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Article

Similar but Different: Uncovering the Multiple Pathways to Life Satisfaction in Asia*

Dong-Kyun Im | Seoul National University
Hearan Koo | Seoul National University
Sang-Hee Park | University of Seoul

Employing social surveys conducted in three East Asian and four Southeast Asian countries, this study examines the pathways by which individuals' well-being and life satisfaction are shaped and makes a cross-regional comparison. Past studies on well-being and life satisfaction have largely neglected to show the complex interdependencies and chain of effects between well-being components and their determinants from a holistic standpoint. Taking advantage of the relatively novel empirical strategy of Bayesian network analysis, this study uncovers the conditional dependency structure of multidimensional social well-being and its regional heterogeneity with regards to how well-being is determined in a processual manner. Results show that regions in East and Southeast Asia share some commonalities, but there are key differences in how individuals' well-being is determined. We propose a compensatory mechanism hypothesis to explain the difference; various economic and relational mechanisms are developed and they effectively make up for the low level of baseline life satisfaction in East Asia.

Keywords: *social well-being, life satisfaction, Bayesian network analysis, East Asia, Southeast Asia*

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Introduction

Since popular attention has turned to the notion of "going beyond GDP" as an alternative development concept, pursuing the betterment of people's "well-being" has gained broad acceptance as a policy goal to replace the economy-centered model of social progress. Improving individuals' well-being became a widespread creed guiding many societies regardless of its stage of economic development. Policymakers have attempted to construct well-being measures for evaluating and monitoring social progress and designing relevant policies. National governments and international organizations have invested a significant amount of resources into developing well-being indicators that are comparable across different countries and times. Researchers have devoted their efforts to produce a more elaborate and scientific understanding of well-being and to discover its determinants.

Despite all these endeavors, we are still lacking sufficient knowledge with regards to effective policy tools for improving the well-being of individuals and societies (Dolan, Peasgood and White 2008; Duncan 2010; Kenny 2011). A major reason for this is that there are notable inconsistencies in empirical findings regarding the factors that have an impact on the well-being of peoples and societies. Over the last three decades, a large quantity of work has been conducted to ascertain the determinants of well-being. The results, however, demonstrate that the determinants of well-being are not equally important across countries or regions (Bonini 2008; Helliwell, Huang, and Harris 2009; Fleche, Smith and Sorsa 2011; Kroll 2015). Researchers agree that individuals' life satisfaction should be understood in the context of the developmental goal and strategy of each country. Nevertheless, they failed to identify key determinants of well-being for people "in a way that is universally comprehensible but is nevertheless sensitive to particular social, economic and cultural contexts" (McGregor, Coulthard and Camfield 2015, p. 2).

As evidenced by prior literature, well-being is a multidimensional and complex concept by nature. The complexity and multifacetedness of well-being is captured through well-being equations that are an aggregate of a variety of life domains such as health, employment, family, income, housing, social relations, and more. Successful application of well-being measures to the arena of policy necessitates knowledge about the interactions among these various determinants of well-being. Therefore, at this point, we need to consider the perspective provided by the Stiglitz-Sen-Fitoussi report (Stiglitz,

Sen and Fitoussi 2009). They pointed out that progress regarding well-being should be examined by looking at various life domains and emphasized that policies designed for specific life domains should consider their impact on different domains as well.

Motivated by this, this study is intended to investigate the overall patterns of interrelationships between determinants of well-being in order to achieve a clear understanding of the multi-dimensional nature of social well-being and yield implications for policy development. We examine the structure of the multiple pathways to life satisfaction in a holistic manner rather than focus on binary associations between variables. For empirical analysis, we employ the Bayesian network analysis, modelling well-being as a complex system made up of chains of dependencies among numerous well-being components. This allows us to show holistic and systematic interrelations among the various components of well-being.

Our empirical investigation focuses on Asia. Asia is a particularly interesting case because it has been undergoing rapid economic growth and social transformation for the past few decades. As the economy develops, people have grown concerned with whether the rising economic prosperity they are experiencing can enrich their lives and improve social well-being. This clearly touches on the idea of pursuing multifaceted well-being as well as the question of Easterlin's paradox. Nevertheless, prior studies on social well-being predominantly focused on Western countries. Consequently, there exist relatively fewer studies on well-being in Asia. This study has the potential to add an important piece of empirical evidence to our understanding of well-being in Asia.

We compare two Asian regions: East Asia and Southeast Asia. While these two regions share some similar historical and cultural characteristics, there are marked differences in terms of population structure, the developmental stage of the economy, and the socio-cultural and political systems. We are interested in revealing how the components of well-being are linked in the two regions and the similarities and differences in determining the level of subjective well-being. By examining these non-Western regions, we will have a more comprehensive understanding of social well-being and develop more appropriate policy tools for improving well-being.

This study is intended to turn our attention from finding additional influencers of well-being and life satisfaction to investigating the structure of interdependence between the determinants of well-being across heterogeneous regional contexts. The following section will provide a literature review of the determinants of well-being and discussion on

contradictory findings regarding country-level and regional variations in the literature. Then, the next section will describe the data and methodology used in this article, followed by a presentation of the key results. The concluding section addresses the implications and limitations of this study and suggests directions for further research.

Multidimensional Social Well-Being and its Debates

Homogeneity versus heterogeneity

A large number of researches have investigated the determinants of well-being. Studies have revealed that contextual differences at the national or regional level are important factors to understanding the various pathways to well-being. Stage of development, culture, religion, and other values such as (post)materialism are considered significant factors that make a difference (Diener and Diener 1995; Ahuvia 2002; Okulicz-Kozaryn 2010 etc.). In this context, the widely held assumption that the better the economic conditions, the better the individual's well-being, which can be referred to as the *homogeneity* perspective, has been questioned in a number of studies (Easterlin 1995; Delhey 2010 etc.)

One of the reasons for the presence of such strong contingency and heterogeneity is attributable to the nature of the relationship between individuals and their environments. Cross-national studies have focused on "person-environment congruence." For example, Elgar et al. (2011) examined the relationship between social capital, health, and life satisfaction in 50 countries by examining the person-environment fit. This necessitates studies that investigate the problem of country-level heterogeneity, rather than homogeneity, in empirical research on well-being and life satisfaction. It also suggests that empirical investigation into the manner in which different patterns of associations between personal, relational, and social well-being dimensions affect life satisfaction is warranted.

Although the sociological understanding of the pathways to well-being has deepened through the discovery of the effects of contextual differences at the national or regional levels, the debate regarding homogeneity versus heterogeneity is far from over. Studies by Helliwell and his colleagues (2009) and Kroll (2013) illustrate such tensions. Helliwell and his colleagues (2009) argue there are key *universal factors* that eventually determine the level of life satisfaction despite some minor differences across countries. In contrast,

Kroll (2013) asserts that determinants of life satisfaction vary depending on country-specific contexts and argues that different factors should be focused on according to a particular country's policy orientations and development goals.

Helliwell and his colleagues (2009) reviewed "the assumption that people all over the world have similar basic preferences, and answer life satisfaction questions in roughly comparable ways" (4). As a result of comparing 105 countries with different cultural backgrounds in different regions, it was found that several key variables such as income, age, attainment of basic needs, having someone to count on, perceived corruption level, and a sense of freedom work in more or less the same way.

Kroll (2013), however, focused on the differences between countries. Taking the *Human Development* approach, he showed that the impact of material conditions, health, and education on life satisfaction varies not only across countries but also across different subgroups within each country. As for the country-level variation, results showed that in Morocco, Georgia, and Egypt, higher income resulted in higher life satisfaction, while in Finland, Norway, and Armenia, income was less relevant and even had a negative correlation with life satisfaction in Turkey and Armenia. The impact of education particularly varied across countries.

