

# A Brief Money Management Scale and Its Associations With Personality, Financial Health, and Hypothetical Debt Repayment

Masha Ksendzova,<sup>a</sup> Grant E. Donnelly,<sup>b</sup> and Ryan T. Howell<sup>c</sup>

*Money management is essential for financial health, and more research is needed to better assess people's money management practices. Therefore, we factor-analyzed 205 scaled questions from previous money management measures to select the best items and examined their internal consistency and convergent validity. Our resulting 18-item Brief Money Management Scale and its factors (management of cash, credit, savings, and insurance) replicate and clarify previous relationships between types of money management and financial outcomes as well as personality and demographic antecedents. Furthermore, this scale is reliable and predicts participants' hypothetical debt repayment behavior, suggesting concurrent validity. We discuss how future studies can use this multifaceted measure of money management to better understand the antecedents and consequences of different financial decisions.*

*Keywords: budgeting, debt, money management, savings, scale development*

The United States is an indebted nation. Recent statistics suggest that Americans' median total household debt is \$75,600 (Bricker, Bucks, Kennickell, Mach, & Moore, 2011). Credit card debt has risen 6.5% in 2016, contributing to a national debt balance spanning beyond \$3 trillion (Federal Reserve, 2017). With ever-growing debt, the personal savings rate for Americans has plummeted (U.S. Department of Commerce, Bureau of Economic Analysis, 2016). Such trends negatively impact society and individuals. For instance, the massive foreclosures of the housing bubble, worsened by many customers taking out risky adjustable rate mortgages with little or no money down (see Finke, Huston, Siman, & Corlija, 2006), resulted in creditors and banks reporting losses in the hundreds of billions (Morgenson, 2008). Not surprisingly, the extent of financial stress among Americans has been high (Prawitz et al., 2006) and has negatively impacted their lives. For instance, financial stress has been linked to low work commitment (Kim & Garman, 2003), decreased productivity (Garman, Leech, & Grable, 1996), low marital satisfaction (e.g., Kerkmann, Lee, Lown, & Allgood, 2000),

and poor health (e.g., O'Neill, Prawitz, Sorhaindo, Kim, & Garman, 2006).

An important safeguard against people's excessive consumption and personal debt is good money management (i.e., budgeting, saving, investing, and otherwise regulating spending; see Godwin & Koonce, 1992). It holds the promise of valuable financial and emotional benefits. People who manage their money are less likely to shop compulsively (e.g., Donnelly, Ksendzova, & Howell, 2013), experience less financial stress (e.g., Xiao, Sorhaindo, & Garman, 2006), report more financial satisfaction (e.g., Dowling, Corney, & Hoiles, 2009), tend to save more money (Antonides, de Groot, & van Raaij, 2011), and have better health (e.g., O'Neill, Xiao, Sorhaindo, & Garman, 2005). In addition, good money managers have lower credit card debt in various economic strata (Lea, Webley, & Walker, 1995), and money management predicts lower accumulation of debt beyond the influence of other factors relevant to financial responsibility, such as financial knowledge (see Donnelly, Iyer, & Howell, 2012).

<sup>a</sup>PhD Student in Marketing, Boston University Questrom School of Business, Rafik B. Hariri Building, 595 Commonwealth Ave., Boston, MA 02215. Email: mashak@bu.edu

<sup>b</sup>PhD Student in Marketing, Harvard Business School, Morgan Hall, Soldiers Field Road, Boston, MA 02163. Email: gdonnelly@hbs.edu

<sup>c</sup>Associate Professor of Psychology, San Francisco State University, Ethnic Studies & Psychology Building, 1600 Holloway Ave., San Francisco, CA 94132. Email: rhowell@sfsu.edu

However, more research is needed to better assess money management. Previous research has mostly relied on proxies of responsible consumer behavior (e.g., actual levels of consumer debt; see Bernstein, 2004) or self-reports of money management behaviors (e.g., Perry & Morris, 2005) that have often not undergone proper psychometric investigation (i.e., examining the reliability, factor structure, and convergent validity; see Dew & Xiao, 2011). For instance, some scales have failed to report the reliability of their measures (e.g., Godwin & Koonce, 1992), correlational patterns with likely predictor variables (e.g., personality and materialistic values; Davis & Weber, 1990), and likely financial benefits (e.g., Kim, 2004). It was because of this limitation in the literature that Dew and Xiao (2011) constructed a money management scale that addressed many of these concerns, laying the invaluable foundations for this research. Dew and Xiao warned that their measure required further refinement because the cash and credit management subscales were not reliable. Indeed, these subscales have been psychometrically problematic and required adjustments to produce more reliable measures (Donnelly et al., 2013). Consequently, Donnelly et al. (2013) emphasized the importance of developing a psychometrically sound, multidimensional assessment of money management behavior. Likewise, Gutter et al. (2012) advised the need for future research to develop a more robust assessment of money management.

There have been inconsistent relationships reported between money management and demographic variables (e.g., Godwin & Koonce, 1992; Robb & Woodyard, 2011) as well as important financial outcomes (e.g., Antonides et al., 2011; Webley & Nyhus, 2001). One possible reason for these disparate results is the lack of consistency in how money management has been conceptualized and measured (e.g., Loix, Pepermans, Mentens, Goedee, & Jegers, 2005; Robb & Woodyard, 2011). The development and use of a single, multidimensional measurement tool will help researchers draw conclusions to the true predictors and outcomes of various money management practices and possible moderating variables.

For instance, the relevancy and helpfulness of various money management practices may depend on age, and such differences are one reason why components of money management are important to isolate. According to life-cycle theory (Berthoud & Kempson, 1992), financial needs and

responsibilities change along with one's life circumstances (e.g., marriage, retirement). In turn, different money management practices may serve to meet these shifting needs. For example, people's motivations for saving money change as their income increases (Xiao & Noring, 1994). Likewise, Hilgert, Hogarth, and Beverly (2003) suggest that money management behaviors develop hierarchically, with cash management occurring first, then credit management, savings/investment, and lastly insurance. Moreover, Deacon and Firebaugh's (1988) family resource management model posits that people use money management to transform available resources (e.g., income) into financial outcomes (e.g., net wealth), and these available resources vary between people. Consequently, if money management is properly separated into its subcomponents, future research may benefit from assessing the quality of money management skills appropriate for a person's life stage.

