Factorial Structure of the Frugality Scale: Exploratory Evidence

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Abstract
This article aims to promote an investigation of the psychometric properties of Frugality Scale adapted to Brazilian Portuguese. Frugality is characterized by using and consuming goods in a resourceful way, fully exploring its durability as well. To this end, 626 people responded to an online form that contained the frugality scale. Procedures such as non-graphical solutions to the scree plot, exploratory graphical analysis and a Schmid-Leiman factor solution point to evidence that the scale's structure is not one-dimensional but two-dimensional. Finally, modeling strategies also indicate that a bifactor solution can be applied.
Keywords: frugality; resources; consumption; consumer behavior; validity

Estrutura Fatorial da Escala de Frugalidade: Evidências Exploratórias

Resumo
Este artigo tem por objetivo promover uma investigação das propriedades psicométricas da Escala de Frugalidade (Lastovicka et al., 1999) adaptada para o português brasileiro. Frugalidade é caracterizada pelo controle em consumir e pelo uso pleno de recursos. Com esse objetivo, 626 pessoas responderam a um formulário *on-line* que continha a Escala de Frugalidade. Foram utilizados quatro procedimentos com o objetivo de investigar a estrutura da escala de frugalidade por um *framework* exploratório. Procedimentos como as soluções não gráficas para o *scree plot*, análise gráfica exploratória e a solução fatorial Schmid-Leiman apontam para a possibilidade da escala não ser unidimensional, mas bidimensional. As estratégias de modelagem da estrutura da escala apontam que um modelo bifator pode ser aplicado.
Palavras-chave: frugalidade, recursos, consumo, comportamento do consumidor, validade

La Estructura Factorial de la Escala de Frugalidad: Evidencia Exploratorios

Resúmen
Este artículo tiene como objetivo promover una investigación de las propiedades psicométricas de la Escala de Frugalidad (Lastovicka et al.,1999) adaptada al portugués de Brasil. La frugalidad se caracteriza por el control en consumir y la plena utilización de los recursos. Con este objetivo, 626 personas respondieron a un formulario online que contenía la Escala de Frugalidad. Se utilizaron cuatro procedimientos con el objetivo de investigar la estructura de la Escala de Frugalidad por un *framework* exploratorio. Los procedimientos como las soluciones no gráficas para el *scree plot,* el análisis gráfico exploratorio y la solución factorial Schmid-Leiman apuntan hacia la posibilidad de que la escala no sea unidimensional, sino bidimensional. Las estrategias de modelado de la estructura de la escala señalan que un modelo bifactor puede ser aplicado.
Palabras-clave: frugalidad; recursos; consumo; comportamiento del consumidor; validez

Since the very beginning of Brazil as an independent country in 1822, consumers thrived dealing mostly with basic needs until the later 1980's 1990's. Initially, the economy was structured on the exportation of raw material, which was a poor source of employment. Brazil would increase its development on services and industrial production only during the 1930's and markedly during the 1950's when policies were approved in order to attract multinational companies in the post-war scenario. The country ascended as an emergent economy until the year of 2001. Through all this time, and even now, frugality has been playing a major role as a value in the Brazilian society, although it does not necessarily implies going through economic hardships – frugality is a matter of choice.

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Frugality alone reflects the degree to which someone is (1) restrained in acquiring and (2). Considering that, being frugal is different from "living tight" and is observed as an option throughout different economic levels. Still, there is evidence on the relationship between hardships and values on frugality. According to, economic crisis can be an important.

Pepper, Jackson & Uzzell (2009) revealed also that frugal consumer behavior is strongly related to personal materialism – the importance of ownership and acquisition of material goods as life goals. The authors comment also that although personal materialism is known to be related negatively with universalism and postmaterialism (conscious purchasing), both were not found to be related with frugal purchasing. Frugal purchasing was not related to socio-political materialism (economic growth and national defense are priorities) as well, but was negatively associated with power. In the current state of things, Pepper et al (2009) indicate that besides its importance, frugality still is not associated with ecological or social justice considerations, and so remains as a value yet to be fully developed as a moral challenge to consumerism.