How can these seeming contradictions between the homogeneity and heterogeneity perspectives and their implications can be resolved? In this article we provide empirical evidence that contribute to such a discourse and our understanding of the generalizability of well-being models, particularly by examining the cross-regional patterns of relationships among multidimensional well-being components. Prior studies have made methodological, as well as theoretical, attempts to deepen our understanding of the contextual mechanisms of how individual-level well-being is determined. For example, Helliwell and his colleagues (2009) applied a methodology based on multilevel models whereas Kroll (2013) employed a new methodology based on the human development approach. Despite their important contributions to the literature, they were not able to directly show how well-being is shaped and changed through diverse societal channels in a processual manner. By empirically analyzing well-being and life satisfaction, our work will attempt to provide a different, more holistic picture that more clearly illustrates the structure of interrelationships and dependencies between well-being components and their determinants.

Building on the above understanding, it should be noted that the multidimensionality of well-being not only refers to the fact that there are

multiple dimensions within well-being, but also implies that those multiple dimensions interact together and jointly determine individuals' well-being as an outcome. We argue that while previous studies have focused on the former, they have overlooked the latter. Therefore, we propose two approaches to social well-being; the first—a more conventional approach in the literature—is to locate significant variables that affect different dimensions of well-being. The second approach is to discover the interactions and relationships of the variables and how they are jointly structured to constitute the social process of shaping individuals' well-being. While most studies have focused on the first approach, our approach will contribute in both aspects.

Three dimensions of well-being

In this section, we will briefly introduce and discuss the main dimensions of well-being on which our empirical analysis is focused. Social well-being denotes 'a combination of the perception of individual life conditions, their quality of relationship with others, and the conditions of society they reside' (Koo et al. 2016, p. 45). Social well-being can be understood as the joint configuration of three dimensions: personal, relational, and societal well-being. Personal well-being is defined as a positive evaluation of one's life in general. Relational well-being refers to the state of having rich and meaningful relationships with others and of having trusting and embracing attitudes toward others. Finally, societal well-being is shaped by the quality of institutions and one's positive perceptions regarding the functioning of their society (Koo et al. 2016, p. 45). This definition implies that individuals living in a trusting and inclusive society and who are forming rich and meaningful relationships with others are likely to enjoy a high level of life satisfaction and happiness.

Based on this framework, life satisfaction is treated as a measure of *personal well-being* and the final outcome variable in this study. As the most representative single indicator that measures subjective well-being, life satisfaction is an individual's cognitive and affective evaluation of the general state of their life. The level of life satisfaction is often the result of the individual's comparisons between their perceived life conditions and self-imposed standards (Shin and Johnson 1978; Pavot and Diener 1993). The degree of life satisfaction is evaluated according to the degree that those perceived conditions match their standards. In other words, life satisfaction reflects the multidimensional conditions of one's well-being, covering

personal, relational, and societal well-being. Within the personal well-being dimension, financial satisfaction and life satisfaction are closely related. Some prior studies demonstrated that life satisfaction is more strongly associated with satisfaction with family life than with financial satisfaction in affluent societies (Oishi et al. 1999), which calls for a more careful examination of cross-cultural differences in how personal well-being is shaped through different cultural pathways.

Relational well-being is largely measured by the quality and quantity of one's social network and it is one of the most important factors that affect the physical and mental health of an individual (Berkman and Syme 1979; House, Umberson, and Landis 1988; Seeman 1996; Berkman et al. 2000; Cohen, Gottlieb and Underwood 2000; Uchino 2004, 2006; Koo and Park 2016, p. 38 recited). The existence of a stable and effective social support network acts as a buffer against various risks that an individual may encounter in the course of their life. Relational well-being has a meaningful effect on health by mitigating stress, bringing about psychological stability, and promoting healthy behaviors (Cohen 1988; Uchino, Cacioppo, and Kiecolt-Glase 1996; Koo and Park 2016, p. 38 recited). Social capital measured according to the strength family, neighborhood, religious, and community ties, promotes physical health and subjective well-being (Helliwell and Putnam 2004).

From a macro-level perspective, the level of political and economic development and the cultural environments are considered the main factors that constitute *societal well-being* and affect life satisfaction. Life satisfaction at the national level correlates with political and economic development factors, such as human rights, and societal equality (Diener, Diener and Diener 1995), freedom and justice (Veenhoven 2005), free choice (Inglehart et al. 2008), democracy (Frey and Stutzer 2000), GDP per capita (Diener et al. 2010), and the levels of corruption (Oishi and Roth 2009; Oishi 2012; Diener, Inglehart, and Tay 2013, p.501 recited).

Additionally, individuals' sociodemographic conditions such as their gender, education level, age, income level, marital status, and state of employment are known to influence their well-being (Clark and Oswald 1994; Gerdtham and Johannesson 2001; Meeks and Murrell 2001; Dear, Henderson and Korten 2002; Fugl-Meyer, Melin, and Fugl-Meyer 2002; Blanchflower and Oswald 2004; Moksnes and Espnes 2013 etc.).

East and Southeast Asia as the Case

This study focuses on Asia—East and Southeast Asia, in particular—employing a cross-national survey conducted in seven Asian countries (i.e., Japan, Korea, Taiwan, Indonesia, the Philippines, Thailand, and Vietnam). Because previous studies on the topic mainly focused on Western countries, this study has the potential to add an important piece of empirical evidence to the literature and enhance our sociological understanding of well-being in Asia.

Here, before moving on to the empirical analysis section of this article, we will briefly justify our grouping the seven countries into two regions. First, because a significant portion of prior literature has dealt with the issue of how economic growth and well-being are related, grouping the countries by their levels of economic development and examining regional differences in well-being is significant and may yield interesting observations. Ceriani and Gigliarano (2016) also made a similar comparison between West EU and East EU when studying the multidimensional well-being. In that sense, the fact that China (PRC) is not included in our East Asian sample is important. Considering the fact that China is a very significant country in East Asia but not a developed economy at this point, it would be more fair to re-define "East Asia" in our analysis as "*affluent East Asia*" (AEA). Likewise, because there are relatively wealthy societies like Singapore in Southeast Asia that were not surveyed, our sample may be called "*developing Southeast Asia*" (DSA) to describe our approach in a more precise manner.[1] In this article, though we will refer to the two groups as East Asia and Southeast Asia for the sake of efficiency, the two terms actually refer to AEA and DSA. Secondly, focusing on the differences between the two regions can contribute to the line of literature dedicated to examining regional-level differences. For example, Inglehart-Welzel's cultural maps show that the two regions share a distinct cultural value system (Inglehart 2018). Ngoo, Tey, and Tan (2015) found that the standard of living and marital status have stronger influence on life satisfaction in East Asia, while the role of government is more significant in Southeast Asia. Although we will primarily analyze at the regional-level, some inter-regional observations will be also provided in the results section.

In summation, this study is intended to deepen our sociological understanding regarding the manner in which various societal, relational,

[1] We thank an anonymous reviewer for pointing this out.

and personal level factors shape and create channels that determine individuals' well-being by focusing on the multidimensional structure of the components of well-being and their interdependency by employing a Bayesian network approach, focusing on two Asian regions. The following sections will show and discuss our empirical findings.

Data and Methodology

Data and Variables

We use data[2] from the Social Well-Being Survey in Asia (SoWSA), which was conducted in 7 Asian countries. SoWSA data collection was supported by the MEXT-Supported Program for the Strategic Research Foundation at Private Universities of Japan, 2014-2018 (S1491003). The survey was designed by the Center for Social Well-being Studies at Senshu University in Japan, and conducted in three East Asian countries (Japan, Korea, and Taiwan) and four Southeast Asian countries (Indonesia, the Philippines, Thailand, and Vietnam). The surveys were intended to measure the level of social well-being in each country and to explore the structures and mechanisms that were responsible for varying levels of well-being in different countries. The survey questions included a set of multilayered items that were intended to measure individual and societal well-being at micro, meso, and macro levels. Data collection in each country was directed by national collaborators who participated in the International Consortium for Social Well-Being Studies (ICSWB).