Therefore, the goal of this investigation is to develop a short and reliable money management scale using the items from previously published money management measures. The heterogeneity of the relations reported earlier highlights a consistent weakness in the money management literature—there exists a need for a single scale that is widely accepted and used by money management researchers (Dew & Xiao, 2011).

One strategy to refining the previous published scales is to factor-analyze all the questions of these scales, determine which items best measure the construct, and evaluate the relations these items have with various demographic and financial variables.

### **The Current Research**

In Study 1, we seek to use previously published scales that have been used to measure money management behaviors to determine the best set of items through factor analysis for the Brief Money Management Scale (BMMS). We also test the relationships of the BMMS and its factors with previously established antecedents (e.g., personality traits) and consequences (e.g., financial well-being) of good money management. Then, in Study 2a, we aim to replicate the factor structure of the BMMS as well as its relationships with key variables when participants respond to (a) only BMMS questions rather than a comprehensive list of measures used for its creation, (b) in fixed order, and (c) on the same response scale. In Study 2b, we assess test–retest reliability.

Finally, in Study 3, we examine people's BMMS scores in relation to their performance in a debt repayment simulation game, a marker of convergent validity that does not rely on self-reports of financial behavior.

### Study 1: Exploring the Factor Structure of Money Management

#### Participants

Our initial sample consisted of 2,038 individuals who had begun the study after consenting (please refer to Table 1 for descriptive statistics). These participants were either students recruited from a public urban West Coast university

( $N = 347$ ; 17.1%) in exchange for class credit or nonstudent volunteers recruited through social media websites (i.e., Craigslist and Facebook;  $N = 1,691$ ; 82.9%). There existed no overlap in recruiting channels. Similar to working adults, students possess general consumer knowledge (Cole & Sherrell, 1995) and must make important money management decisions (Archuleta, Dale, & Spann, 2013).

#### Procedure

**Selection of Money Management Items.** We examined empirical studies measuring money management published between January 1, 1986, and December 31, 2012.

**TABLE 1. Descriptive Statistics of the Samples**

		Study 1	Study 2a	Study 2b	Study 3
Age		$M = 33.48$ , $SD = 14.12$	$M = 35.32$ , $SD = 15.20$	$M = 37.51$ , $SD = 12.14$	$M = 24.59$ , $SD = 4.87$
Gender	Female	73.30%	50.6%	41.7%	51.3%
	Male	25.8%	49.4%	58.3%	48.7%
	Transgender	0.9%			
Race	White	66.8%	52.6%	83.3%	42.8%
	Asian American	11.8%	17.5%	2.8%	36.2%
	Hispanic	8.9%	6.5%	2.8%	5.9%
	Multiracial or other	8.5%	5.2%	2.8%	
	African American	3.5%	18.2%	8.3%	15.1%
	Native American	0.5%			
Education	High School or less	6.9%	7.1%	17.8%	7.8%
	Some college	42.5%	39.0%	13.3%	29.4%
	Associate's degree		7.1%	15.6%	5.9%
	Bachelor's degree	30.7%	29.2%	35.6%	32.7%
	Master's degree	17.8%	11.7%	15.6%	19.0%
	Doctorate or professional degree		4.5%	2.2%	5.2%
	Other	2.1%	1.3%		
Marital Status	Married	24.0%			
	Domestic partnership	13.8%			
	Never married or in a domestic partnership	50.6%			
	Divorced	7.7%			
	Separated	1.9%			
	Widowed	2.0%			
Employment	Full-time	32.4%			
	Part-time	31.0%			
	Self-employed	8.2%			
	Not employed	28.4%			

Studies were found through the following electronic article databases: EconLit, Family & Society Studies Worldwide, Google Scholar, PsycARTICLES, and PsycINFO. Query terms included *money management*, *financial management*, *cash management*, *financial behaviors*, *financial practices*, *money practices*, *budgeting*, and *budgeting practices*. Our selection criteria in the literature search were that the article (a) developed a self-report measure aimed at assessing money management and (b) was published after 1985 (excluding items generated more than 30 years ago, which may not apply to people's current financial situations). Thirty-four unique financial management measures, from 32 empirical studies were selected for further review.

Second, because the intention of our study was to conduct a factor analysis with all published items, we decided to retain only measures that (a) reported the exact language of their questions (or measures whose authors provided such details upon our inquiry), (b) allowed for responses on a Likert-scale (as opposed to dichotomous responses; e.g., Atkinson, McKay, Kempson, & Collard, 2007), and (c) had questions which were not limited in scope to a specific population (e.g., farmers; Scannell, 1990). From the 34 measures initially gathered in our literature search, 14 measures were removed from further evaluation because they did not meet these criteria. The resulting sample consisted of 20 measures, with 205 items.

#### ***Additional Measures Included to Assess Validity of Items***

Because a psychometrically sound money management scale should be correlated with previously established antecedents and consequences, we asked participants to report the following information. Specifically, previous research suggests that good money management is related to the Big Five personality traits (especially higher conscientiousness; see Donnelly et al., 2012), lower materialistic values (especially the striving-for-happiness dimension; e.g., Gardarsdottir & Dittmar, 2012), greater financial knowledge (e.g., Antonides et al., 2011), higher education (e.g., Donnelly et al., 2012), and better financial standing (e.g., income [Xiao et al., 2006], savings [Gardarsdottir & Dittmar, 2012], and lower debts [Lea et al., 1995]).

Participants completed the Big Five Inventory (BFI-10; Rammstedt & John, 2007) as a measure of personality traits, the Material Values Scale (MVS-15; Richins, 2004) as a measure of materialistic values (along three dimensions:

seeing consumption as a central goal, a signal of success, and a way to achieve happiness), the Financial Products Knowledge Scale (Antonides et al., 2011) to assess knowledge of financial products as well as financial and demographic information. Participants reported their current economic standing (Howell, Kurai, & Tam, 2012) in terms of income ("What is your household income after taxes are taken out?"), savings ("What is the amount in all your savings and money market accounts?"), investments ("What is the value of all your investments [such as CD, stocks, or bonds]?"), credit card debt levels ("What is the balance on all your credit cards?" and "During the past year, how many of your credit cards have carried half or more of the maximum balance?"), and wealth ("Wealth, also known as net worth, is defined as the total value of everything someone owns minus any debt that he or she owes. A person's net worth includes his or her bank account or cash savings."). Lastly, participants provided demographic information including their gender, age, and education.

