Does subjective well-being contribute to our understanding of Mexican well-being?

¿El bienestar subjetivo contribuye a nuestra comprehensión del bienestar mexicano?

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Abstract

The article reviews the history of the well-being literature and uses statistical analysis to examine how subjective question surveys can improve our understanding of well-being in Mexico. The research uses data at the (32 federal) state level, principally from two subjective questionnaires, Módulo de Bienestar Autorreportado (BIARE) and Encuesta Nacional de Victimización y Percepción sobre Seguridad Pública (ENVIPE), applied in 2014. The study uses a descriptive analysis of a state-by-state landscape of indicators in an initial search for stand-out well-being patterns; it also uses an econometric study of indicators inspired by theory and previous Mexican research. The analysis confirms that subjective well-being correlates strongly with and complements objective data, and that happiness increases with income, as theory suggests. Moreover, it was found that Mexicans are relatively happy, considering their mediocre incomes and high levels of insecurity. The article suggests that well-being is a complex, multidimensional construct which can be revealed by using exploratory multi-regression and partial correlation models that juxtapose subjective and objective indicators.

Keywords: Subjective and objective well-being; multidimensionality.

Resumen

El artículo hace una reseña de la literatura del bienestar y mide cómo los cuestionarios con preguntas subjetivas pueden mejorar nuestra comprensión del bienestar en México. El cuestionario utiliza datos a nivel estatal principalmente de dos cuestionarios de enfoque subjetivo, Módulo de Bienestar Autorreportado (BIARE) y Encuesta Nacional de Victimización y Percepción sobre Seguridad Pública (ENVIPE), ambos aplicados en 2014. El estudio emplea un análisis descriptivo y econométrico de indicadores inspirado tanto en la teoría como en investigaciones mexicanas previas. El análisis confirma que el bienestar subjetivo correlaciona con y complementa los datos objetivos y que la felicidad crece con un aumento en los ingresos, como lo sugiere la teoría. Además, se encontró que los mexicanos son relativamente felices, considerando los bajos ingresos y los altos niveles de inseguridad en el país. Se sugiere que el bienestar es un fenómeno complejo y multidimensional que se puede explorar utilizando la regresión múltiple exploratoria y modelos de correlación parcial que yuxtaponen indicadores subjetivos y objetivos.

Palabras clave: Bienestar subjetivo y objetivo; multidimensionalidad.

Introduction

Happiness may be the main objective of human existence -according to Greek philosopher Aristotle, all human behavior aims to achieve it (Machado *et al.*, 2015). Research by Diener *et al.* (2013) shows that most college students around the world consider happiness and life satisfaction to be extremely important and more important than money. This and other studies with similar conclusions justify researching and improving our measurement of happiness. A word of caution is perhaps in order: the meanings of subjective well-being (SWB), quality of life (QoL), and happiness certainly overlap, but they are not perfect synonyms (Medvedev & Landhuis, 2018). According to Steptoe *et al.* (2015), SWB can mean three things: evaluative well-being (or life satisfaction), hedonic well-being (feelings of happiness, sadness, anger, stress, and pain), and eudemonic well-being (sense of purpose and meaning in life). It also measures the presence of positive feelings and the absence of negative ones.

The definition of objective well-being (OWB) has expanded from its origins in income and expenditure to include approaches such as basic needs, capabilities, and freedoms (Stiglitz *et al.*, 2009). Using SWB is a direct way to complement and extend what is measured more indirectly with conventional OWB indicators like income, health, and education. According to Diener *et al.* (2013), researchers now know a lot more about what correlates with different aspects of well-being, both objective and subjective. That being the case, it is more important to understand the processes that underlie happiness, in terms of people's higher order goals, coping efforts, and dispositions. Kubiszewski *et al.* (2019) suggest that if we could know how to attain happiness, an important policy goal should be the creation of the conditions that allow people to maximize it. Consequently, "The hope is that national well-being accounts will help policymakers understand and promote that which really matters..." (Angner, 2011).

SWB has been studied using well-being indicators through most of the 20th century in the fields of psychology, sociology, and education (Angner, 2011; Porter, 1995); and from the 1970s onward, subjective indicators have been incorporated into well-being studies. The "Social Indicator Movement" was motivated by a desire to develop accurate measures of the QoL (Andrews, 1989; Bauer, 1966; Campbell, 1976), because widely used income measures are imperfect proxies for well-being. There are many journals publishing research on SWB, for instance, *Social Indicators Research*, *Quality of Life Research*, *Journal of Happiness Studies*, and *Applied Research in Quality of Life*.

The report by the Commission on the Measurement of Economic Performance and Social Progress by Stiglitz *et al.* (2009), popularly called the Fitoussi report, lent credence to the operationalization of SWB. It was created at the beginning of 2008 on the initiative of the French Government, with the objective of signaling a shift of emphasis to measuring people's well-being in the context of environmental sustainability (Stiglitz *et al.*, 2009). Universally, standardized gross domestic product (GDP) is still the most widely used objective measure of economic activity; however, it measures market production rather than well-being, and it conflates "well-off" with "well-being", favoring the implementation of erroneous policy orientated towards economic growth without "trickle-down" (Stiglitz *et al.*, 2009).

The Fitoussi report has influenced subsequent studies in many countries, for example, a methodology document published by Instituto Nacional de Estadística y Geografía (INEGI) concerning the Módulo de Bienestar Autorreportado (BIARE) survey explains that "the conceptual reference and starting point of these ideas were established in the Stiglitz-Sen-Fitoussi commission by the French government..." (INEGI, 2014).

Recent international empirical studies of well-being in specialized journals have produced some interesting findings on various issues, including material living standards and inequality, health and education, individualism and community, the multidimensionality of well-being, and the paradox of Latin American happiness in the face of adversity.

Concerning material living standards, according to Kenny (2005), over a wide sample of (both developing and rich) countries, objective QoL indicators are positively related to income; therefore, people in poor countries are unhappier than people in rich countries. However, this positive connection is stronger among lower income groups and in poorer developing countries, while in richer communities there appear to be diminishing returns to additional income, more relative income comparisons (keeping up with the neighbors) and also heightening expectations over time, reducing the feel-good effect of extra income −in countries as diverse as the USA (Cummins, 2018), Australia (Eckersley, 2009), Bangladesh and Malaysia (Camfield *et al.*, 2010), Peru (Copestake *et al.*, 2009), Brazil (Gori-Maia, 2013), and South Africa (Tibesigwa *et al.*, 2016).