For Bhatti (2012) and, frugality can be an important engine for innovation in a society, as it involves using products in a resourceful way. It is not by chance that since long, the literature of ecological values usually have dialogs with frugality. As resources tend to become increasingly scarce in the world, ingenuity related to reusing and recycling products to get the maximum of usability becomes a real interest. As frugality values need more investigation with the objective of promoting them across society, the development of measures able to detect cues are needed.

While proposing a measure for frugality, Lastovicka et al. (1999) defined it as a unidimensional consumer lifestyle trait consisting of the degree towards which consumers are both restrained in acquiring and using wisely economic goods and services, in order to achieve long-term goals. Measuring frugality can be of importance in several instances such as understanding self-control in consumer behavior (e.g. Haws, Naylor, Coulter & Bearden, 2012), the composition of worldviews (e.g. Nepomuceno & Laroche, 2014) and even in clinical problems such as compulsive shopping (e.g.). Despite the frugality scale by Lastovicka et al (1999) being largely used in the research field (e.g. Rick, Cryder & Lowenstein, 2008), we did not find until this moment a meta-analysis on its adaptation to other languages.

In Brazil, we were not able to detect the use of the measure in our bibliographic review. Using the keyword "frugalidade" in Scielo returned only three studies – Veras (2004), Ribeiro and Schramm (2004) and Carvalho and Oreiro (2007). In Google Academics, no papers were found related to psychology and the construct of frugality. The scarcity of contributions in this field can be considered problematic as data might not be available on the afore mentioned aspects pertinent to frugality and in need of further development.

According to the need of development on the study of frugality in Brazil, our initiative is to provide Brazilian Portuguese version. The main objective of this paper is to assess the scale's structure in order to provide information on construct validity. This paper considered an investigation of dimensionality and also on the instrument's latent structure through.

Methods

Participants

Our research design can be considered cross-sectional. The sampling technique of the current research can be characterized as convenience sampling, with subjects being recruited by students from Centro Universitário Celso Lisboa's psychology laboratory, at Rio de Janeiro city, Brazil, and from the Universidade Federal do Rio de Janeiro (UFRJ), located in the same city. Data was collected through internet, whereas survey instruments were available starting in March 1st of 2014 and finished in July 1st of 2014. Descriptive statistics on sample characteristics are available in the results section.

Procedure

As affirmed before, this research used an online form containing: (1) a consent form explaining the objectives of our research and implications, (2) a sociodemographic form and (3) the frugality scale, through the web applet of Google Docs which enables to create online surveys. The link was posted to the web address of a blog maintained for this research's purposes only. Prior to answering the survey, participants red and signed a consent form. The survey took about 15-20 minutes to be filled as verified in our pilot study.

Instruments

Participants answered both sociodemographic questions and the Frugality Scale. For the sociodemographic scale, participants had to report their sex, age, highest education level achieved, and income. A

Brazilian Portuguese version of the Frugality Scale was elaborated by our research team according to the International Test Comission's (2010) recommendations. The original version was extracted from the paper by Lastovicka et al. (1999). Versions on both idioms are available at Table 1. Data on the adaptation and translation process will be available on future publications.

Participants were instructed to read each item and answer based on how much they agree/disagree that the item reflects their usual behavior at the present. Each item should be judged separately. Responses were in the form of a rating scale from one to six, where the minimal category represented "completely disagree", while the opposite represented "completely agree". The rating scale was kept in the same way as the original scale, as an even number of options. This strategy can be considered a strength of the instrument as it prevents against the tendency of central responses.

Statistical analysis

All of the statistical analysis was computed through R v3.3.2 (R Core Team, 2016). Data Analysis had three main objectives: (1) evidence on dimensionality and (2) modeling structure. First, dimensionality was assessed through the package nFactors (Raiche & Magis, 2015), which computes regular eigenvalues, parallel analysis, optimal coordinates and acceleration factor. Dimensionality was determined through parallel analysis considering the amount of factors to be retained by the method. Further investigation on dimensionality and structure in an exploratory framework was conducted using the packages Exploratory Graphical Analysis (EGA, Golino, 2017) and psych (Revelle, 2017). EGA represents a perspective where items are nodes in a network while they can be grouped according to their connections, those groups could be also representative of possible latent variables. Psyche package allows for the use of the omega command, which tests for the general factor saturation of a test for a given structure. The data set then is tested through factor analysis, factors are rotated obliquely and a Schmid Leiman transformation is performed, so that omega can be estimated.