#### ***Results***

***Survey Completion.*** There were 1,078 participants who completed all 20 money management measures included in the factor analysis (a 52.89% completion rate). Attrition did not systematically exclude participants who identified as money managers based on their money management quality,  $t(1,777) = 0.89, p = .39$ .

Students ( $M_{\text{age}} = 22.87$  years,  $SD = 6.03$  years) were younger than volunteers ( $M_{\text{age}} = 38.91$  years,  $SD = 13.99$  years),  $t(1,031) = -20.49, p < .001$ . Overall, student participants reported having a median annual household income of \$20,000–\$29,999; savings in the \$1,001–\$2,500 range, \$0–\$100 in investments, \$101–\$500 in credit card balance, and \$0–\$24,999 in total net worth. Volunteer participants reported a median annual income of \$40,000–\$49,999, \$5,001–\$10,000 in savings, \$501–\$1,000 in investments, \$101–\$500 in credit card balance, and \$25,000–\$49,999 in total net worth. Overall, students reported significantly less savings,  $t(1,035) = -8.88, p < .001$ ; investments,  $t(1,027) = -12.19, p < .001$ ; credit card debt,  $t(1,038) = -3.59, p < .001$ ; and net worth,  $t(1,023) = -7.46, p < .001$ , than nonstudent volunteers.

***Items Selected.*** To begin, all 205 scaled questions from the 20 money management measures were included in a factor analysis, and participants' responses were standardized. We

followed Dew and Xiao (2011) in conducting a Promax rotation by requiring all items to load above .60 to belong to a factor. We extracted four factors and retained 78 items that loaded above .60. Subsequently, as an item-reduction approach, all items loading above .60 were evaluated for replication and redundancy. If two items had identical or highly similar language, we eliminated the item with the lower factor loading. If similarly worded items had identical factor loadings, the item that contributed less to the internal consistency of the subscale was eliminated (for recommendations about how to retain items best contributing to subscale consistency, see Raubenheimer, 2004). Once items were eliminated, we conducted another factor analysis with the remaining items. This pruning process was repeated three times, eliminating all but 18 items.

These remaining 18 items were internally consistent ( $\alpha = .87$ ) and explained 64.13% of the variance in money management (Table 2). They produced four factors, each of which was internally consistent: savings management ( $\alpha = .89$ ), insurance and investment management ( $\alpha = .82$ ), credit management ( $\alpha = .80$ ), and cash management ( $\alpha = .79$ ). This factor solution differed slightly from the factors observed by Dew and Xiao (2011). As in Dew and Xiao (2011), the retained items separated based on cash management (i.e., how individuals manage and record their cash purchases) and credit management (i.e., how individuals use their credit cards and repay loans). However, instead of a savings and investment management subscale (i.e., saving, planning for retirement, and investing money), the remaining items separated so that (a) savings was a separate factor and (b) investment items formed a factor with insurance items, which assess frequency of actions taken to protect property and health. The resulting BMMS was composed of 18 items from four original scales: 7 items from the Financial Management Behavior Scale developed by Dew and Xiao (2011), 6 items from the Financial Management Scale developed by Parrotta and Johnson (1998), 4 items from the Financial Behaviors Scale developed by Kim (2004), and 1 item from the Financial Behavior Scale developed by Xiao et al. (2006).

#### **Correlations With Personality and Outcome Variables.**

Students scored lower on general money management, as assessed by the BMMS, than nonstudent participants,  $t(1,076) = -8.91, p < .001$ . Particularly, the largest difference was in insurance management,  $t(1,076) = -11.72,$

$p < .001$ ; followed by cash management,  $t(1,076) = -5.52, p < .001$ ; then credit management,  $t(1,076) = -3.45, p < .005$ ; and savings management,  $t(1,067) = -2.93, p < .005$ . The removal of student participants did not alter the factor structure of the final BMMS.

Overall money management was positively related to financial knowledge ( $r = .43$ ). It was also associated positively with conscientiousness ( $r = .28$ ) and negatively with neuroticism ( $r = -.09$ ). Furthermore, money management was negatively related to materialism overall ( $r = -.28$ ) and more specifically the striving-for-happiness dimension of materialism ( $r = -.35$ ). Likewise, money management was positively correlated with savings ( $r = .18$ ), investments ( $r = .51$ ), and wealth ( $r = .47$ ) and negatively correlated with credit card debt ( $r = -.17$ ). All reported correlations were significant at  $p < .001$ .

Important to note is that the components of the BMMS were also related to relevant financial outcomes: (a) the savings management factor (e.g., “I regularly set money aside for possible unexpected expenses”) was positively correlated with savings ( $r = .55$ ), (b) credit management (e.g., “Made only minimum payments on a loan,” reverse-scored) was negatively correlated with credit card debt ( $r = -.47$ ), and (c) insurance and investment management (e.g., “Maintained or purchased adequate health insurance”) was positively correlated with investments ( $r = .57$ ). Furthermore, savings management’s negative relationship with debt ( $r = -.16$ ) addressed one of the shortcomings Dew and Xiao (2011) observed with previous measures. All reported correlations were significant at  $p < .001$ . Likewise, cash management (e.g., “Review and evaluate spending on a regular basis”) was not significantly related to credit card debt ( $r = -.02, p > .05$ ), as previously found in Dew and Xiao, likely because cash management and credit management are different domains of financial management.