The sample size from each country varied from around 1,100 in Thailand to 11,804 in Japan and the respondents' age also varied. For comparative purposes, we selected respondents aged 20 to 69. The number of respondents from the East Asian region (EA) and the Southeast Asian region (SEA) were 16,089 and 4,402, respectively. The mean age of respondents from EA (43.9 years old) was slightly higher than those from SEA (41.4 years old) and the proportion of married respondents was lower in EA (60.5%) compared with SEA (69.9%). Some key descriptive statistics and information on the surveys conducted in each country is summarized in Table 1.

Before we conducted Bayesian network analysis (BNA), we selected the

[2] The data we analyzed is the merged SoWSA data set version 0.5 which is prepared by KOSSDA and shared between ICSWB members.

Table 1
Survey and Sample Descriptions

Country	South Korea	Japan	Taiwan	The Philippines	Thailand	Vietnam	Indonesia
Fieldwork year	2015	2015	2017	2016	2016	2015	2017
Population (Universe)	Persons aged 20-69	Persons aged 20-69	Persons aged 20-69	Persons aged 18-80	Persons aged 17-90	Persons aged 18-74	Persons aged 20-82
Geographic coverage	Nationwide	Nationwide	Nationwide (excluding off-shore islands)	Nationwide	Nationwide	Nationwide	Java and Bali
Sampling method	Proportionate quota sampling stratified by sex, age, and region	Proportionate quota sampling stratified by sex, age, population of municipality, and region	Proportional quota sampling stratified by sex, age, and region	Two-stages, Quota	Proportionate quota sampling stratified by sex, population of municipality, and region	Two-stages, Quota	Two-stages, Quota
Fieldwork methods	Web survey, partly telephone survey	Web survey	Web survey	Face-to-face interview	Face-to-face interview	Face-to-face interview	Face-to-face interview
Region	East Asia			Southeast Asia			
N. of cases	16.089			4,402			
Age (mean)	43.9			41.4			
Female (%)	49.8			51.0			
Married (%)	60.5			69.9			

variables of interest from the SoSWA survey. While we limited the number of variables in order to increase the readability of *directed acyclic graph* (DAG) outputs and the parsimony of our model, we also tried to incorporate as many variables as possible if they were known determinants of well-being from the previous studies discussed earlier. The variables can be categorized into five groups: socioeconomic variables, subjective life conditions, relational well-being, societal well-being (i.e., perceptions on the functioning of society), and overall personal well-being (i.e., life satisfaction). The following list shows the variables used in the analysis and their corresponding labels attached to nodes in the Bayesian network DAG.

Socioeconomic Variables

- AGE: Respondents' age
- EDU: Level of education
- INC: Household income
- JOB: Work status (employed/self-employed/unemployed/not looking for work)
- FAM: The number of household members

Subjective Life Conditions

- INC_SAT: Satisfaction with family income
- EMPL_SAT: Satisfaction with the state or security of employment
- LEI_SAT: Satisfaction with the amount of leisure time

Relational Well-being

- NEIGHBOR: The degree of participation in neighborhood activities and the frequency of interaction with neighbors (mean score)
- SUPPORT: How much respondents rely on family, relatives, friends, regional groups, and neighbors (mean score)
- RF_INT: The frequency of interaction with relatives and friends
- TRUST: General trust ("To what degree do you trust most people?")

Societal Well-being

- FAIR_DIS: Respondents' perceptions regarding how fairly people are treated on the basis of gender, age, education, occupation, income, assets, or family background (mean score)
- INC_GAP: Respondents' opinions about whether the income gap is too large

Overall Personal Well-being

· LIFE_SAT: Life satisfaction

It should be noted that education and income variables were standardized and other variables, except JOB, were mean-centered for each country before the country-level data were merged and utilized in further analysis.

Methods

In the following analysis, we introduce the results of the BNA to explore the multiple heterogeneous pathways of well-being in East and Southeast Asia. BNA is a statistical method that is capable of revealing the structure of probabilistic dependencies in a given set of variables. It uncovers the conditional independent relationships among variables and visualizes them as a DAG. For instance, when there are three variables, X, Y, and Z, and if Y is conditionally dependent on X, Z is conditionally dependent on Y, but Z is not dependent on X, their probabilistic causal relationships can be shown as a DAG of X → Y → Z. The links in the graph are *directed* and there are no circular loops (*acyclic*). The presence of directed links represents the probabilistic dependence structure and the absence of such a link between two variables indicates statistical independence between the two.

When applied to a large set of many variables, BNA can effectively show the complex relationships and probabilistic dependencies among the variables. The causal structure is represented via a graphical structure (G), which consists of vertices (nodes) and edges (arcs or links). Bayesian network analysis produces a DAG of the joint probability structure distribution induced by the model, which can encode individuals' various states of well-being and their background characteristics.

To be clear, this graphical representation does not show the structure of deterministic relationships, but rather the probability structure as a probabilistic model. That is, the Bayesian network model constructs a joint distribution structure over every combination of responses of N variables, according to which ones can estimate a posterior distribution of any Xj when the value of Xi is specified. Thus, analyzing individuals' requirements for well-being with Bayesian networks means treating the multidimensional elements as complex probability distributions, thereby unearthing diverse pathways to life satisfaction. Assigning a probability structure (or stochastic structure) to the such an analysis reflects the extent of uncertainty in the

formation of individuals' well-being and life satisfaction (Im 2014).[3]

Finding the knowledge structure by factoring a distribution using a graphical representation (network) is usually done by finding conditionally independent relationships among the variables. This is where the concept of a d-separation (direction-dependent separation; Pearl, 1988) is used. Simply speaking, two nodes in the network, X and Y, are conditionally independent, or "d-separated" in graphical tests, if every path from X to Y is blocked by a set of random variables Z in the DAG.[4] As mentioned earlier, conditional independence between two variables is represented as a graphical segregation (i.e., no edge) in the visualized output, whereas an arrow (directed edge) from node A to node B indicates that B is dependent on A. Conditional independence tests using d-separations are used in various kinds of structure learning algorithms built on constraint-based algorithms, which are used for this study (See Scrutari 2010).[5]

Though Bayesian network analysis is often used for tackling "causal" relational patterns by using DAGs and testing conditional independencies between variables, we do not use Bayesian networks in this study for illustrating "causal" relationships but rather to reveal and project a holistic picture of the embeddedness of individuals' well-being. The cross-sectional nature of our data, the possibility of the omitted-variable bias problem occurring, and mutual feedbacks that arise among a given set of variables preclude us from interpreting the results in highly causal terms. The results of the BNA presented in this article, therefore, should be read as patterns of interrelationships rather than causal relationships.

For a more concrete understanding of BNA, a much more detailed and technical explanation is required. Due to practical constraints, however, we cannot provide a full explanation regarding the details of BNA here. More information can be found in Darwiche (2009); Koller and Friedman (2009);

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[3] Although this analysis is called "Bayesian" network analysis, it does not mean that learning the structure of the network is based on Bayesian analysis. The Bayesian part becomes relevant when a researcher, by taking advantage of the relational structure of random variables (i.e., nodes) of a Bayesian network (DAG), computes conditional probabilities and uses such probabilities, for example, to diagnose the reasons for a specific outcome. Prior information is used to construct such conditional probabilities. "Bayesian network" should be understood in this context as a specific term that indicates a probabilistic DAG model.

[4] More specifically, X and Y are d-separated given Z when their connective structures are either serial (X→Z→Y; X←Z←Y) or diverging (X←Z→Y), or when the structure is converging and Z (X→Z←Y) is not conditioned on. See Pearl (2000) for a more detailed explanation.

[5] There are other kinds of structure learning algorithms such as score-based algorithms that do not use conditional independence tests.