Modeling the frugality scale's structure was conducted using the package lavaan (Rosseel, 2012). Structures were tested using Mean and Variance-adjusted Weighted Least Square (WLSMV). Selected fit indexes were robust X^2, CFI (fit is indicated by values close to 1.00), TLI (same as prior index), RMSEA (error of approximation is acceptable for values below .08) and SRMR (same as prior error of approximation

Table 1.
Item translations from English to Brazilian Portuguese

	English Version by Lastovicka et al. (1999)	Brazilian Portuguese Version
Q1	If you take good care of your possessions, you will definitely save money in the long run	Se você tomar cuidado com as suas posses, você irá definitivamente economizar a longo prazo
Q2	There are many things that are normally thrown away that are still quite useful	Existem muitas coisas que normalmente são jogadas fora, mas que ainda são úteis
Q3	Making better use of my resources makes me feel good	Fazer melhor uso dos meus recursos me faz bem
Q4	If you can re-use na item you already have, there's no sense in buying something new	Se você pode reutilizar um item, não faz sentido comprar algo novo
Q5	I believe in being careful in how I spend my money	Eu acredito em ser cuidadoso(a) em como gasto o meu dinheiro
Q6	I discipline myself to get the most from my money	Eu me disciplino para extrair o máximo do meu dinheiro
Q7	I am willing to wait on a purchase I want so that I can save money	Eu estou disposto a esperar para comprar algo que eu quero para juntar dinheiro
Q8	There are things I resist buying today so I can save for tomorrow	Há coisas que eu resisto comprar hoje, para que eu possa economizar para o futuro

index). This paper followed guidelines for interpreting fit indexes suggested by Brown (2015).

Results

Final sample did not need removal of any subjects due to missing data. A total of 626 participants answered our online form. From the total, 402 (64,2%) are female, 223 (35,6%) male, with an age of M=34,96 (DP =13,18). Considering location, 85,7% of the participants were from Rio de Janeiro city. Results for dimensionality assessment were obtained from the package nFactors by plotting the non-graphical solutions to scree test. Kaiser criteria, parallel analysis and optimal coordinates resulted in a two factors solution, whereas acceleration factor resulted in a single factor solution. Solution is available at figure 1.

Considering the results problematic considering the original paper's structural factor, dimensionality was also assessed considering an Exploratory Graphical Analysis (EGA), which also resulted in a two-factors solution, where items 1 to 4 were correlated in a first dimension, while items 5 to 8 loaded in the second dimension. Considering listed items, the first dimension seems to be related to values on the management of resources, while the second dimension has items related to the management of financial resources. The robust solution for the resulted structure achieved a fit of $X^2(19)=61,15$, CFI=0,99, RMSEA=0,036, GFI=1,00, NFI=0,97. As the chi-square test resulted significant, statistical fit still indicates there's room for improvement in the model. Solution for the EGA is available in figure 2.

Considering aspects that could be related to a bifactor solution, command omega was executed considering a two-factors solution. That resulted in an alpha coefficient of 0,73 and an omega total of 0,79. Factor loadings in the Schmid Leiman solution were all significant and above 0,20 for the general factor, while just item 2 resulted in a factor loading below 0,30 on that factor. Factor 1, which included items from 5 to 6 had factor loadings above 0,50, while factor 2 has only item 4 with a weak factor loading of 0,23, with the others achieving loadings above 0,30. Structure and factor loadings are available at figure 3.

From the results obtained through the omega command it is possible to include in the the possibility of a bifactor structure. Among possible solutions we tested for a two-factors oblique solution, a second-order solution with two factors and a bifactor structure.