**Predicting Net Worth and Debt.** Money management was significant in predicting net worth,  $F(4, 1023) = 122.43, p < .001$ . Specifically, our regression analyses indicated that better credit ( $\beta = .23, p < .001$ ) and insurance management ( $\beta = .48, p < .001$ ) predicted greater net worth, whereas better cash management predicted lower net worth ( $\beta = -.12, p < .001$ ). Our money management components also significantly predicted credit card balance,

**TABLE 2. Promax Rotated New Scale Factor Structure for Study 1**

	Save	Insurance	Credit	Cash
Set money aside for emergencies.	.88			
Saved for a long-term goal such as a car, education, home, and so forth	.87			
Regularly set aside money for saving.	.86			
Regularly set money aside for possible unexpected expenses.	.83			
Maintained or purchased adequate property insurance like auto or homeowners insurance		.86		
Maintained or purchased an adequate health insurance policy		.84		
Maintained or purchased adequate life insurance		.77		
Contribute to a retirement savings plan (e.g., 401k). <sup>a</sup>		.64		
Review the adequacy of the insurance coverage that I have. <sup>a</sup>		.60		
Did not pay the total balance on my credit card but instead just made a partial payment <sup>b</sup>			.79	
Made only minimum payments on a loan <sup>b</sup>			.77	
Maxed out the limit on one or more credit card(s) <sup>b</sup>			.77	
Get myself into more and more debt each year <sup>b</sup>			.75	
Spent more money than I have <sup>b</sup>			.66	
Follow a weekly or monthly budget.				.87
Review and evaluate spending on a regular basis.				.82
Kept a written or electronic record of your monthly expenses				.75
Estimate household income and expenses.				.67
Eigenvalues	5.79	2.56	1.83	1.35
Percentage of variance explained by factor (total variance explained = 64.13%)	32.19	14.24	10.18	7.52
$\alpha$	.89	.82	.80	.79
( $\alpha$ of entire scale = .87)				
<i>M (SD)</i>	3.28 (1.09)	3.93 (0.96)	3.00 (1.26)	2.78 (1.28)

<sup>a</sup>We recommend for future research not to use these items in assessing insurance and investment management of college students because these two items did not load above .60 onto the factors in a student-only subsample.

<sup>b</sup>Reverse scoring.

$F(4, 1036) = 94.61, p < .001$ . Specifically, credit management was the strongest negative predictor of credit card debt ( $\beta = -.48, p < .001$ ), followed by savings management ( $\beta = -.08, p < .05$ ). However, insurance management also predicted higher credit card debt ( $\beta = .24, p < .001$ ).

**Summary.** Taken together, it appears that the overall BMMS, as well as its four factors, demonstrate good reliability and convergent validity. However, one limitation of this study is that not all items were measured on the same scale and with the same prompt. Also, given

that we tested numerous scales, these items were not presented together. Because of this limitation, we sought to evaluate the reliability and convergent validity of the BMMS with a new sample by administering only BMMS questions with the same prompt and on the same scale in Study 2a.

### Study 2a: Replicating Study 1 With Standardized Instructions

One aim of Study 2a was to replicate the factor structure of the BMMS (see MacCallum, Widaman, Zhang, & Hong,

1999, for recommendation of replicating factor structures), confirm the relationships between the BMMS and key variables, and use a single instruction of asking participants to indicate how often they have engaged in the following activities on a scale of 1 (*never*) to 5 (*always*).

### **Participants**

One hundred fifty-four individuals (see Table 1) participated in a series of unrelated lab studies, including other surveys, pertaining to judgment and decision-making. Of the participants, 71 (46.1%) self-reported that they were students, and 83 (53.9%) identified as nonstudent community members. The median monthly income range was \$1,000–\$1,999 among students and \$3,000–\$3,999 among community members.

### **Procedure**

Participants responded to the 18 BMMS items. They also completed the BFI-10 (Rammstedt & John, 2007) and the MVS (Richins, 2004). As in Study 1, participants were asked to report their current economic standing with a four-item proxy based on Howell et al. (2012). Lastly, participants reported demographic information including their gender, age, education, and wealth.

### **Results**

**Overall Measure Properties.** Mirroring Study 1's approach, we ran a principal components factor analysis with a Promax rotation on the 18-item BMMS. Together, these 18 items explained 71.99% of the variance in scores and produced the same four-factor solution (with all items loading only onto their corresponding factor), replicating the results of Study 1 (Table 3). The overall scale was internally consistent ( $M = 3.25$ ,  $SD = 0.70$ ;  $\alpha = .86$ ), as were the Savings ( $M = 3.03$ ,  $SD = 1.24$ ;  $\alpha = .91$ ), Insurance ( $M = 2.43$ ,  $SD = 1.23$ ;  $\alpha = .87$ ), Credit ( $M = 4.35$ ,  $SD = 0.83$ ;  $\alpha = .85$ ), and Cash Management ( $M = 3.12$ ,  $SD = 1.14$ ;  $\alpha = .88$ ) subscales.

Also of importance, high BMMS scores were again related to good financial standing: money management is positively correlated with income, wealth, savings, and investments. Furthermore, the subscales are correlated with the corresponding self-reported financial outcomes: (a) Savings management is positively correlated with savings ( $r = .49$ ,  $p < .001$ ), (b) credit management is negatively correlated with credit card debt ( $r = -.39$ ,  $p < .001$ ), and

(c) insurance/investment management is positively correlated with investments ( $r = .47$ ,  $p < .001$ ). These replicating results demonstrate reliability and convergent validity of the BMMS and its components with our specific instructions and response scale.

### **Associations With Personality and Outcome Variables**

Replicating the results of Study 1, overall money management had no relationship with gender ( $r = .01$ ,  $p > .05$ ) and a positive relationship with education ( $r = .20$ ,  $p < .05$ ). In addition, the BMMS ( $r = .27$ ), as well as the savings ( $r = .21$ ), insurance ( $r = .17$ ), and cash ( $r = .20$ ) subscales, had a positive relationship with conscientiousness. A similar personality profile was observed when regressing overall money management onto the Big Five,  $F(5, 149) = 3.17$ ,  $R^2 = .10$ : Good money managers were highly conscientious ( $\beta = .26$ ) and emotionally stable ( $\beta = .16$ ). Likewise, the happiness-seeking component of materialism had a negative correlation with credit management ( $r = -.23$ ). All described relationships were significant at  $p < .05$ .

### **Study 2b: Measuring Test–Retest Reliability**

The first aim of Study 2b was to assess the test–retest reliability of the BMMS, which should reflect a stable money management tendency. The second aim of Study 2b was to compare people's money management to their self-reported allocation of income (measured as percentage of income instead of an absolute monetary amount) toward spending categories such as savings and investments. The income allocation task complemented our prior assessments of financial behaviors (e.g., savings and investments) by taking into consideration people's available resources (i.e., measuring saving and spending choices as percentages of income, as opposed to absolute amounts).

