (2)*col (3)	Sufficiency threshold for each indicator (=1, if household met the threshold, =0 otherwise)	g_{2j} (j=1 to 6) = col (2)*col (5)
(1)	(2)	(3)	(4)	(5)	(6)
Indicator 1	0.10	1	0.10	1	0.10
Indicator 2	0.05	0	0.00	1	0.05
Indicator 3	0.25	1	0.25	1	0.25
Indicator 4	0.25	1	0.25	1	0.25
Indicator 5	0.15	1	0.15	1	0.15
Indicator 6	0.20	1	0.20	1	0.20
			$m_1 =$ $\sum_{j=1}^6 g_{1j} = 0.95$	$m_2 =$ $\sum_{j=1}^6 g_{2j} = 1.00$	
MDWI = H*A = (m₁+m₂)/2 = (0.95+1.00)/2 =0.975					

Note: $\sum_{j=1}^d w_j = 1$

Hence, there is no guarantee that adding or reducing indicators will improve the results of the index (i.e. increase in MDWI) as described in the above example. The improvement can only happen if households are better off in the additional dimensions. The reason we included more

indicators and dimensions in the construction of the index is that more indicators and dimensions are expected to capture various aspects of well-being that affect individuals. For example, in Wave-4, 11 sets of indicators, only the respondent's employment status was captured in the Finance dimension. However, in Wave-7, among the 25 indicators, the spouses' employment status was also considered. This is expected to capture more information about the financial stability or the lack of financial stress of the individual under consideration than the 11-indicator measure.

Appendix C. Established regression relationships between subjective well-being (life satisfaction and/or happiness) and the indicators utilized to construct the MDWI

Domains and indicators	Relevant study	Correlated variable(s)	Regression model(s)	Finding(s)
(1)	(2)	(3)	(4)	(5)
D1: Health				
I1: Self-reported health status	Tang et al. (2018)	Life satisfaction and self-rated health status	Linear regression	Positive and significant relationship.
I2: Not often gone without food	-	-	-	-
I3: Not often gone without medicine	-	-	-	-
D2: Finance				
I4: Self-rated financial satisfaction	Van Praag et al. (2003)	Life satisfaction and self-rated financial satisfaction	Radom-effect regression	Positive and significant association.
I5: Did you save last year	Chen et al. (2021)	Life satisfaction and amount of savings	Ordered logit	Positive and significant association.
I6: Whether the respondent is employed	Frijters et al. (2004)	Life satisfaction and employment status	Panel regression	Positive and significant association.
I7: Whether the spouse is employed	Esche (2020)	Life satisfaction and partner's employment	Fixed-effect regression	Negative (compared to employed).
D3: Social Capital				
I8: Frequency of using social media	Koç & Turan (2020)	Life satisfaction and social media use intensity	Partial least-squares	Positive association
I9: Importance of family	Jayasinghe et al. (2021a)	Life satisfaction and connection with family	Ordered logit	Positive and significant association.
I10: Importance of friends	Helliwell & Putnam (2004)	Life satisfaction and the importance of friends	Linear regression	Positive and significant association.
I11: Whether most people can be trusted	Helliwell & Putnam (2004)	Life satisfaction and generalised trust	Linear regression	Positive and significant relationship.
I12: Trust in different groups of people	Helliwell & Putnam (2004)	Life satisfaction and trust in others	Linear regression	Positive and significant association.
D4: Safety				
I13: Not felt unsafe at home	Kudebayeva & Sharipova (2025)	Life satisfaction and security index*	Oaxaca-Blinder decomposition	Negative and significant association.
I14: Feeling of security	Kudebayeva & Sharipova (2025)	Life satisfaction and security index*	Oaxaca-Blinder decomposition	Negative and significant association.
I15: Frequency of various crimes	Kudebayeva & Sharipova (2025)	Life satisfaction and security index*	Oaxaca-Blinder decomposition	Negative and significant association.
I16: Ever been a victim of crime	Powdthavee (2005)	Happiness and being a victim of crime	Ordered logit	Negative and significant association.
D5: Governance				
I17: How often do you vote	Frey & Stutzer (2000)	Happiness and democratic right index	Linear and ordered probit	Positive and significant associations.
I18: Importance of honest election	-	-	-	-
I19: Government performance	Helliwell & Putnam (2004)	Life satisfaction and governance quality	Linear regression	Positive and significant relationship.
D6: Religion				
I20: Importance of God	Helliwell & Putnam (2004)	Life satisfaction and the importance of God	Linear regression	Positive and significant relationship.
I21: Attendance at religious services	Clark & Lelkes (2005)	Life satisfaction and frequency of attendance	Ordered logit	Positive and significant relationship.
I22: Frequency of prayer	Clark & Lelkes (2005)	Life satisfaction and frequency of prayer	Ordered logit	Positive and significant relationship.
D7: Science and Technology				
I23: Technology makes the world better	-	-	-	-
I24: Technology makes life better	Frey et al. (2007)	Life satisfaction and watching television	Linear and ordered probit	Positive and significant association.
I25: Technology creates opportunities	-	-	-	-

Note. *The security index is created from four variables, including perceived security of assault, theft, violence, and fraud.