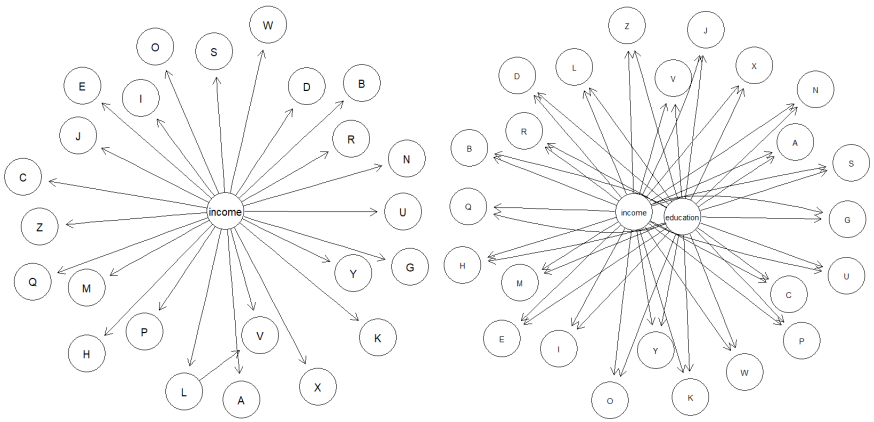

Fig. 1. Hypothetical Bayesian networks

Lopez, Ramirez, and Casado (2012); and Ceriani and Gigliarano (2016). Instead of providing a more lengthy, technical account, we think it would be more beneficial to provide a simple, hypothetical example that shows what kind of output is produced by BNA and whether or not the methodology is effective (Im 2014).

Figure 1 shows two hypothetical examples of conditional dependence networks represented by BNA. For Graph (A), we hypothesized a case where all individual outcomes are affected by income. In order to simulate such a case, we created 24 hypothetical random variables (from A to Z) that represent individual-level outcomes, which are produced by a linear combination of randomly distributed income and residual errors (N = 5,000). The presence of an arc between two variables indicate that they are conditionally dependent on each other, which means that their relationship is statistically significant ($p < .05$) even after other variables are controlled for.

The Bayesian network aptly shows that all random variables are influenced by individuals' income ($p < .001$), showing directed arrows from income to random variables. Because all variables other than that were created as a function of income, there were significant correlations among them (A to Z), but such significant links are eliminated from the graph after conditional independence structure among variables is considered. The only exception is that the significant effect ($p < .01$) of variable L on variable V is produced by random chance under joint uniform distribution.

Another hypothetical case is one in which all outcomes are produced by two factors, such as income and education. Graph (B) represents such a case,

which consists of 24 random variables, income, and education. The random variables are produced through linear combinations of income, education, and residual errors, which are randomly generated. This output of the Bayesian network, again, shows a result consistent with the underlying dependency structure used to create the network. All variables are significantly affected by income and education ($p < .001$), and directed relationships are displayed on the graph.

To detect the underlying causal structure that shapes the relationships between diverse variables, scholars often turn to the structural equation modeling (SEM) technique. Although SEM is popular and has its valuable merits, it is not without limitations. For example, in order to run a SEM model, a researcher must have a hypothesized model of causal relationships among variables and make model comparisons based on fit statistics. The fit statistics, however, will only tell the researcher if the whole model is relatively acceptable or not while not specifying which part of the structural equation model is problematic; it makes the method prone to misspecification and sometimes calls for evaluating conditional independencies which are available through BNA (Greiff and Heene 2017; Thoemmes, Rosseel, and Textor 2018). Because SEM takes a theory-driven approach, BNA, as a data-driven method, can illustrate a different picture of the relational pathways that determine individuals' well-being in their life-course.[6] Compared to more conventional regression-based methods like OLS, BNA in particular has an advantage because it can more clearly illustrate the *social process* by which well-being is determined. Thus, it can provide us with a more holistic picture than regression-based approaches that only show the binary relationships between predictors and outcome variables.

We also used various types of Bayesian network learning algorithms and compared their goodness-of-fit scores to evaluate their fits and determine the choice of algorithm. We found that the Grow-Shrink algorithm, which is one of the constraint-based structure learning algorithms, produced the best results by showing the lowest BIC values. All procedures were conducted using the *bnlearn* package in R. See Scutari (2010) for more detailed information about the R package and Bayesian network structure learning algorithms. Bayesian network graphs were produced using the DOT layout, so that the hierarchical structure of relationships can be effectively displayed.

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[6] Finding the DAG structure for BNA, however, can be also understood as non-parametric SEM. We appreciate an anonymous reviewer for pointing this out. Additionally, a BNA model can also be partly theory-driven when researchers apply their knowledge of causal relationships while fitting the Bayesian networks.

In order to compute the fit statistics, all edges in the Bayesian network need to be directed. In order to make it a directed network and ease the identification process, we eliminated some possible directed relationships in advance. There were two kinds we eliminated; the first were the ones that contradicted common sense, which are the arcs from subjective variables to sociodemographic variables (e.g., any subjective attitudes → age) or to relatively objective variables (e.g., employment satisfaction → frequency of interaction with neighbors), although the latter can be probed deeper with panel data. The second were the arcs that were less convincing than their opposite (e.g., life satisfaction → social support). While most of the second type of blacklists were consistent with common sense, some of them needed further discussion and they will be explained in the results section (See footnote 8). This process was carried out via blacklist setting in the *bnlearn* package in R. It should be noted that BNA often relies on expert knowledge so that researchers can effectively assist with the identification process (e.g., blacklisting some arcs) (Lee and Kim 2019).

Results

Figure 2 shows the Bayesian network of the aforementioned list of variables, using the three East Asian countries (i.e., Japan, South Korea, and Taiwan). It should be noted that in order to solve the problem of the much larger sample size of the Japanese sample (N=11,786), which is about six to ten times larger than the other countries, we randomly selected 2,000 cases from the Japanese sample pool in order to make it similar compared with other countries (e.g., Korea, N=2,000). In order to confirm the representativeness of the subsample, we tested whether there was a significant difference in mean values and standard deviations between all the variables used in BNA between the selected and non-selected Japanese cases. The results displayed no statistically significant difference between the two.

Figure 2 shows a large dependency structure where sociodemographic variables and various dimensions of the well-being variables constitute a complex pathway to life satisfaction. The presence of an edge between two variables indicates that the relationship is conditionally dependent. Because the large sample size enabled the significance test to detect even minimally meaningful relationships as significant, the threshold of statistical significance was lowered to $p < 0.01$. The thickness of the arcs is proportional to the probability that is the arc is significant in bootstrap replicates. The

probabilities were derived by calculating the frequency of how often the arc was found to be significant in bootstrapped samples. We generated 100 nonparametric bootstrapped samples each of which had a sample size of 100. The thickness of the arc represents the *confidence* we have in each arc (Friedman, Goldszmidt, and Wyner 1999).

There are several points that merit our attention. First, an individual's satisfaction with their life is affected by various factors that include economic well-being (e.g., family income, satisfaction with income, and employment), relational well-being (e.g., trust, social support, interaction with neighbors, and interaction with family and friends), and other kinds of personal well-being (i.e., satisfaction with leisure). One important caveat here is that the directions of some of the arcs in the Bayesian network were predetermined in the BNA procedure. See footnote 8 for the details.[7] The result show that satisfaction with life in East Asia can be determined through various channels and it is dependent on multiple processes. Increases to one's household income may not affect only income satisfaction and thereby increase life satisfaction but also influence one's social capital, which can consequently improve life satisfaction.

Second, Figure 2 clearly shows that satisfaction with income (INC_SAT) plays a prominent role throughout the network. The importance of the variable is due particularly to its strong mediator position. INC_SAT affects satisfaction with leisure, satisfaction with employment, and satisfaction with

[7] By using the 'blacklist' option in the *bnlearn* package, we forced the arcs from life satisfaction to leisure satisfaction and employment satisfaction to be excluded. It is possible that that life satisfaction can affect the two satisfaction variables, but we hypothesized that the two variables can be conceptualized as the determinants of life satisfaction which is regarded as the final destination and the most inclusive concept in our multidimensional well-being model. There are two other kinds of blacklisted arcs that require clarification. One of them is the arc from life satisfaction to trust. Again, although it is possible that the level of life satisfaction changes the level of trust, previous studies, such as Kroll (2008), Elgar et al. (2011), and Helliwell and Huang (2011), suggest that possessing a high level of trust towards other people or living in an environment where a high level of generalized trust is nurtured tends to generate higher levels of happiness and life satisfaction. The other blacklisted arc which is relatively less important in the network but still needs explanation is the arc from life satisfaction to perceptions of income inequality in society (INC_GAP). While it is not impossible that perceptions of inequality affects one's life satisfaction, we excluded such a directed arc for two reasons. First, it is difficult to imagine that an ordinary person's evaluation of inequality in society would have a great impact on their overall life satisfaction even when that person's income, income satisfaction, and other characteristics are controlled for. Second, studying the relationship between inequality and happiness is usually meaningful at the cross-national level or by looking at the objective level of inequality and changes in the levels of happiness using panel data. Although our data is based on multiple countries, the INC_GAP variable is standardized so we can disregard the effect of country-level differences in the level of inequality.