### **Participants**

First, 80 participants (see Table 1) completed the BMMS administered on Amazon's Mechanical Turk, an online system of paid survey-takers. Two weeks after completing the survey, all participants were invited to take the BMMS again; however, only 45 participants did so ( $M_{\text{age}} = 37.51$ ,  $SD = 12.14$ ; 41.7% female; 83.3% White; see Table 1). Hence, we had a completion rate of 56% and report the results only relating to participants who completed the BMMS in both instances. Important to note is that the mean BMMS scores in the first survey did not significantly

**TABLE 3. Promax Rotated New Scale Factor Structure for Study 2a**

	Save	Insurance	Credit	Cash
Set money aside for emergencies.	.91			
Saved for a long-term goal such as a car, education, home, and so forth	.77			
Regularly set aside money for saving.	.86			
Regularly set money aside for possible unexpected expenses.	.94			
Maintained or purchased adequate property insurance like auto or homeowners insurance		.93		
Maintained or purchased an adequate health insurance policy		.87		
Maintained or purchased adequate life insurance		.71		
Contribute to a retirement savings plan (e.g., 401k).		.64		
Review the adequacy of the insurance coverage that I have.		.81		
Did not pay the total balance on my credit card but instead just made a partial payment <sup>a</sup>			.77	
Made only minimum payments on a loan <sup>a</sup>			.79	
Maxed out the limit on one or more credit card(s) <sup>a</sup>			.81	
Get myself into more and more debt each year <sup>a</sup>			.83	
Spent more money than I have <sup>a</sup>			.78	
Follow a weekly or monthly budget.				.87
Review and evaluate spending on a regular basis.				.90
Kept a written or electronic record of your monthly expenses				.71
Estimate household income and expenses.				.85
Eigenvalues	5.70	3.56	2.19	1.51
Percentage of variance explained by factor (total variance explained = 71.99%)	31.68	19.76	12.18	8.36
$\alpha$	.91	.87	.85	.88
( $\alpha$ of entire scale = .86)				
<i>M (SD)</i>	3.03 (1.24)	2.43 (1.23)	4.35 (0.83)	3.12 (1.14)

Note. Items were kept in the same order as Table 1 for ease of comparison.

<sup>a</sup>Reverse scoring.

differ between participants who chose to participate in the second survey and those who chose not to participate. The median net worth reported by participants was \$15,000, and their median level of education was a 4-year university degree.

#### **Procedure and Measures**

The participants completed the BMMS, with the items presented in random order. In addition, participants reported their income allocation: the approximate percentage of

income they allocate toward essential purchases (e.g., food or house supplies), material goods (e.g., furniture or clothing), life experiences (e.g., vacations), charitable donations, and savings and investments. Two weeks after taking the first survey, participants again completed the BMMS and the income allocation task.

#### **Results**

In both instances, the BMMS displayed good internal consistency ( $\alpha = .85$  at Time 1 and  $\alpha = .84$  at Time 2).



Participants' mean money management scores at Time 1 ( $M = 3.33$ ,  $SD = .71$ ) and Time 2 ( $M = 3.36$ ,  $SD = 0.69$ ) had a strong correlation ( $r = .82$ ,  $p < .001$ ), and participants' mean scores on the savings factor displayed a strong positive relationship with their respective savings scores 2 weeks later ( $r = .81$ ,  $p < .001$ ). Participants' mean insurance and investments management scores at Time 1 correlated positively with scores at Time 2 ( $r = .75$ ,  $p < .001$ ), and their credit management scores were also temporarily stable ( $r = .75$ ,  $p < .001$ ). Similarly, mean cash management scores at Time 1 are positively related to mean cash management scores at Time 2 ( $r = .55$ ,  $p < .001$ ). Finally, all 18 BMMS items had a significant positive correlation ( $ps < .05$ ) with their counterpart items at Time 2.

Moreover, people's allocation of income demonstrated adequate temporal stability, with allocation correlations ranging from  $r = .34$  to  $r = .70$ ,  $ps < .05$ . People's quality of money management was positively related to their percentage of income allocated toward the "savings and investments" category at Time 1 ( $r = .34$ ,  $p < .05$ ) and at Time 2 ( $r = .55$ ,  $p < .001$ ; controlling for the proportion of income allocated toward meeting basic needs). This positive relationship implies that good money managers, as defined by the BMMS, are more likely to allocate their income toward saving and investing, regardless of their income. Furthermore, income allocation toward material goods (e.g., jewelry) served as a complementary measure to their previously assessed materialistic values. As expected, people's BMMS scores were negatively related to the percentage of income they reported spending on material items, marginally at Time 1 ( $r = -.26$ ,  $p = .09$ ) and significantly at Time 2 ( $r = -.46$ ,  $p < .005$ ). This finding suggests that good money managers are not only less materialistic in their values than people with low BMMS scores but may also spend proportionally less of their income on material goods.

### **Study 3: Establishing Concurrent Validity With a Debt Repayment Game**

For a more comprehensive examination of concurrent validity, we sought to examine if the BMMS was predictive of money management behavior that is observed, instead of self-reported. Dew and Xiao (2011) have noted that self-report assessments of financial behavior inevitably carry the burden of socially desirable responding. Moreover, because money management involves paying attention to one's financial resources (Godwin & Koonce, 1992),

people who report inadequate money management may not accurately estimate their financial information (e.g., savings) in either absolute amounts or proportions of income.

We used a simulator game designed to mimic the debt repayment process of everyday life (adapted from Amar, Ariely, Ayal, Cryder, & Rick, 2011). Amar et al. (2011) found that suboptimal behavior in their simulator game positively predicts participants' actual household debt. More important, this debt repayment game had ecological validity in that performance was monetarily incentivized (i.e., participants repaid hypothetical debts to win real money) and the game required multiple repayment decisions, which mirror the ongoing nature of money management.

#### **Participants**

A sample of 161 adults (see Table 1) participated in a series of unrelated lab studies at a private university in the Northeastern United States for a payment of \$20 with the chance of additional bonuses (see "Procedure"). Eight (5%) participants did not report their occupation. Of those who did, 90 (58.8%) identified as students and 63 (41.2%) were nonstudent community members. As in Study 2a, students reported that their median monthly income range is \$1,000–\$1,999. The community members' median monthly income range is \$2,000–\$2,999.