A cross-cutting issue is inequality, and it is interesting that a cross-country review by Evans *et al.* (2017) finds no link between SWB and inequality as measured by the Gini coefficient. Schneider (2016) concurs that it remains unclear from international research whether people living in environments where everyone is more equal are necessarily collectively happier.

The relationship between health status and SWB has been extensively studied, given health's pivotal position in life (Maccagnan *et al.*, 2019). Studies consistently reveal a strong relationship between health and happiness, even stronger than that between happiness and income. Health shocks such as serious diseases or permanent disabilities have negative and often lasting effects on happiness. At the same time, happier people are healthier, so causality runs in both directions (Graham, 2008). However, healthy people are not uniformly happy, and people with severe health limitations or who suffer accidents can adjust to their circumstances and recover normal levels of happiness (Subramanian *et al.*, 2005). There are several pathways through which SWB can affect health, an important one is that happier individuals have a healthier lifestyle with respect to not smoking, taking exercise, healthy eating, good sleeping habits, and adherence to treatment regimes (Maccagnan *et al.*, 2019). Many factors affect physical and mental health, including poverty (Cazzuffi & López-Moreno, 2018), social life, marriage, friendship (Tiliouine, 2009), employment status, dependency status, and crime rates (Cazzuffi & López-Moreno, 2018).

Studies in different countries find that education and SWB are positively related. It is amply demonstrated that income returns to education are universally high, often accompanied with improvements in one's self-esteem and success in marriage, but also with a loss of leisure time and an increase in stress (McMahon, 2009). Rojas uses a system of equations and ordinary least squares to show that education increases SWB primarily through a positive income effect (Rojas, 2018b). Where income and wealth variables are included in econometric studies, the relationship between education and SWB can be weak or non-existent due to rising or unfulfilled expectations created by a better education and in places as diverse as Japan (Clark *et al.*, 2015) and Australia (Clark *et al.*, 2015; Kristoffersen, 2018).

It is assumed by many researchers that SWB is determined mainly by individual characteristics. The expectation is that specific features of communities and social capitals do impact on the QoL of citizens; nevertheless, little is known about it (Helliwell & Putnam, 2004; Hooghe & Vanhoutte, 2011; Lee & Kim, 2018). Asking people about life in general or the lives of others provides a very different result than asking them about their own lives. Interviewing picks this distinction up, because interviewees downgrade their individual well-being if they have previously answered questions on societal or political issues. Researchers tend to buffer this "contamination" by using interview devices to change the subject, assuming that

individual well-being is what primarily matters (Eckersley, 2009, 2013). Studies may have purposefully or inadvertently left out societal issues which link back into individual well-being in ways which have not been detected or understood. So, for example, in a study of Finnish youth, mental issues such as fears of loneliness or suicide have been increasing in recent decades, alongside measured improvements in well-being, which means that something is not being correctly identified (Lindfors *et al.*, 2012). Thus, Eckersley (2013) in a cross-country review suggests that SWB tends to measure individualism, modernization, and westernization rather than improved QoL or human progress. In more general terms, this argument is important because it points out that well-being indicators can be biased both in their initial definition (because for objective indicators we impute their importance as proxies of well-being) and in their application (i.e., how we survey), a point made by both Diener *et al.* (2013) and Rojas (2011).

Fernández & Gómez (2019) discuss the multidimensional nature of well-being using principal component analysis (PCA) to categorize indicators in dimensions, such as material well-being, health, education, etc., and derive weights from PCA output which indicate their relative importance in explaining variation. Multidimensional life satisfaction studies by Rojas, using Mexican data with PCA, similarly identify many domains (including health, economics, job, family, friendship, personal, and community) to create composite indexes, and they also use econometric modelling to determine the relative importance of those domains (Rojas 2006). According to Fernández & Gómez (2019), INEGI OWB indicators describe most of the variation in Mexican well-being, which is strongly heterogeneous geographically across the 32 States. Interestingly, both objective and subjective BIARE indexes rank the States in similar orders according to well-being, which means that the subjective corroborates the objective, and vice versa. According to Rojas, SWB is invaluable because it measures life satisfaction as affirmed by the people themselves, dealing with human beings as "flesh and blood" (Rojas, 2016) rather than what is presumed or imputed to be important by researchers using objective indicators which can suffer from errors of misspecification (Rojas, 2011). Velasco *et al.* (2019) conclude that the BIARE data is useful although INEGI needs to construct a multidimensional model to facilitate the study of well-being. Kopsov (2019) proposes modelling SWB as a combination of two states, current (transient) and future (projected). Internationally, studies experimenting with SWB indicators since the 1970s believe they not only complement objective indicators but also further our understanding of QoL (Halleröd & Seldén, 2013; Kubiszewski *et al.*, 2019; Oswald & Wu, 2010).

An interesting finding of Mexican and Costa Rican studies is the detection of relatively high levels of well-being, apparently created by close extended family networks which are an essential part of a Latin American lifestyle, and which appear to compensate for relatively low incomes, pervasive poverty, inequality, and crime and violence. In other words, income is significantly relevant to well-being as are many other factors, but a closely-knit, active, family life is probably more important (Rojas, 2018a; Rojas & Elizondo-Lara, 2012). This relative Latin American well-being extends to young people who are happier than their counterparts in other regions of the world (Marquez & Long, 2021). However, SWB also depends on age, and virtually all countries report a lifecycle "U" shape happiness curve which is the consequence of a widespread midlife crisis, and Mexico is no exception to the rule (Blanchflower, 2021). However, Latin American well-being is not immune to prevailing social and economic problems. According to an econometric analysis by Rojas (2018a), satisfaction with life declines in the presence of perceptions of corruption and exposure to crime, these results coincide with those of Martinez-Martinez *et al.* (2018). Charles-Leija *et al.* (2018) report that violence disproportionally affects women, although stronger social and family networks and better educations reduce the likelihood of physical assaults and violence. Not everything is a problem in Latin America, and public policy needs to recognize that family and community are a source of strength and inspiration (Rojas, 2018a; Rojas & Elizondo-Lara, 2012).