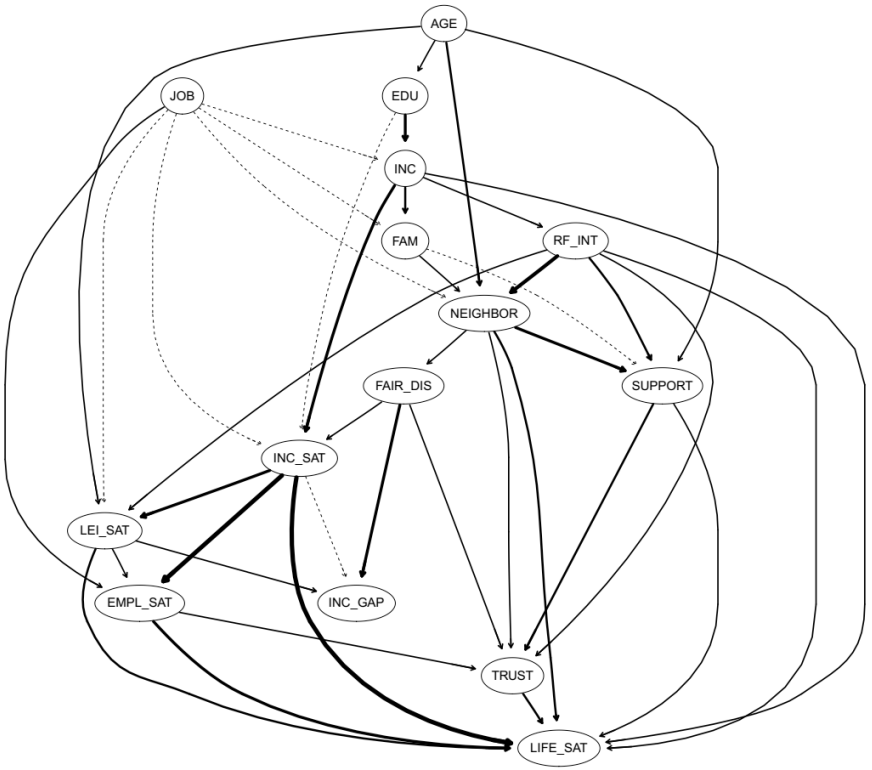


Fig. 2. A Bayesian network plot for East Asian countries (South Korea, Japan, and Taiwan)

life, all of which are the key well-being variables in this BNA. The fact that income satisfaction is strongly affected by household income and that level of income is affected by the level of education shows why education is often heavily emphasized in East Asia.

Third, the roles of the relational well-being variables (i.e., NEIGHBOR, SUPPORT, RF_INT, and TRUST) merit close attention. In the network, they occupy significant positions that connect socioeconomic variables with subjective attitudes and well-being. The channels through which they influence people's life satisfaction are also diverse. Sometimes they are directly linked to life satisfaction, which means life satisfaction is conditionally dependent on them (e.g., NEIGHBOR, SUPPORT, RF_INT → LIFE_SAT). Sometimes they affect other kinds of well-being and satisfaction, which subsequently affect life satisfaction. For example, they can increase

people's leisure satisfaction, which increases life satisfaction. They can also enhance individuals' social trust, which leads to higher life satisfaction. Among the relational well-being variables, TRUST shows a particularly interesting characteristic. It will be discussed when we examine the results of the Southeast Asian region.

In summation, with regards to the East Asian samples, there are two distinct pathways to life satisfaction. The two major mediators that have the highest degree centrality, which is 8, in the network are income satisfaction (INC_SAT) and interaction with neighbors (NEIGHBOR). It is noteworthy that these two main channels are not heavily intertwined with each other and therefore the two pathways based on economic capital and social capital remain relatively distinguishable. Nevertheless, the strength of the arcs show

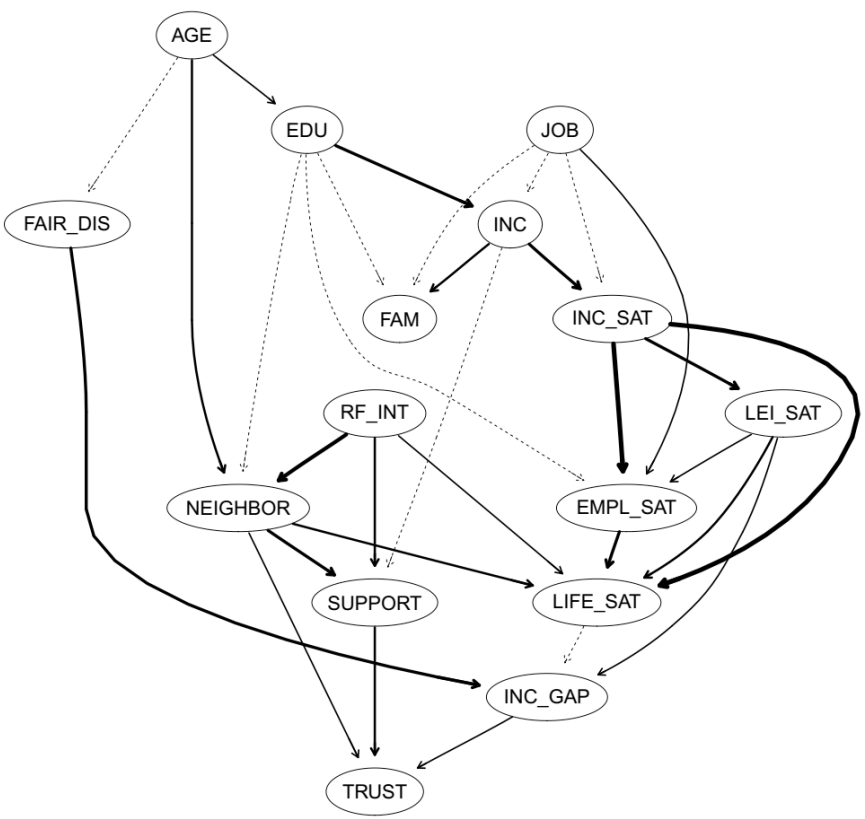
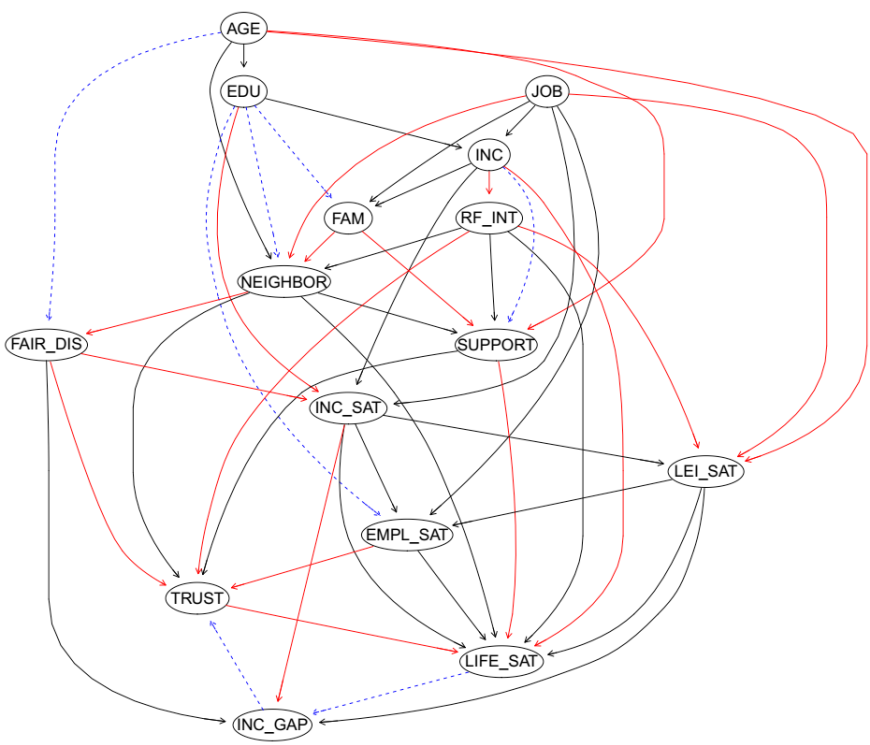


Fig. 3. A Bayesian network plot for Southeast Asian countries (Indonesia, the Philippines, Thailand, and Vietnam)

that economic satisfaction is relatively more important than social capital in determining one's life satisfaction.