#### **Procedure**

First, participants completed the BMMS. As in Studies 2a and 2b, participants were asked to indicate how often they had engaged in the following activities on a 1 (*never*) to 5 (*always*) scale. Descriptively, the scores on the overall measure ( $M = 3.09$ ,  $SD = 0.62$ ;  $\alpha = .78$ ) as well as the savings ( $M = 2.84$ ,  $SD = 1.16$ ;  $\alpha = .90$ ), insurance ( $M = 2.13$ ,  $SD = 1.02$ ;  $\alpha = .75$ ), credit ( $M = 4.16$ ,  $SD = 0.96$ ;  $\alpha = .88$ ), and cash ( $M = 3.19$ ,  $SD = 0.98$ ;  $\alpha = .77$ ) subscales were similar to those found in our previous studies.

Next, respondents participated in the debt repayment simulator game (Amar et al., 2011). In this debt repayment game, participants were saddled with six debt accounts that varied in amount (ranging from \$3,000 to \$60,000) and annual interest rate (ranging from 2.0% annual percentage rate [APR] to 4.0% APR). The game lasted for 25 rounds, and each round represented 1 year. In each round, participants received a hypothetical \$5,000 cash allotment to pay

down on one or more debts. After participants made and confirmed their repayment choices, the program presented the updated balance of each debt and a graph displaying the past and current standing of each debt. More important, the game was incentive compatible—that is, participants were told that they would receive a bonus based on their performance. Specifically, they would receive \$2 if their total debt was \$30,000 or less, \$1.50 if their total debt was between \$30,001 and \$35,000, \$1 if their total debt was between \$35,001 and \$40,000, or \$0.50 if their total debt was greater than \$40,001. Overall, the median ending debt balance was \$35,860.60.

In addition to this basic paradigm (i.e., the control condition;  $N = 74$ ), we included an experimental condition ( $N = 87$ ). This condition differed from the basic paradigm in that it allowed for repayment of specific purchases within the most problematic debt account of the six (i.e., \$60,000 at 4.0% APR). In contrast, the basic paradigm did not allow for repayment of specific purchases in any of the six accounts. The intention of this experimental condition was to improve repayment decisions under the assumption people would pay off more hypothetical debt when paying for specific purchases, rather than for only portions of a large debt sum. However, although we expected those in the experimental group to perform better than those in the control group, we hypothesized that money management would predict better performance in both the control and experimental conditions.

### Results

When examining the skewness of the distribution of ending balances, we determined that the distribution was negatively skewed: Participants generally performed well, finishing the game with low debts. Because the distribution was skewed, we treated the ending debt balance as an ordinal variable and followed the procedures of previous studies (e.g., Donnelly et al., 2013) that used optimal scaling models (i.e., the SPSS CATREG procedure) to allow for ordinal, scaled outcomes in regression.

We conducted a categorical regression, with bootstrapping procedures to estimate the standard errors, predicting ending debt balance from trait money management, condition (i.e., experimental = .50 and control = -.50), and the interaction between money management and the condition. The overall model was significant,  $F(3, 160) = 4.82$ ,

$p < .005$ ,  $R^2 = .084$ . As we hypothesized, participants in the experimental condition had lower debts than those in the control condition ( $\beta = -.22$ ,  $SE = .10$ ,  $p < .05$ ), and good money managers had lower debt balances ( $\beta = -.19$ ,  $SE = .09$ ,  $p < .05$ ). More important, because the interaction of condition (control vs. experimental) and money management was not significant ( $\beta = .04$ ,  $SE = .09$ ,  $p = .64$ ), we concluded that the relation between money management and debt repayment was not significantly different between the two conditions. Thus, these results indicated that money management, as measured by the BMMS, predicted hypothetical debt repayment behavior beyond the influence of a circumstance conducive to good debt management (i.e., opportunity to repay specific purchases). Furthermore, these results involved a measure of financial behavior that was not self-reported and thus was a promising behavioral indication that good self-reported money management corresponds to responsible money management practices.

### Discussion

A factor analysis of items found in previous money management measures resulted in an 18-item scale of money management that is multifaceted, internally consistent, temporally stable, and indicative of concurrent validity with both self-report and behavioral assessments. This scale was associated with the expected antecedents as well as benefits of good money management. Furthermore, the BMMS addressed both the lack of multidimensionality and the low reliability of previous measures. More important, our factor analysis revealed four factors of money management: savings, insurance and investment, credit, and cash. In addition, the BMMS factors independently predicted the expected benefits of good money management (e.g., greater savings predicted by savings management, greater investments predicted by insurance and investment management, and lesser credit card debt predicted by credit card management). The BMMS factors were also related to traits that predispose people to manage their money well (e.g., low materialism being related to better credit management and high conscientiousness being related to savings, insurance and investment, and cash management). Finally, the simulated debt repayment game employed in Study 3 acted as another indicator of financial decision-making and complemented participants' self-reported information about their financial well-being and income allocation; thus, BMMS's prediction of good debt repayment behavior signaled concurrent validity. Therefore, future studies can use the

multifaceted BMMS to isolate and target specific financial behaviors to better understand their impact on financial and overall well-being.

Our findings may also help future research understand the demographic differences in money-management quality. In Study 1, student participants scored lower than nonstudent participants on savings and insurance management, and these differences may be explained by nonstudents' higher age and more extensive education. Our results complement previous findings concerning age and education being positively related to general money management and positive financial behaviors (e.g., Kim, Garman, & Sorhaindo, 2003; Robb & Woodyard, 2011; Xiao et al., 2006); however, they also contradict other results, which suggest either a negative or no relationship with age (e.g., Loix et al., 2005; Mugenda, Hira, & Fanslow, 1990). As previously mentioned, it is unclear whether these varying relationships can be attributed to the way money management has been operationalized by different measures. However, the consistent use of the psychometrically improved BMMS will inform future research about whether money management does indeed improve with age and education. Furthermore, the multifaceted nature of the BMMS will help elucidate how various components of money management might differ between particular populations.

However, the BMMS remains sensitive to people's financial realities beyond age and completed education. The difference between students and nonstudents in cash and credit management may be better explained by life-cycle theory (Berthoud & Kempson, 1992), which posits that people's money management skills change at different points in their lives, depending on their financial needs and responsibilities.