Following this introduction, the Materials and Methods section looks at data sets and analytical approaches, while the Results section probes descriptively and quantitatively Mexican survey data to test postulations evidenced in recent regional research, before introducing a novel approach which includes partial correlations. The Discussion section contextualizes the quantitative findings within the well-being literature, which are summarized in the Conclusions.

Materials and Methods

The article examines the evolution of well-being indicators, both objective and subjective, and the relationship among them. It uses available Mexican data to test how SWB can corroborate or complement the objective indicator story of well-being and, at the same time, validate recent findings concerning well-being in Mexico and Latin America. The most complete SWB data set for Mexico, BIARE (INEGI, 2014) or self-reported well-being, is fully representative at the state level in the extended format only for 2014, while for 2013 there is a pilot survey; and from 2015 to 2018, the basic survey application is representative solely at the national level. A more narrowly focused SWB data set, Encuesta Nacional de Victimización y Percepción sobre Seguridad Pública (ENVIPE) (INEGI, 2014) or National Survey of Victimization and Perception of Public Security, is representative at the state level and available from 2011/12 to 2018, but it only covers the perception of security and related issues. Comprehensive OWB data from various censuses are available for periodic applications, as well as most reports for 2014, namely: 1) The United Nations Development Project, Mexico office (UNDP, 2016); 2) The INEGI (2021) webpage by state, which combines state level indicators from different sources; 3) The Encuesta Nacional sobre Disponibilidad y Uso de Tecnologías de la Información en los Hogares (ENDUTIH) survey of 2015 (INEGI, 2015), which deals with the availability and use of household technology; and 4) The Consejo Nacional de Evaluación de la Política de Desarrollo Social (Coneval, 2021) web site for social policy and program data. Consequently, 2014 is the reference year for the research. Most of the SWB indicators are presented as means and in population categories which report the intensity of replies. This is not the case for OWB indicators, presented only as simple means with the information loss which that entails.

Based on the main goal, which is understanding how OWB indicators and SWB are interconnected, the principal concept guiding this study is correlation matrices. Several econometric models are used for estimation purposes, moving from simple to more sophisticated ones. The descriptive analysis centers on Pearson correlations, and econometric models based on regressions use SWB indicators from two sources, BIARE and ENVIPE, and OWB indicators from various INEGI surveys. In the descriptive analysis in the Results section, the BIARE, ENVIPE, and various objective indicator census sources are uploaded onto a symmetrical spreadsheet format, state by state, creating 39 SWB BIARE indicators and 29 SWB ENVIPE indicators, arranged as per their original survey domains. A total of 88 OWB indicators from various census sources are grouped into 13 dimensions or domains, namely: population, multidimensional well-being, income, inequality, education, health, social security, gender issues, work, household amenities and services, crime and security, rurality and agriculture, and availability and use of household technology. Some of the indicators overlap, for example, multi-dimensional poverty indicators combine individual indicators, while indicators from different surveys can be almost identical. The only requirement here is that they are reputable and representative at the state level; and in fact, all of them are sourced from INEGI.

For the econometric models in the quantitative analysis with aggregated data, weighted averages are used for each of the 32 States, which allows us to combine information from different sources, such as BIARE, ENVIPE, and UNDP. Only one question is selected from the ENVIPE survey, namely: *In terms of criminality, do you consider the State you live in to be secure/insecure?*. Concerning OWB indicators, only the income component of the human development index (HDI) is used, as reported by the UNDP (2016).

Some models are estimated, the emphasis is on parsimony in the specification of the linear regressions. The purpose was not the search for a linear model having a high determination coefficient, since it is not expected that the relationship of variables is linear. After the presentation of linear regressions, the article estimates a logistic regression which includes additional explanatory variables.

The logistic regression with microdata and a Gaussian graphical model for partial correlations use a micro-data approach by selecting information exclusively sourced from BIARE (See Backhaus *et al.* [2021] for a systematic presentation of the model). The article presents two blocks of BIARE questions: Table 4 in Appendix A lists 16 questions, each graded from 0 to 10, with 10 denoting maximum satisfaction, while table 5, also in Appendix A, lists a second block also from BIARE, each question graded from 1 to 7.

Underlying a regression there is a particular structure of an explained variable and a set of regressors in which the coefficients manifest correlations. This structure already suggests causality and gives a special role to a unique variable. In the Gaussian graphical model with partial correlations, the paradigm changes with the choice not to single out a variable, but instead to analyze how a set of selected BIARE questions are interconnected, inspired by the multidimensional nature of well-being. For these relationships, partial correlations are used, and this is the key difference with a regression analysis. A partial correlation other than 0 between two variables counts as a connection. In the context of Gaussian graphical models, which are considered here, such a connection is an edge in a graph constructed from the matrix of partial correlations. Shifting from correlations to partial correlations has the advantage that a connection between two questions cannot be due to the influence of a third factor (understood as a question in the survey). This procedure produces new insights into the complex construct of well-being. From an econometric point of view, partial correlations are computed using a Gaussian graphical model (Refer to Borsboom & Cramer [2013] and Robinaugh *et al.* [2020] for surveys on applications in psychology, and to Lauritzen [1996] and Maathuis *et al.* [2020] for a systematic presentation of Gaussian graphical models).