Figure 3 shows the Bayesian network produced using the Southeast Asian samples (i.e., Indonesia, the Philippines, Thailand, and Vietnam). The results show a different pattern in several aspects. In order to make a more effective comparison between the two regions, we also present Figure 4. Dependencies found only in East Asian countries are expressed as solid red lines. Dependencies found only in Southeast Asian countries are shown in dashed blue lines. The links commonly shared by both are displayed in solid black lines.

The two graphs possess some commonalities. Both results show that two somewhat distinct pathways have been developed centering around income



Solid black lines: Links commonly shared by both
Solid red lines: Dependencies found only for East Asian countries
Dashed blue lines: Dependencies found only for Southeast Asian countries

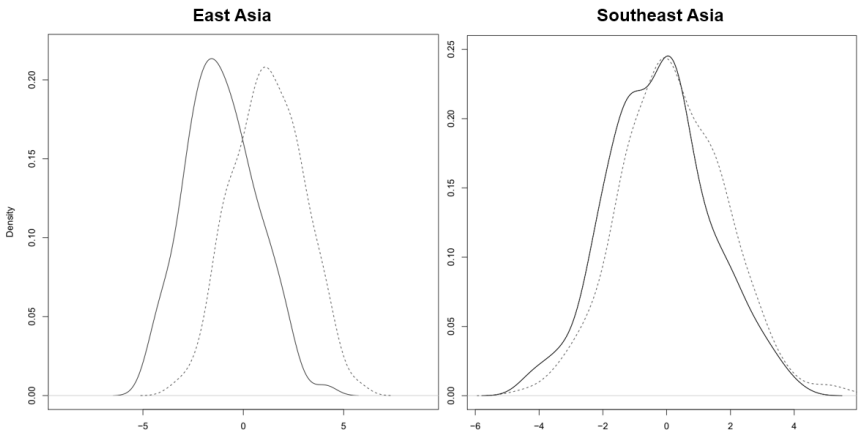
Fig. 4. Comparison of Bayesian networks between East Asian and Southeast Asian countries

satisfaction and social capital. As with the East Asian case, Southeast Asia also shows that these two paths are not very closely related to each other. Also, like the East Asia case, the most robust pathways in the Southeast Asia case are the ones that radiate from income satisfaction and directly or indirectly reach life satisfaction. NEIGHBOR has the highest degree centrality in the network. That pattern is also the same across Southeast Asia and East Asia.

However, there are also significant differences between the two networks. First of all, the Bayesian network of East Asia shows a relatively denser conditional dependency network than Southeast Asia. While both networks have 15 nodes, the East Asia network has 42 edges (a density of 0.400) and the Southeast Asia network has 31 edges (0.295). The nodes that have the highest degree centrality in East Asia are income satisfaction, life satisfaction, and neighbors, which has a degree centrality of 8. Several other variables have degree centrality of 6. In Southeast Asia, only life satisfaction and neighbors have the highest degree centrality, 6. When BNA was applied to each country to examine country-level heterogeneity, the results showed substantially similar differences across the two regions. The network density scores of the Bayesian networks are as follows: Korea (0.33), Japan, (0.31), Taiwan (0.32), Indonesia (0.16), the Philippines (0.22), Thailand (0.18), and Vietnam (0.21). The overall configuration of BNA plots for each country confirms such regional level differences (See Appendix).

Such a difference in network density and the overall level of connectedness suggests that in Southeast Asia, the paths to life satisfaction are less structured or solidified than in East Asia. Another important point related to the difference in network density is the role of income. In East Asia, household income directly affects life satisfaction and also social capital. In Southeast Asia, household income is not directly connected to life satisfaction and has a relatively limited role in influencing social capital. The relative impact of income satisfaction on life satisfaction is also different. The conditional density computed by the Bayesian networks shows that income satisfaction has an effect of .320 on life satisfaction in East Asia, while its effect is .240 in Southeast Asia. When all other direct and indirect paths are considered together, the effect of income on life satisfaction has a much smaller effect in Bayesian networks. In order to confirm these differences, we examined the conditional probability distribution of life satisfaction computed by the Bayesian networks.

Figure 5 shows the probability distribution of the life satisfaction variable conditional on the level of household income. The solid line indicates the



Solid line: household income <= -1 s.d.
Dashed line: household income => 1 s.d.

Fig. 5. Probability distribution of life satisfaction conditional on household income

conditional probability distribution when individuals' household income is equal to or less than -1 standard deviations from the mean. The dashed line shows the same type of distribution when income is equal to or greater than one standard deviation. (Recall that income variables are standardized to have a mean of zero and standard deviation of one.) The figure clearly shows that the effect of income on life satisfaction in Bayesian networks is far greater in East Asia than in Southeast Asia.

In general, the entire Southeast Asian dependency network shows a relatively weaker correlational structure than in East Asia. Income satisfaction; interactions with neighbors; and friends, social support, and life satisfaction are all linked to relatively fewer other variables via conditional dependencies. Even the absolute size of the correlation coefficients is considerably lower in most cases of the Southeast Asian sample, which suggest that the pathways suggested by the network have much weaker differential effects on individuals' well-being.

In addition, the role of generalized trust (TRUST) is markedly different in the two graphs. While a few paths are directed towards TRUST, it does not have any significance in relation to life satisfaction in Southeast Asia. In contrast, TRUST is one of the most important nodes in the whole dependency network in East Asia, grouping five edges together and sending

them on the pathway to life satisfaction. This result illustrates that the sociological implications and importance of trust with regard to people's lives can be remarkably different depending on the sociocultural context.

The difference in the importance of other relational well-being indicators also warrant our attention. Three indicators that measure individuals' interpersonal embeddedness (i.e., NEIGHBOR, RF_INT, and SUPPORT) are associated with a larger number of variables that are related to satisfaction in East Asia. Combined with the finding on the effect of TRUST explained above, the results collectively suggest that relational well-being has a larger differential effect on well-being and life satisfaction in East Asia than in Southeast Asia.

To summarize, we found striking similarities and commonalities between the two Asian regions with regards to big picture comparisons. However, close examination of the two dependency networks clearly reveals that there is a greater number of channels and pathways in East Asia through which the level of individuals' well-being and life satisfaction is shaped. Individuals' economic and relational conditions and resources have larger differential effect on life satisfaction in East Asia. In the following section, we provide an interpretation to account for such a regional difference.

Discussion

The results of the BNA present interesting differences between East Asian and Southeast Asian societies and confirms heterogeneity in the social processes of how individuals' well-being is determined. So, how do we explain these major differences? Why do we see such differences between the two regions?

One simple yet plausible reason for the difference, particularly the relatively sparse Bayesian network in Southeast Asia, is that the model may not include all the determinants of well-being in Southeast Asia. For example, the absence of a link between trust and life satisfaction may be due to some missing nodes that (fully) mediate and connect the two variables. This hypothesis, however, cannot be properly tested with our data.