Financial educators and planners should consider these financial realities if they use the BMMS as a screening tool to identify specific areas of money management in which their clients struggle. By striving to first change particularly problematic money management behaviors, people may sooner experience relief from financial stress and pave the way to improving their other financial habits. For example, if people score especially low on credit management, a financial counselor may advise them to first make adequate credit card payments to reduce interest-driven debt growth and only then to allocate income toward savings. Nevertheless,

bad credit management should not call for the same behavioral improvement among all people. Sometimes, the stressful accumulation of debt at a particular time in one's life (e.g., college) may be invaluable to future well-being and financial success. In such situations, counselors and educators may choose to advise a student on how to handle debts (e.g., which accounts to pay off first), as opposed to avoiding debt accumulation altogether. The BMMS predicted hypothetical debt repayment, so low scores may call attention to people's real-life debt repayment habits.

### ***Limitations and Future Directions***

A limitation of our research is that unlike Dew and Xiao (2011), we did not use nationally representative samples. We recruited through several channels, but these do not ensure geographical or socioeconomic diversity. A consequent limitation is that some financial behaviors included in our scale may not be appropriate to measure across all socioeconomic populations when assessing money management quality. For instance, scales that exclude higher access financial tools (e.g., investing behaviors and credit management) show low-income families scoring higher (Godwin & Koonce, 1992). Furthermore, active financial management is related to knowledge about one's finances and the financial tools currently available (Hilgert et al., 2003; Kim et al., 2003). Thus, a more representative scale would assess money management based on whether or not individuals use the financial tools they can actually access. Consequently, we advise for future research to examine participants' BMMS scores in the context of their financial opportunities and, of course, in an expanded pool of participants of diverse financial standing.

Furthermore, unlike Dew and Xiao's (2011) scale, the BMMS contains a single factor entitled insurance and investments; in contrast, Dew and Xiao's scale has a separate insurance factor and instead groups savings and investments together. Possibly, this deviation from Dew and Xiao may have occurred because our item-pruning procedure ultimately yielded only one investment item, referring to contribution toward savings plans (e.g., 401k). This item may be conceptually similar to insurance because it describes allocating money toward a future monetary benefit, which may be useful in a later unexpected financial hardship. Consequently, researchers should further investigate the conceptual gray areas between insurance, investments, and savings.

Another limitation to this research is that Study 3 examines money management behavior with a simulator game that spans only the period of one laboratory session and offers a monetary incentive immediately following its completion. A better test of external validity would be to track people's money management behavior longitudinally.

In addition, it is unclear for how long the BMMS and its items will remain applicable to people's money management practices. Increased atomization and electronic access to financial information may soon let researchers gather consumer data without relying on self-report scales, and such innovations may alter money management behavior. Just as check-writing has declined with the growing frequency of electronic payments (Hancock & Humphrey, 1997) and items pertaining to check-writing are concentrated in older money management measures (see Godwin & Koonce, 1992), items composing our newly developed BMMS may also become obsolete. In turn, self-report measurements of money management will need to undergo further refinement as financial practices change because of innovations in the financial industry.

**Implications for Financial Counselors.** Fernandes, Lynch, and Netemeyer (2014) shed light onto an important policy issue of interventions to increase financial knowledge: They are costly but do not consistently improve financial behavior. One reason may be that knowledge tied to specific financial decisions (e.g., ways to obtain health insurance) is too often introduced out of a context in which people may actually make those decisions. With money management assessments, financial counselors may more quickly narrow the topics of provided education to the most relevant in addressing their clients' current problems.

The BMMS offers the empowering benefit of practical knowledge—a tool to more precisely spot money management problems. Its application should be to identify strengths and weaknesses in areas of money management behavior. The pace and order of problem-solving will depend on people's different resources and needs. However, assessment of one's current behaviors with a psychometrically sound money management scale is a good start to informing those decisions.

## References

Amar, M., Ariely, D., Ayal, S., Cryder, C. E., & Rick, S. I. (2011). Winning the battle but losing the war: The

psychology of debt management. *Journal of Marketing Research*, 48(Suppl.), S38–S50.

Antonides, G., de Groot, M., & van Raaij, F. (2011). Mental budgeting and the management of household finance. *Journal of Economic Psychology*, 32, 546–555. <http://dx.doi.org/10.1016/j.joep.2011.04.001>

Archuleta, K. L., Dale, A., & Spann, S. M. (2013). College students and financial distress: Exploring debt, financial satisfaction, and financial anxiety. *Journal of Financial Counseling and Planning*, 24(2), 50–62.

Atkinson, A., McKay, S., Kempson, E., & Collard, S. (2007). Levels of financial capability in the UK: Results of a baseline survey. *Public Money & Management*, 27(1), 29–36.

Bernstein, D. (2004). Household debt and IRAs: Evidence from the survey of consumer finances. *Journal of Financial Counseling and Planning*, 15, 63–72.

Berthoud, R., & Kempson, E. (1992). *Credit and debt: The PSI report*. London, United Kingdom: Policy Studies Institute.

Bricker, J., Bucks, B., Kennickell, A., Mach, T., & Moore, K. (2011). *Surveying the aftermath of the storm: Changes in family finances from 2007 to 2009. Finance and Economics Discussion Series 2011–2017*. Washington, DC: Board of Governors of the Federal Reserve Board.

Cole, L., & Sherrell, D. (1995). Comparing scales to measure compulsive buying: An exploration of their dimensionality. *Advances in Consumer Research*, 22, 419–427.

Davis, E., & Weber, J. (1990). Patterns and obstacles to financial management. *Journal of Financial Counseling and Planning*, 1, 41–51.

Deacon, R. E., & Firebaugh, F. M. (1988). *Family resource management: Principles and applications*. Boston, MA: Allyn and Bacon.

Dew, J., & Xiao, J. J. (2011). The financial management behavior scale: Development and validation. *Journal of Financial Counseling and Planning*, 22(1), 43–59.

Donnelly, G., Iyer, R., & Howell, R. T. (2012). The Big Five personality traits, materialistic values and financial well-being of self-reported money managers. *Journal of Economic Psychology*, 33(1), 1129–1142. <http://dx.doi.org/10.106/j.joep.2012.08.001>

Donnelly, G., Ksendzova, M., & Howell, R. T. (2013). Sadness, identity, and plastic in over-shopping: The interplay of materialism, poor credit management, and emotional buying motives in predicting compulsive buying. *Journal of Economic Psychology*, 39, 113–125.