Results

Descriptive Analysis

A selection of indicators from the spreadsheet is presented in figure 1, and it captures the key features of the data correlations. Note that the correlations can be strongly positive or negative, depending on the original specification of the indicators, for example, perceptions of both security and insecurity crop up in different sections of the ENVIPE survey. The selected indicators come from the BIARE survey (indicators 1 through 7), ENVIPE survey (indicators 8 through 14), UNDP data (indicators 15 through 18), and objective indicators (19 through 24) from conventional surveys.
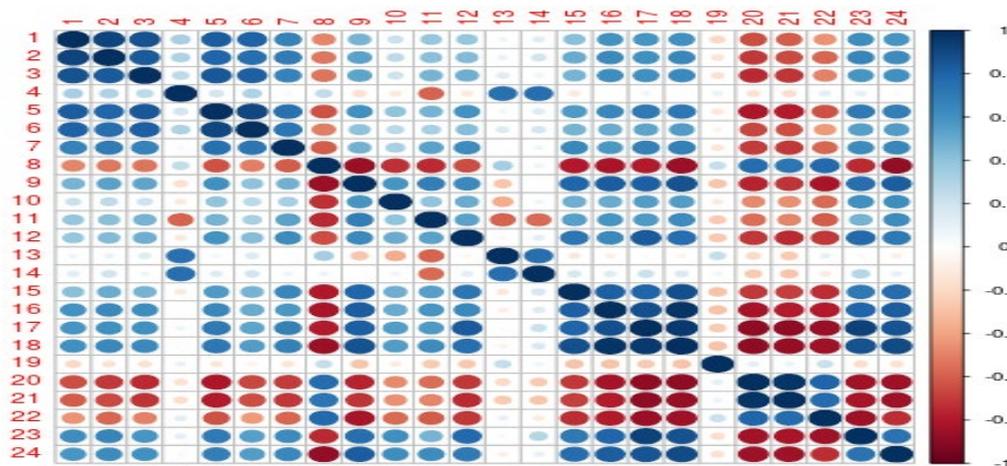
Figure 1. Correlogram of selected subjective and objective indicators for Mexico, 2014.
Keys: 1. Life in general; 2. Health; 3. Achievements; 4. Satisfaction with personal security; 5. Material needs satisfied; 6. Excellent living conditions; 7. Wouldn't change anything if born again; 8. Perception of poverty; 9. Perception of corruption; 10. Criminals go unpunished; 11. Insecurity; 12. Narcotraffic; 13. Perception of local security; 14. Perception of municipal security; 15. Health Indicator IDH; 16. Education Indicator IDH; 17. Income Indicator IDH; 18. IDH; 19. GINI; 20. % population with at least one social deprivation; 21. % population without access to social security; 22. % population in rural localities; 23. Households with access to internet; 24. Salaried employment.
Source: Authors' own elaboration.

Comparing OWB indicators for the 32 Mexican states provides background for subsequent analysis of SWB and tells a similar story to previous studies, that is, OWB indicators strongly correlate with each other in geographical analyses (Heald, 2018). There are strong correlations across indicators for multidimensional well-being, income, education, household quality and amenities, household access to internet and ownership of computers, rurality (negatively) and salaried work. This can be seen in figure 1 by observing the bottom right quadrant. However, the Gini coefficient, which measures inequality, correlates poorly with the rest of the indicator landscape, as it does in other studies (Heald, 2018), underlining its ambiguous impact on well-being. Interestingly, when SWB and OWB indicators are compared (top-right quadrant in figure 1), starting with the BIARE survey summary indicator *Satisfaction with life in general*, strong correlations are obtained again with the same OWB indicator domains, including multidimensional well-being, income, etc.; and, again, there is poor correlation with the Gini coefficient. This suggests a deep relationship between subjective and objective indicators, validating the Fitoussi recommendations for Mexico on including SWB in QoL studies. In general, over half of the BIARE subjective indicators share similar correlation patterns to the summary indicator *Satisfaction with life in general* and correlate widely across the indicator landscape, although the rest do not. Concerning the ENVIPE survey, which specializes in crime and security perceptions, only five of the indicators correlate strongly with the universe of objective indicators presented here, which is perhaps not surprising considering the specialist nature of the survey, which intersects less generally across indicator domains. In figure 1, various ENVIPE indicators (numbered 8 to 12) which do correlate strongly are shown.

Comparing SWB with SWB indicators at the top, left quadrant, strong correlations exist within surveys, for example BIARE with BIARE indicators (numbered 1 to 7 in Figure 1), or ENVIPE with ENVIPE indicators (9 to 14); this can be expected considering that the questions are based on perceptions which can overlap. More intriguing are correlations between BIARE and ENVIPE indicators. Interestingly, the BIARE perception of personal security correlates with the ENVIPE indicators for perceived insecurity, and the perception of security at the local and municipal level (figure 1, indicators 4, 11, 13, and 14, respectively).

This is put in perspective by noting that indicators 4, 13, and 14 correlate very poorly with everything else. The two SWB surveys applied independently corroborate perceptions of crime, violence, and insecurity, strengthening the conviction that well-constructed SWB surveys are reliable and useful.

The correlation analysis broadly confirms recent literature findings on well-being, for instance, that it is multidimensional and complex and that SWB indicators corroborate and complement OWB indicators. It also sets the stage for some more in-depth econometric analysis in the Results section.

Before commencing the econometric analysis, some further visual evidence is presented. At the national level, the BIARE data set has 39 274 observations. As an initial inspection of the data, three variables are selected to analyze the interplay between SWB, in this case hedonic happiness, and OWB, represented here by an evaluative SWB indicator of material needs satisfaction (See the Introduction section for well-being definitions). Mexico, like other parts of Latin America, has suffered years of violence (in Mexico's case due to drug trafficking), so it is interesting to discover how the perception of personal security links into well-being. Table 2 shows *perceived insecurity* from the ENVIPE survey, and table 3 shows *perception of personal security* from the BIARE data, which includes the question: *How satisfied do you feel with public safety and security?* (satis9). In figure 2, 50% of the BIARE data set, randomly selected, are displayed with the following interpretation:

1. The color of the circle indicates the perception of personal security (Question satis9), with blue representing a positive perception.

2. The size of the circle represents the population size according to the survey design.

3. The Y axis represents satisfaction concerning covering material needs of household members (Question: *Do you consider that you have your basic material needs satisfied?* - afirma2).

4. The X axis represents satisfaction concerning personal happiness (Question: *Do you consider yourself a happy person?* - afirma1).