An alternative explanation focuses on the diversity of structural and societal contexts of the two regions. It is worth noting that all four Southeast Asian countries in our sample report have significantly higher levels of life satisfaction than the three East Asian countries. Specifically, the mean life satisfaction score of each country, based on an 11-point scale, is as follows:

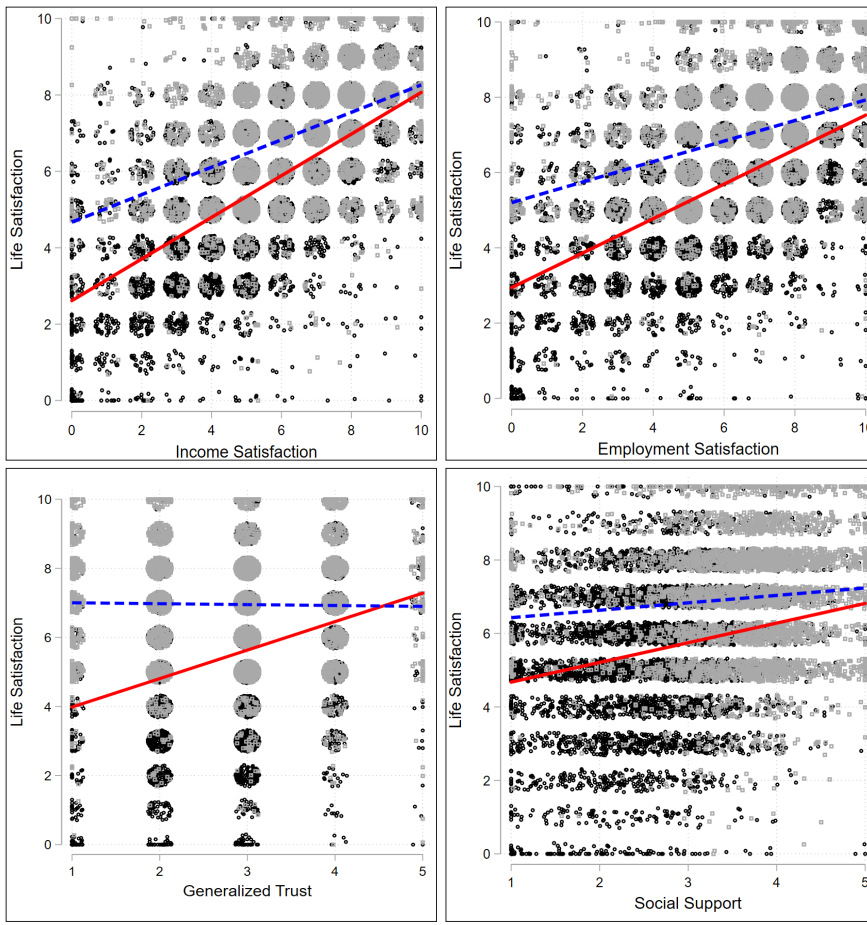
Thailand (7.29), Vietnam (7.02), Indonesia (6.92), the Philippines (6.67), Japan (5.65), South Korea (5.54), and Taiwan (5.54). Even the standard deviation of life satisfaction is larger in East Asia, which reflects a higher level of inequality in life satisfaction in the region.

Although it is tempting to conclude, based on such an observation, that economic development and the rise of living standards might have paradoxically decreased overall life satisfaction and happiness in East Asia, there are other compelling explanations. For example, East Asian societies may display lower levels of life satisfaction because of peculiar cultural contexts and practices in the region, irrespective of economic development. A number of previous studies have found that Japan, Korea, and Taiwan share relatively similar cultural value systems (e.g., Inglehart-Welzel cultural map), which consists of pressure to compete and achieve academic excellence, emphasizes conformity, and discourages individuality and the expression of emotion, all of which could be factors that result in lower happiness levels (Ng 2008).

This article, indeed, does not intend to adjudicate between structural and cultural theories to explain the lower level of life satisfaction in East Asia. The reason the lower level and the larger standard deviation for life satisfaction in East Asia matters is because it indicates that there is more room for structural and institutional factors to affect individuals in the region. In order to delve deeper into this problem, we examined the relationship patterns between life satisfaction and other key variables in East and Southeast Asia. Figure 6 shows the results.

The results display a consistent pattern with regards to the differences between East and Southeast Asia. In East Asian societies, the average level of life satisfaction is lower, especially when economic and relational conditions are poor. However, the satisfaction gap shrinks and eventually becomes negligible once such conditions are improved for individuals. In other words, the differential effect of economic and relational factors is greater in East Asia, where baseline life satisfaction is low. Such a powerful differential effect was reflected in additional conditional dependencies in the Bayesian network model of East Asian cases.

In this article, we posit that *compensatory mechanisms* are one of the main operating mechanisms that drive the patterns revealed in Figure 6 and through the Bayesian networks. That is, due to the mix of cultural and structural factors, the overall level of life satisfaction is lower in East Asia, and some socially desirable pathways are formed and developed to compensate for such a low level of satisfaction. Within the cultural and societal context



Solid red lines: East Asia (Japan, Korea, and Taiwan)
Dashed blue lines: Southeast Asia (Indonesia, Thailand, the Philippines, and Vietnam)

Fig. 6. The relationship between life satisfaction and other well-being indicators in East and Southeast Asia

that depresses the life satisfaction of individuals, individuals strive to attain the economic or relational resources to bolster their happiness. Our result demonstrate that economic conditions and interpersonal relations play an important compensatory role in life satisfaction. Furthermore, at least for individuals who can enjoy such resources, their level of life satisfaction improves significantly compared to other members of society and reaches the level of life satisfaction experienced by Southeast Asians. For individuals who

fail to accumulate such resources, however, their life satisfaction will remain considerably lower, as implied by the conditional dependency structure from the Bayesian networks.

In summation, in order to account for the differences displayed in the BNA comparing East and Southeast Asian societies, we focused on the lower mean score and higher variance of life satisfaction in East Asian societies. It is our view that, in such East Asian contexts, some compensatory mechanisms are developed for individuals to make up for their low baseline life satisfaction, which can have a powerful differential effect compared to Southeast Asia.

Conclusion

In this article, we argued that the inter-connectedness of well-being determinants should be examined in order to develop a deeper understanding of the role of each determinant in improving individuals' well-being in society. We hypothesized that the structures and dynamics of inter-connected well-being determinants will vary depending on societal context.

We investigated the similarities and differences in the pathways to well-being and life satisfaction in affluent East Asian (AEA) and developing Southeast Asian (DSA) countries by using Bayesian networks. We found that economic elements, such as income satisfaction, play a central role in improving life satisfaction both regions. We also found that two distinct routes developed around both income satisfaction and social capital and they serve as prominent pathways to life satisfaction in the two regions.

The results, however, show that there are significant differences between the pathways of the two regions. The most outstanding difference is that entire dependency structure is more dense in East Asia, showing a stronger correlational structure. We also found that household income has a much higher differential effect on life satisfaction in East Asia. The role of social trust is also different; in East Asian countries, various well-being factors influence life satisfaction through general trust, while in Southeast Asian countries, the route from trust to life satisfaction is disconnected. In the discussion section, we proposed a compensatory mechanism hypothesis to account for such regional differences.

We have demonstrated in this study that the Bayesian network approach can be a useful tool to examine the conditional dependencies of the various dimensions of well-being and effectively identify structures of diverse

pathways across societies with different social and institutional environments. The network approach to well-being determinants has great potential to better our understanding of the complex relationships between well-being determinants and it may significantly transform contemporary well-being research. In particular, it can be used to provide an integrated model for public policy decision-making because it can identify, and thereby prioritize, key elements to target and find efficient pathways to develop synergies between well-being determinants.

This study has the following limitations: first, although BNA is often used to probe the causal structure of given variables, we cannot, indeed, fully ascertain the causality of the directed relations presented in our Bayesian networks. The fact that several arcs must be manually blacklisted, as previously mentioned, in order to identify a Bayesian network as a DAG remains the primary limitation of our analysis. Nevertheless, that does not change the main finding regarding the regional differences between East and Southeast Asia described in this article. On the other hand, although DAG is mostly developed and used to identify the causal structure, our analysis utilizing this method cannot derive strict causal implications from these results. That calls for more careful research in the future on the utility and limitations of BNA for analyzing survey data in the social sciences.