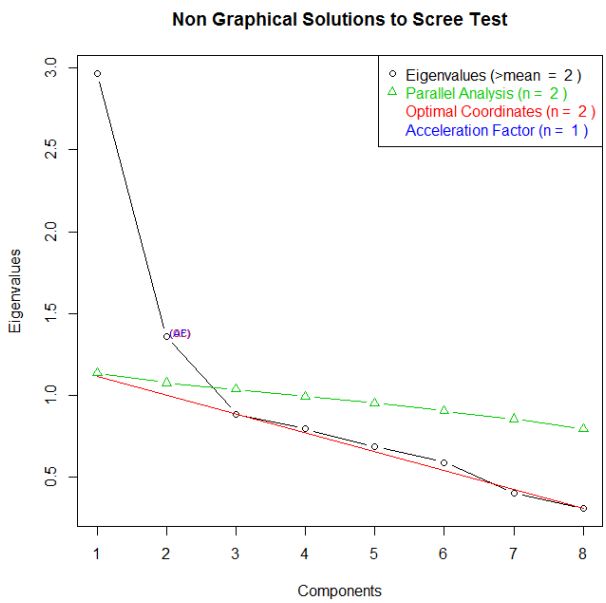

Figure 1. Dimensionality assessment's plot including Kaiser criteria (*eigenvalues*), parallel analysis, optimal coordinates and acceleration factor

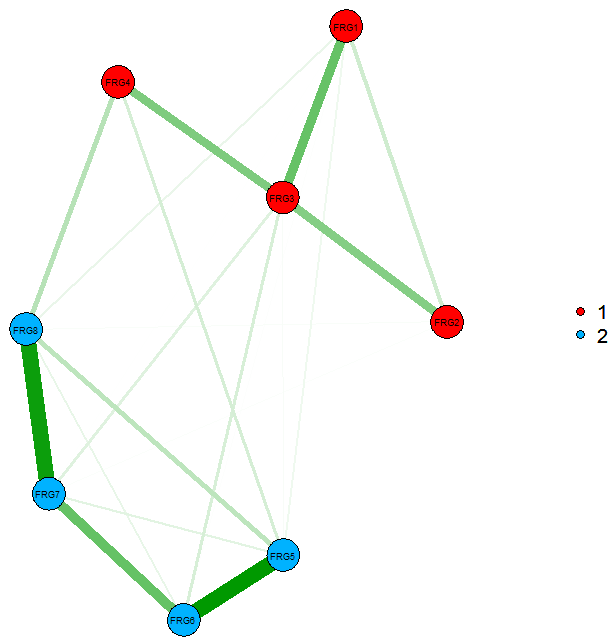

Figure 2. Exploratory graphical analysis' solution for the Frugality Scale

An orthogonal solution was also tested just for comparison. Obtained fit results are available in Table 2.

Among the obtained solutions, all of the proposed models achieve better fit when compared to the baseline model. The orthogonal structure performed the worse when compared to other modeled structures. A second order factor structure failed converging a solution, while the oblique and bifactor solution performed close comparing other fit indexes than chi-square, where the bifactor model achieved the best performance.

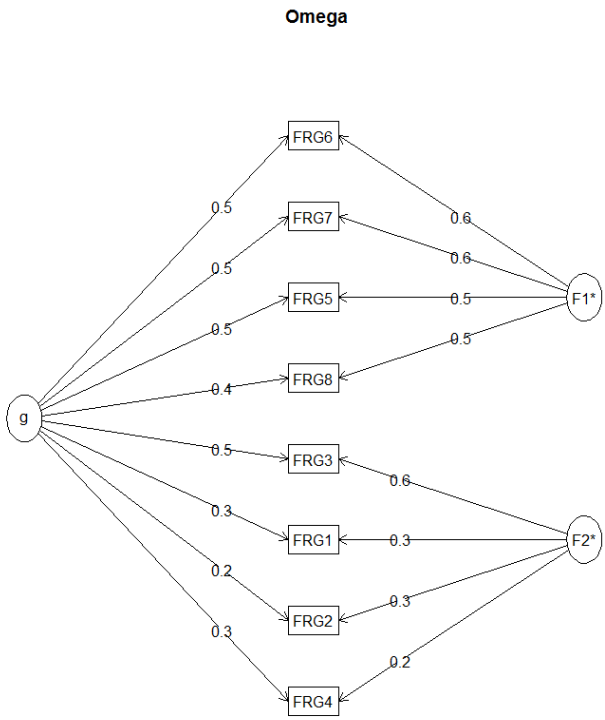

Figure 3. Structure resulted from the omega command for a two-factor solution

Considering the bifactor solution, there remains a significant chi-square fit and through the items, item 4 did not achieve a significant factor loading on its factor, which was expected as it obtained a low factor loading on the Schmid Leiman solution, while still loading significant at the general factor. After keeping only the factor loading from item 4 into the general factor, a high dependence between item 7 and 8 was detected in the modification indices output. After applying the two mentioned modifications, the model achieved a fit of $X^2(12)=12.09$, $p=0.439$, CFI=1.00, TLI=1.00, RMSEA=0.003 and SRMR=0.016. Factor loadings for each item and factor is available at table 3.