Figure 2 illustrates a positive relation between the hedonic SWB question concerning *happiness perception* and *satisfying material needs of household members*. This means that from an individual perspective there is a relationship between evaluative SWB (measured as an individual's success in *satisfying material needs*) and hedonic SWB (measured as an individual's expressed *happiness with life*). On the other hand, the color of the circles indicates how the individual rates her or his *personal security*. It is evident that the red and yellow colors dominate, indicating a generalized perception of poor personal security. However, it is notable that, despite this, many individuals reveal high levels of expressed *happiness with life*, which concurs with the Latin American well-being literature.
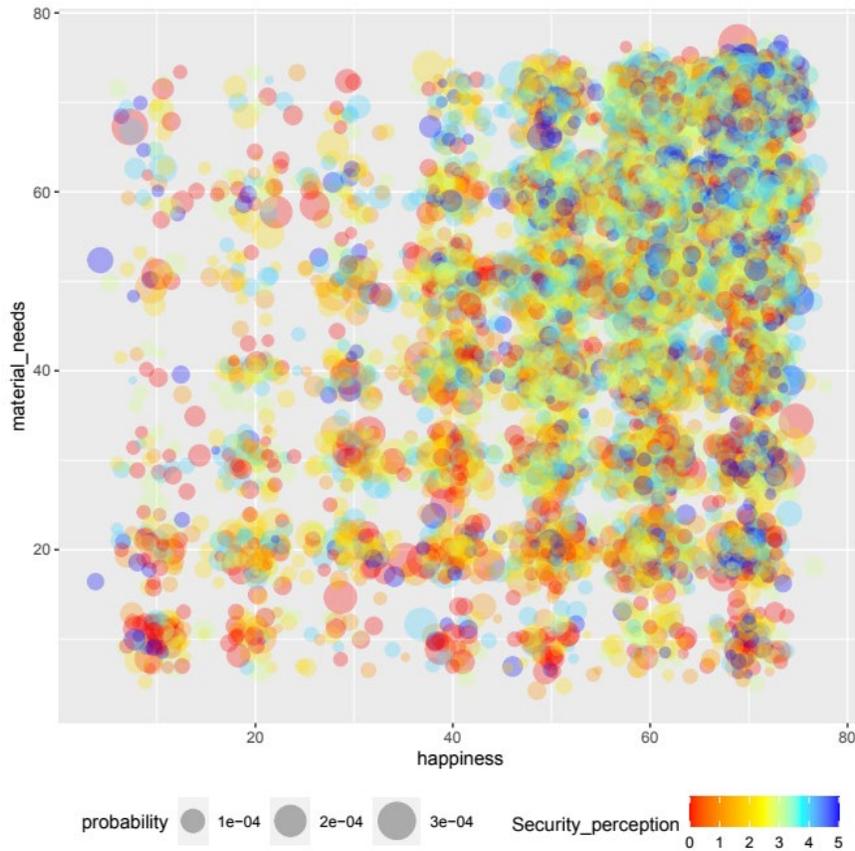
Figure 2. Bubble plot of the relation between happiness and satisfaction of material needs with personal security superimposed.
Source: Authors' own elaboration.

On the other hand, the graph also shows individuals with a positive perception of security occupying the top, right hand side of the graph, where higher levels of happiness, material needs, and personal security are satisfied, suggesting that insecurity disproportionally affects poorer families. This indicates that well-being is multidimensional as evidenced through mutually reinforcing indicators. This visual evidence is discussed and confirmed below through some econometric models.

Quantitative Analysis with Aggregated data

In order to give a more quantitative description of figure 2, and to enable us to move beyond visual evidence, some linear regressions are introduced, which provide interesting initial results concerning the multidimensional nature of well-being using the BIARE, ENVIPE, and UNDP (2016) data. The results of linear regressions with two different dependent variables are displayed in table 1.

Table 1. Regression results I. The impact of the IDH income index on reported happiness and basic material needs.

Independent variables	Dependent variables	
	Do you consider yourself a happy person? (afirma1)	Do you consider basic material needs satisfied? (afirma2)
IDH Income Index	1.065* (0.587)	3.755*** (0.734)
Intercept	7.990*** (0.424)	5.039*** (0.530)
Observations	32	32
R2	0.099	0.466
F Statistic	3.292*	26.212***

Standard errors are reported in parentheses.
Significance codes: 0 '***', 0.001 '**', 0.01 '*', 0.05 '.'
Source: Authors' own elaboration.

In the central column, the dependent SWB variable is *The household member is a happy person* (afirma1), and the explanatory variable is the HDI income component. Although significant, and with the expected sign, the fit of the model is poor. This confirms the literature findings reported in the Introduction section, stating that income is linked to well-being, but it is not synonymous with it, and consequently other factors need to be included. In the right column of table 1, the same explanatory variable is used; however, the dependent variable is now *satisfying material needs of household members* (afirma2). The fit of the model is clearly superior, which is to be expected owing to the obvious relation between objective income and satisfying material needs.

So far in the initial regressions, the study has explored the relationship between a hedonic SWB indicator (happiness) with the income component of HDI, an OWB indicator. In the second regression (table 2), the study explores the relationship between an evaluative SWB indicator (satisfaction with current life) with the same OWB income component of the HDI, plus a perception indicator from ENVIPE.

Table 2. Regression results II. The impact of the IDH income index and the perception of insecurity from the ENVIPE survey on satisfaction with current life.

Independent variables	Dependent variable	
	Satisfaction with current life (encsat1)	
IDH Income Index	3.060*** (0.807)	2.989*** (0.840)
ENVIPE Insecurity Perception		-0.093 (0.246)
Intercept	5.748*** (0.583)	5.862*** (0.664)
Observations	32	32
R2	0.324	0.327
F Statistic	14.389***	7.059***

Standard errors are reported in parentheses.
Significance codes: 0 '***', 0.001 '**', 0.01 '*', 0.05 '.'
Source: Authors' own elaboration.

The central column of table 2 reports the result of a linear regression, which presents the dependent variable as SWB indicator *How satisfied are you with your current life?* (encsat1), and the explanatory variable once more is the income component from HDI. Again, there is a significantly positive relationship between SWB and OWB indicators. The right-hand side column in table 2 reports an extended version of

the model which also includes the *perception of insecurity* variable from ENVIPE (AP4-3-3) (*In terms of criminality, do you consider the State you live in to be secure / insecure?*). It is to be noted that the coefficient of the insecurity variable has the expected negative sign, although it is not statistically significant. This finding is hardly surprising considering the evidence in figure 2, in which a perception of insecurity predominates despite positive scores for both satisfaction of material needs and happiness. It suggests however that the perception of insecurity integrates in complex ways with other individual sentiments and perceptions, which requires a more sophisticated econometric model. This is tested below through more sophisticated models such as the logistic regression and a Gaussian graphical model revealing partial correlations.