Secondly, we could not rule out the possibility of the omitted variable bias. Our selection of well-being elements relies entirely on the data we analyze. Although the SoWSA survey attempted to accommodate virtually all of the well-known determinants of well-being recognized in the literature, not all relevant variables were included in the final model. This may ignore other variables that might be just as relevant in explaining well-being and producing different Bayesian network structures. Of course, the fact that our choice of components is limited by data does not mean that the rendered networks themselves are necessarily arbitrary (Schmittman et al. 2013).

Finally, although we very briefly showed that inter-regional patterns are largely consistent with the intra-regional patterns, we focused on examining the Bayesian networks at the regional level and mostly ignored the country-level heterogeneity. Future studies need to probe such inter-regional and even country-level differences in order to more clearly understand the multilevel heterogeneity in individuals' well-being and life satisfaction.

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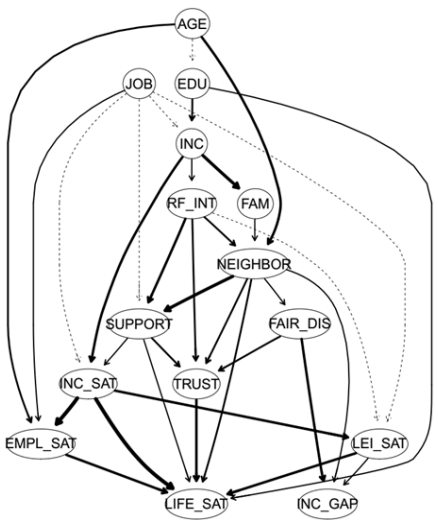
DONG-KYUN IM is an associate professor in the Department of Sociology at Seoul National University. He received his PhD in sociology from Harvard University in 2014. His research interests lie at the intersection of social psychology and political sociology. He is also interested in sociological theory, quantitative methods, and contemporary East Asian societies. [E-mail: dongkyunim@snu.ac.kr]

HEARAN KOO is a research professor at Institute for Social Development and Policy Research, Seoul National University. She obtained her PhD from the University of Chicago in Sociology. Her research interests are social well-being, mental health, and comparative sociological methods. Her recent publications include "Dimensions of Social Well-being and Determinants in Korea (2016)", "Depressed Youth and Anxious Middle-aged: A Network Approach to Mind Health (2019)", and *Beyond Suffering Society: Integrative Approach of Social Well-being Research and Practice* (2018, co-authored book). [E-mail: hrkoo@snu.ac.kr]

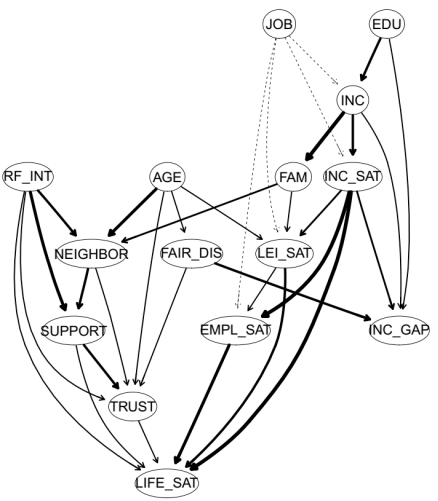
SANG-HEE PARK is a part-time lecturer in the Department of Urban Sociology at

University of Seoul. She received her PhD in sociology from Seoul National University. Her research interests are social well-being, political sociology, refugees, and mixed methodology. She is a co-author of *Beyond Suffering Society: Integrative Approach of Social Well-being Research and Practice* (2018). [E-mail: socialpark2019@gmail.com]

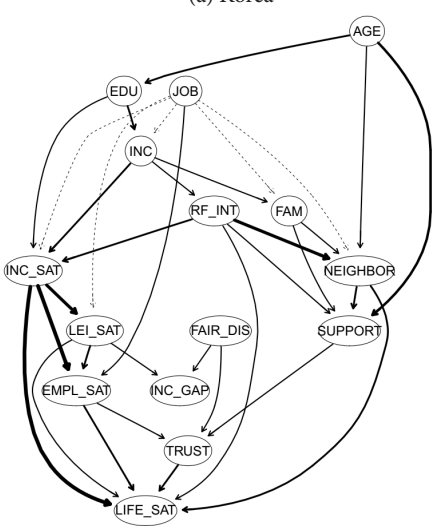
Appendix



(a) Korea

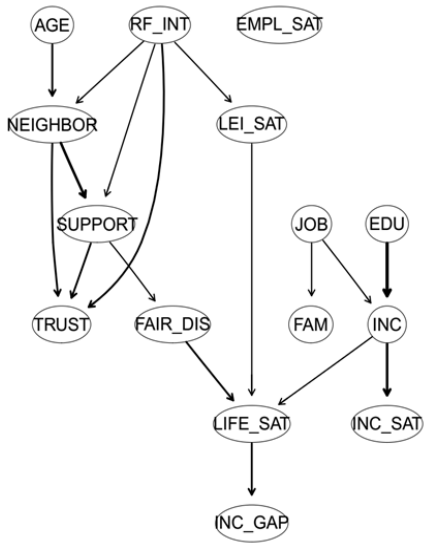


(b) Japan

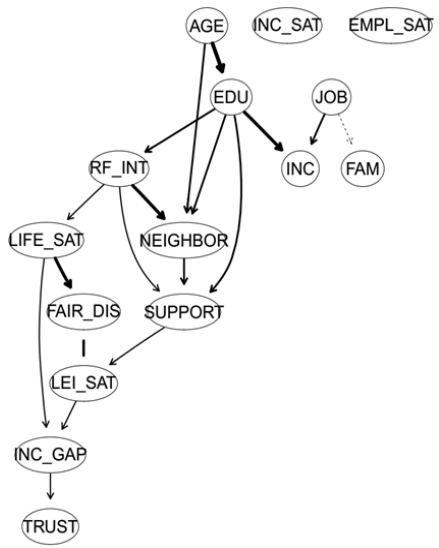


(c) Taiwan

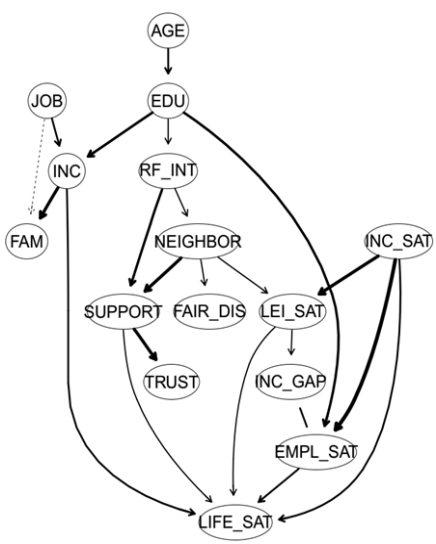
Fig. A1. Results of Bayesian network analysis: Southeast Asia



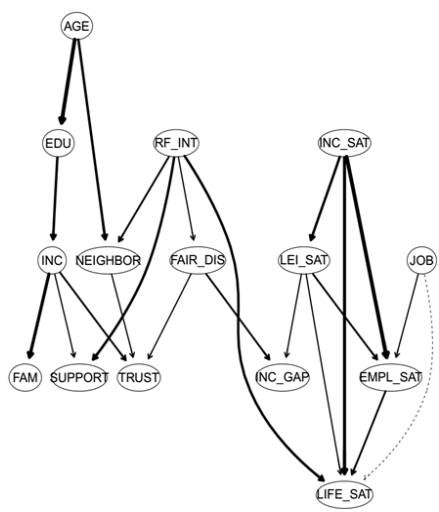
(a) Indonesia



(b) Thailand



(c) the Philippines



(d) Vietnam

Fig. A2. Results of Bayesian network analysis: Southeast Asia