Discussion

The frugality scale has been used extensively as a unidimensional measure since its proposal by Lastovicka et al (1999). Our results represent the value in a Brazilian sample and items were expected to vary considering that across different countries relationship between people and their possessions might vary due to the economic or political moment (Hampson & McGoldrick, 2013).

Different from the original structure, in Brazil the frugality scale seems to be organized through two primary order factors, which can be named as "resource management" and "financial management", while all of the items also loaded in a general factor. The general factor might represent frugality itself. It is reasonable to think that behaviors related to being conservative with money or possessions might not necessarily be related only to wisely managing resources to its fullest as Lastovicka et al (1999) defines the construct. Some of the listed behaviors and attitudes could also be motivated by buying intentions activated by a desired good or even by economic crisis forcing people to act frugal.

Table 2.
Fit indexes by type of structure

Model	Robust X^2	*p-statistics*	*df*	CFI	TLI	RMSEA	SRMR
Orthogonal	179.1	<.001	20	.71	.60	.113	.113
Oblique	61.15	<.001	19	.92	.89	.060	.045
Second order	failed						
Bifactor	43.17	<.001	12	.94	.87	.065	.032
Re-specified bifactor	12.09	.439	12	1.00	1.00	.003	.016
Baseline	579.87	<.001	28				

Table 3.
Factor loadings for items and its corresponding dimensions, standard error (S.E.), Z and p-value

Factor	Item	Loadings	S.E.	Z	*p*-value
Resources	FRG1	0.38	0.10	3.83	0.000
	FRG2	0.41	0.10	4.13	0.000
	FRG3	0.39	0.12	3.34	0.001
Finances	FRG6	0.68	0.06	12.12	0.000
	FRG5	0.57	0.06	9.16	0.000
	FRG7	0.63	0.06	10.78	0.000
	FRG8	0.51	0.08	6.68	0.000
Frugality	FRG1	0.33	0.09	3.67	0.000
	FRG2	0.19	0.10	2.01	0.045
	FRG3	0.57	0.09	6.44	0.000
	FRG4	0.55	0.09	6.26	0.000
	FRG6	0.37	0.07	5.00	0.000
	FRG5	0.42	0.08	5.55	0.000
	FRG7	0.41	0.08	5.25	0.000
	FRG8	0.43	0.09	4.97	0.000

That configuration is better represented by a bifactor solution, where a general independent factor accounts for part of the variance of items, while other items can vary also due to other independent primary factors.

Considering the implications for the usage of the scale in Brazil, it is still safe to score the scale with a single score summing the set of items. Still, it is important to take under consideration that one might be actually looking at variance being explained not only by frugality, but by other activated values. It is important to mention as well that the frugality scale is a very brief measure and there's a risk of underrepresentation issues. Less items also mean less portions of the latent trait being represented. To investigate more thoroughly frugality as a latent trait, we recommend the development of a longer form, with a more varied set of behaviors and attitudes.

Another point is that the scale was applied during the risk of economic recession being communicated through media on the mid 2014. One hypothesis to test in the future could be if the current warning of an incoming economic crisis induced sample respondents to a higher activation of financial-related attitudes and behaviors in a way other than caused by frugality. That way our current sample could be used as a prior for future investigations using the frugality scale.

A major weakness of our research is that we did not use other frugality measures, which could bring more information on the functioning of the other underlying dimensions of the scale that we were able to detect in the current study. Still, in our bibliographic research it was noticeable that frugality measures are scarce or miss a more thoroughly investigation of psychometric qualities. A second weakness is our research design that followed a cross-sectional design, where understanding frugality's stability through time could also elucidate another psychometric information related to test-retest stability or even comparing the factor structure across time.

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