Logistic regression with microdata

There is an important difference with respect to the previous linear regressions in that here the estimation is carried out using data exclusively from the BIARE questionnaire in which all the variables measure SWB. The dependent variable is *How satisfied are you with your current life?* (encsat1), with the following explanatory variables (table 4): Social life (satis1), Family life (satis2), Affective life (satis3), Health (satis5), Perspectives for the future (satis7), and Perception of personal security (satis9). In table 5 the following indicators are included: Material needs (afirma2) and Living conditions of household members are excellent (afirma3).

The variable from the question *How satisfied are you with your current life?* (encsat1) is classified into two answer categories (which presented best fit and therefore an equilibrium), High (with an 8 to 10 score) and Low (0-7). If Y is used to denote the variable which has a 0 value except when question encsat1 is High, with X as a vector of explanatory variables, the proposed model takes the following form:

$$\text{logit}P[Y = 1 \mid X] = a_1 + a_2\text{satis1} + a_3\text{satis2} + a_4\text{satis3} + a_5\text{satis5} + a_6\text{satis7} + a_7\text{satis9} + a_8\text{afirma2} + a_9\text{afirma3}. \quad (1)$$

The category Low is established as reference. All the satisfaction with life (social, family, affective, etc.) coefficients (table 3) have the expected signs, and all are significant. For example, the coefficient of *satisfaction with family life* is equal to 0.160, indicating that for a score of *x* points for this concept the probability of obtaining the response High to the question encsat1 is proportional to $e^{0.160x}$, which can be interpreted as follows: the higher the score for the question concerning *family life*, the higher the probability of obtaining a high score for *satisfaction with current life*.

Table 3. The relationship between satisfaction with current life and a basket of subjective life satisfaction indicators. Logistic model.

Life satisfaction indicators	Dependent variable
	Satisfaction with current life (encsat1)
High: (intercept)	-8.844*** (0.11)
High: social life (satis_1)	0.206*** (0.007)
High: family life (satis_2)	0.160*** (0.01)
High: affective life (satis_3)	0.183*** (0.007)
High: health (satis_5)	0.218*** (0.007)
High: future prospects (satis_7)	0.174*** (0.008)
High: public safety (satis_9)	0.049*** (0.005)
High: basic material needs (afirma_2)	0.186*** (0.011)
High: conditions of life in your home (afirma_3)	0.183*** (0.011)
Observations	39274
pR2	0.27
LR Test	12 408.460***

Standard errors are reported in parentheses.
Significance codes: 0 '***', 0.001 '**', 0.01 '*', 0.05 '.'
Source: Authors' own elaboration.

The rest of the coefficients have similar interpretations. Note that the perception of security is now positively significant too because the BIARE variable refers to *security* rather than to *insecurity* as in the previous regression using the ENVIPE survey variable. It is evident that SWB is truly multidimensional, which is logical considering that satisfaction with life depends on many factors, including health, family, and community. The fact that the coefficients are statistically significant justifies the existence of a taxonomy of relevant SWB factors. However, the fitness of the logistic regression, as measured by the pseudo R2, is still low, indicating that the model does not yet capture the complex nature of SWB, which requires the more complex models and specifications of the following section. So thus far, variables that common sense indicates are related to *satisfaction with current life* are confirmed to be significant in logistic regressions.

Gaussian graphical model for partial correlations

For the estimation of a Gaussian graphical model, two blocks of questions are considered. The first block consists of the questions listed in table 4. Figure 3 presents a graphic representation of the results in which nodes represent the questions, and the widths of the connections represent the magnitude of the partial correlations which are labelled between corresponding nodes. If two nodes are not linked through an edge, it means that their partial correlation has a value between 0 and the (somewhat arbitrarily low) threshold of 0.03, and that they are at best indirectly connected through another node.

Interpreting the graph and starting with the geographical context, an interesting path is revealed with nodes 16, 15, 14, and 13, representing satisfaction with the country, city, neighborhood, and household, respectively, which may provide evidence of a community aspect to well-being. The strongest partial correlation in the graph is between nodes 15 (city) and 16 (country). Another interesting component is

represented by nodes 7, 8, and 9, in which *future perspectives* (node 9) are related to *achievements in life* (node 8) but also to (good) *health* (node 7).
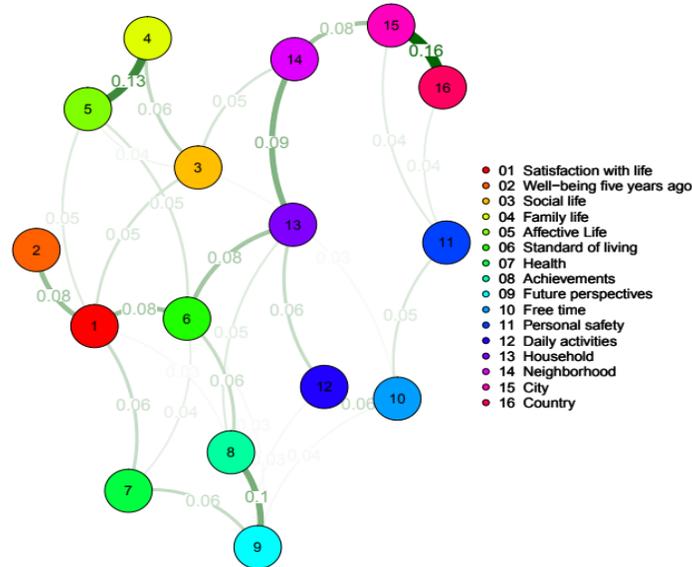

Figure 3. Graph of partial correlations of Mexican life satisfaction
according to BIARE data (first block).
Source: Authors' own elaboration.

Nodes 4 and 5 represent *satisfaction with family life* and *satisfaction with affective life*, respectively, which are of course naturally related. Surprisingly, family does not link directly with satisfaction with life. In another component of the graph, node 1 is directly connected to nodes 2, 3, 5, 6, and 7. Hence, satisfaction with life is directly connected to memories of well-being from the past (five years previously) but also to social and affective life, standard of living, and health. This demonstrates that satisfaction with life is directly influenced by various factors, including subjective emotions and a self-perception of success represented as material well-being, but, surprisingly, not as much as by correlations which account for indirect relationships, for example, via the geographical context. There are also unexpected results concerning established facts in the literature; for example, one would expect family and personal security to be connected to satisfaction with life, but such connections do not reveal themselves as direct links. Interestingly, personal security is poorly connected with other questions, which coincides with its ubiquitously poor correlations in the correlogram in figure 1.

The second block consists of the questions listed in table 5, and the graph of partial correlations is presented in figure 4. Direct links with node 1 (*personal happiness*) include nodes 2, 4, and 7, concerning *material needs*, *life almost ideal*, and *satisfaction with life*, respectively. The strongest link is between node 1 and 7, and this is interesting since it connects hedonic SWB with evaluative SWB, although being satisfied with life and happy at the same time is hardly surprising. The link between nodes 1 and 2 is weaker and again associates a hedonic experience with OWB and material needs. It would appear that *material needs* and *standard of living* do not guarantee happiness, and vice versa, which concurs with Latin American experience of happiness in adversity reported in the Introduction section.
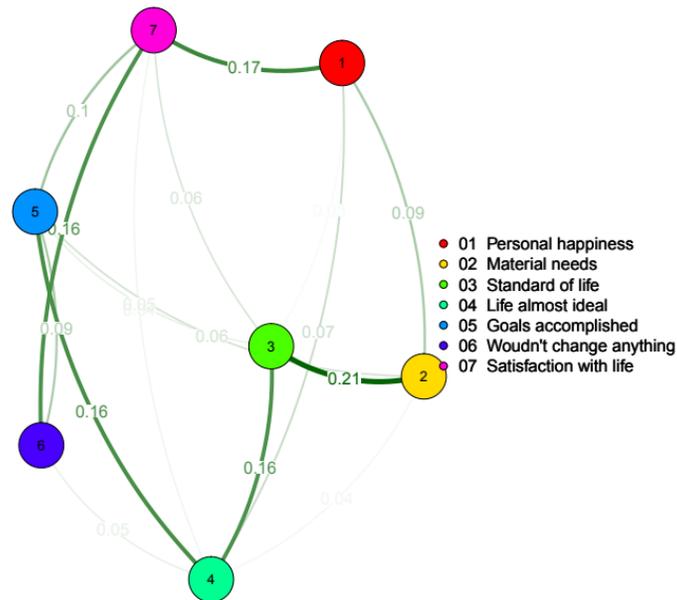
Figure 4. Graph of partial correlations of Mexican life satisfaction
according to BIARE data (second block).
Source: Authors' own elaboration.

Another strong link is between nodes 6 *wouldn't change anything* and 7 *satisfaction with life*, as one would expect. The link between nodes 4 and 5, *life almost ideal* and *goals achieved*, respectively, is natural; and although in the model there is no in-built causality, one is tempted to suggest that a *life almost ideal* is surely related to meeting one's goals. Nodes 2 and 3 are also naturally connected because satisfying material needs requires running a household, which improves the members' standard of living.

Discussion

Both SWB and OWB are recognized as important for studies of happiness, QoL, etc. (Fernández & Gómez, 2019; Rojas, 2011). While objective indicators have the advantage of being verifiable, they are indirect measures, they may be motivated by prevailing doctrine and not just science, and as such they may not even be functional proxies. On the other hand, subjective measures are direct, although their *instant reply* spontaneity may make them unreliable due to the transience of moods, and they may suffer response heterogeneity due to cultural factors (Rojas, 2004). In other words, both types of indicators have their drawbacks; hence, a sensible solution is to use both. Combined, as the Fitoussi report proposes, they can logically provide more insight into the human condition than studies which exclude one or other of the approaches. As discussed in descriptive analysis, studies of well-being in Mexico and its federal entities (states) reveal strong geographical heterogeneity in terms of comparative development with southwestern states far poorer than their central and northern equivalents, which gives data sets the opportunity to explore how underdevelopment and poverty affect well-being (Fernández & Gómez, 2019; Heald, 2018).

International studies have found that, at lower levels of development, income is important for well-being and happiness, but that is only one of numerous relevant factors (Kenny, 2005). Satisfying material needs is also important, but as with income, there is evidence that there are diminishing returns (Cummins,

2018; Eckersley, 2009). Human beings are complex and the question of relative as well as absolute income is important due to tendencies to compare with the neighbors (Camfield *et al.*, 2010). The literature also testifies that the multifaceted domain of health contributes to happiness and well-being (Cazzuffi & López-Moreno, 2018; Maccagnan *et al.*, 2019), which would appear entirely logical, although inexplicably it does not always appear to correlate with other well-being domains (Heald, 2018). The interpretation of education in the well-being literature is also complicated due to the aspirations of social climbers who may not achieve their self-achievement goals (Clark *et al.*, 2015; Kristoffersen, 2018). In other words, many studies portray education as QoL neutral, which is not corroborated here because education strongly correlates to well-being according to interstate data (figure 1). There is some truth in the notion that Economic Theory is biased towards the study of individual well-being rather than that of the community, due to its fixation with private property and individual utility, which means that the study of social capital is relatively recent, with important measurement problems (Eckersley, 2013, Hooghe & Vanhoutte, 2011). Due to the multifaceted nature of well-being and happiness, many researchers build dimensions or domains of indicators, representing the diversity of influences, including income, health, education, etc. (Rojas, 2006; Rojas, 2018a). Mexican and Latin Americans reveal some interesting peculiarities in the literature, principally, that they are happier than they should be, considering modest incomes and high crime rates and insecurity, apparently more than countered by strong extended family relationships which confer satisfaction (Rojas, 2018a; Rojas & Elizondo-Lara, 2012). Frustratingly, in this study, crime and insecurity indicators do not easily integrate into multidimensional well-being. Contrasting with Martinez-Martinez *et al.* (2018), in which a collection of indicators from victimization, security perception, etc., are blended to reveal a negative impact on SWB; the findings here point towards the necessity of more specialized surveys with a tailor-made design to gain insight into the relationship of SWB with insecurity.

The descriptive research presented here with Mexican data confirms the findings of other Latin American studies discussed in the Introduction section. Objective indicators are correlated over most domains, as can be expected due to processes of cumulative causation in regional development. However, in this research many subjective indicators also correlate strongly with objective indicators, and subjective indicators correlate with each other, more so than in comparable studies (Fernández & Gómez, 2019). Such concurrences can be interpreted as vindication for using subjective as well as objective indicators in QoL studies. This means that what people perceive and comment does have research validity and universality. On the other hand, inequality as measured by the GINI indicator appears to be unconnected with well-being (figure 1), although inequality is a ubiquitous feature across Mexican regions, which may be one reason why it does not correlate. Another reason is it reflects individualism or our inability to measure social or community well-being (Evans *et al.*, 2017), unless it is synonymous with (extended) family well-being (figure 3).

The econometric analysis in the article also corroborates wider research findings. Using regression equations, significant relations in Mexican data are found between happiness and income, and between material needs and income, i.e., between subjective and objective realms of well-being (Fernández & Gómez, 2019). Income and (self-reported) material well-being proved to be more closely matched, which is to be expected because they are closer neighbors (table 1). The perception of insecurity has the expected negative sign when put in a regression model alongside income to explain satisfaction with life, although it is not significant, which reflects ambiguity in the data when analyzed both descriptively and econometrically (figure 1, table 2, and Introduction section). However, when the dependent variable (life satisfaction) is categorized into High and Low, personal security does turn out to be a statistically significant factor for life satisfaction, alongside other SWB indicators (table 3). The reason, which is also observable in the bubble diagram in figure 2, is that poor households appear to perceive the problem of security more acutely than higher-income households (Charles-Leija *et al.*, 2018). By analyzing it at the household level, the problem of security manifests itself more among the poor in disadvantaged neighborhoods in which

QoL and happiness is compromised by a plethora of impediments to well-being. Well-being is multidimensional as evidenced in a multiple regression of BIARE and SWB indicators, which is corroborated in the top, left quadrant of the correlogram of figure 1. Finally, an analysis of SWB indicators using partial correlations, estimated through a non-conventional Gaussian graphical model, ratifies that well-being is truly multidimensional, linking together affective life, family life, household, and neighborhood factors, as well as past well-being and future perspectives (figures 3 and 4).

Absences of partial correlations in the Guassian Graphical model demonstrates that many of the close correlations between indicators and census OWB indicators reported in the section Descriptive Analysis are due to third factors; in other words, they are indirect. Similarly, the node diagrams of partial correlations in figures 3 and 4 show both strong connections and weak or absent ones, making it a complex structure. For example, it might be expected that satisfaction with life and perhaps happiness would be hubs of interconnections. In figure 3, affective life and family life appear almost divorced from the rest of the SWB indicators; and in figure 4, the nodes separate into two weakly connected groups.

Conclusions

Subjective indicators are proving useful for the study of happiness, QoL, and well-being in general. They complement objective measures and offer new avenues and opportunities for analysis. As the Fitoussi report confirms (Stiglitz *et al.*, 2009), OWB is a powerful instrument, but not the only one, suffering the drawbacks of being an indirect, imputed measure of well-being. SWB is direct and plain-spoken, although it suffers its demons too, including spontaneity (the transient mood of the interviewee), and cultural heterogeneity (some cultures may grade a Likert scale differently than others). An example of ideology creeping into analysis is perhaps a Western predilection for individual rather than community well-being. There are of course other sources of potential bias; for example, the selection of indicator domains or dimensions is evidently normative, whether those indicators are subjective or objective, while mis-specified or incomplete analytical models will always fail. This justifies the use of exploratory correlation analyses, simple regressions, a logit model using categorized subjective indicator data, and partial correlations via Gaussian graphical models which reveal some interesting results from the data. Subjective and objective measures of well-being turn out to correlate widely; therefore, a multidimensional space for well-being clearly identifies itself and includes a lot more than just income. Middle-income Mexico, a deeply inequal geographical space with hardships provoked by economic and social realities, such as crime and insecurity, proves to be significantly happier and more satisfied than it should be based on its relative income, as identified by the regional well-being literature and confirmed here. An intriguing aspect of the results presented here are missing relationships in the partial correlations analysis, also reflected in nearly half of the BIARE indicators (including personal safety), which are not directly related with the rest, for which there is no simple explanation, requiring future research.

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Appendix A: Blocks of BIARE questions

Table 4. First block of questions from BIARE.

Key	Question
Encsat_1	How satisfied do you feel with your current life?
Encsat_2	How satisfied did you feel with your life five years ago?
Satis_1	How satisfied do you feel with your social life?
Satis_2	How satisfied do you feel with your family life?
Satis_3	How satisfied do you feel with your affective (emotional) life?
Satis_4	How satisfied do you feel with your standard of life?
Satis_5	How satisfied do you feel with your overall health?
Satis_6	How satisfied do you feel with your lifelong achievements?
Satis_7	How satisfied do you feel with your future prospects?
Satis_8	How satisfied do you feel with your free-time interests and activities?
Satis_9	How satisfied do you feel with public safety and security?
Satis_10	How satisfied do you feel with your daily activities?
Satis_11	How satisfied do you feel with your house or dwelling?
Satis_12	How satisfied do you feel with your neighborhood?
Satis_13	How satisfied do you feel with your town or city?
Satis_14	How satisfied do you feel with your country?

Source: Authors' own elaboration.

Table 5. Second block of questions from BIARE.

Key	Question
afirma1	Do you consider yourself a happy person?
afirma2	Do you consider that you have your basic material needs satisfied?
afirma3	Do you consider the conditions of life in your home to be excellent?
afirma4	Do you consider your quality of life to be close to ideal?
afirma5	Have you achieved your most important goals in life?
afirma6	Do you agree that you wouldn´t change anything in your life if you could be born again?
afirma7	Do you consider yourself satisfied with life?

Source: Authors' own elaboration.