- Dowling, N. A., Corney, T., & Hoiles, L. (2009). Financial management practices and money attitudes as determinants of financial problems and dissatisfaction in young male Australian workers. *Journal of Financial Counseling and Planning, 20*(2), 5–13.
- Federal Reserve. (2017). *Consumer credit*. Retrieved from <http://www.federalreserve.gov/releases/g19/current>
- Fernandes, D., Lynch, J. G., & Netemeyer, R. G. (2014). Financial literacy, financial education, and downstream financial behaviors. *Management Science, 60*(8), 1861–1883.
- Finke, M., Huston, S., Siman, E., & Corlija, M. (2006). Characteristics of recent adjustable-rate mortgage borrowers. *Journal of Financial Counseling and Planning, 16*(2), 17–28.
- Gardarsdottir, R. B., & Dittmar, H. (2012). The relationship of materialism to debt and financial well-being: The case of Iceland's perceived prosperity. *Journal of Economic Psychology, 33*, 471–481. <http://dx.doi.org/10.1016/j.joep.2011.12.008>
- Garman, E. T., Leech, I. E., & Grable, J. E. (1996). The negative impact of employee poor personal financial behaviors on employers. *Journal of Financial Counseling and Planning, 7*, 157–168.
- Godwin, D. D., & Koonce, J. C. (1992). Cash flow management of low-income newlyweds. *Journal of Financial Counseling and Planning, 3*, 17–43.
- Gutter, M. S., Hayhoe, C. R., DeVaney, S. A., Kim, J., Bowen, C. F., Cheang, M., . . . Mauldin, T. (2012). Exploring the relationship of economic, sociological, and psychological factors to the savings behavior of low- to moderate-income households. *Family and Consumer Sciences Research Journal, 41*(1), 86–101.
- Hancock, D., & Humphrey, D. B. (1997). Payment transactions, instruments, and systems: A survey. *Journal of Banking & Finance, 21*, 1573–1624.
- Hilgert, M., Hogarth, J., & Beverly, S. (2003). Household financial management: The connection between knowledge and behavior. *Federal Reserve Bulletin, 87*, 309–322.
- Howell, R. T., Kurai, M., & Tam, L. (2012). Money buys financial security and psychological need satisfaction: Testing need theory in affluence. *Social Indicators Research, 110*, 17–29. <http://dx.doi.org/10.1007/s11205-010-9774-5>
- Kerkmann, B. C., Lee, T. R., Lown, J. M., & Allgood, S. M. (2000). Financial management, financial problems and marital satisfaction among recently married university students. *Journal of Financial Counseling and Planning, 11*(2), 55–65.
- Kim, J. (2004). Impact of a workplace financial education program on financial attitude, financial behavior, financial well-being, and financial knowledge. *Proceedings of the Association for Financial Counseling and Planning Education*, College Park, MD: University of Maryland Press.
- Kim, J., & Garman, E. T. (2003). Financial stress and absenteeism: An empirically derived model. *Journal of Financial Counseling and Planning, 14*(1), 31–42.
- Kim, J., Garman, E. T., & Sorhaindo, B. (2003). Relationship among credit counseling clients' financial well-being, financial behaviors, financial stressor events, and health. *Journal of Financial Counseling and Planning, 14*, 75–87.
- Lea, S. E. G., Webley, P., & Walker, C. M. (1995). Psychological factors in consumer debt: Money management, economic socialization, and credit use. *Journal of Economic Psychology, 16*, 681–701.
- Loix, E., Pepermans, R., Mentens, C., Goedee, M., & Jegers, M. (2005). Orientation toward finances: Development of a measurement scale. *The Journal of Behavioral Finance, 6*(4), 192–201.
- MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological Methods, 4*(1), 84–99.
- Morgenson, G. (2008, July 20). Given a shovel, Americans dig deeper into debt. *The New York Times*. Retrieved from <http://www.nytimes.com>
- Mugenda, O. M., Hira, T. K., & Fanslow, A. M. (1990). Assessing the causal relationship among communication, money management practices, satisfaction with financial status, and satisfaction with quality of life. *Lifestyles: Family and Economic Issues, 11*(4), 343–360.
- O'Neill, B., Prawitz, A. D., Sorhaindo, B., Kim, J., & Garman, E. T. (2006). Changes in health, negative financial events, and financial distress/financial well-being for debt management program clients. *Journal of Financial Counseling and Planning, 17*(2), 46–62.
- O'Neill, B., Xiao, J. J., Sorhaindo, B., & Garman, E. T. (2005). Financially distressed consumers: Their financial practices, financial well-being, and health. *Journal of Financial Counseling and Planning, 16*(1), 73–87.
- Parrotta, J. L., & Johnson, P. J. (1998). The impact of financial attitudes and knowledge on financial management and satisfaction of recently married individuals.

- Journal of Financial Counseling and Planning*, 9(2), 59–75.
- Perry, V. G., & Morris, M. D. (2005). Who is in control? The role of self-perception, knowledge, and income in explaining consumer financial behavior. *Journal of Consumer Affairs*, 39(2), 299–313.
- Prawitz, A. D., Garman, E. T., Sorhaindo, B., O'Neill, B., Kim, J., & Drentea, P. (2006). InCharge Financial Distress/Financial Well-Being Scale: Development, administration, and score interpretation. *Journal of Financial Counseling and Planning*, 17(1), 34–50.
- Rammstedt, B., & John, O. P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. *Journal of Research in Personality*, 41(1), 203–212. <http://dx.doi.org/10.1016/j.jrp.2006.001>
- Raubenheimer, J. (2004). An item selection procedure to maximize scale reliability and validity. *SA Journal of Industrial Psychology*, 30(4), 59–64.
- Richins, M. L. (2004). The Material Values Scale: Measurement properties and development of a short form. *Journal of Consumer Research*, 31(1), 209–219.
- Robb, C. A., & Woodyard, A. S. (2011). Financial knowledge and best practice behavior. *Journal of Financial Counseling and Planning*, 22(1), 60–70.
- Scannell, E. (1990). Dairy farm families' financial management. *Journal of Financial Counseling and Planning*, 1, 133–146.
- U.S. Department of Commerce, Bureau of Economic Analysis. (2016). *Personal saving rate*. <https://research.stlouisfed.org/fred2/series/PSAVERT>
- Webley, P., & Nyhus, E. K. (2001). Life-cycle and dispositional routes into problem debt. *British Journal of Psychology*, 92, 423–446.
- Xiao, J. J., & Noring, F. E. (1994). Perceived saving motives and hierarchical financial needs. *Journal of Financial Counseling and Planning*, 5(1), 25–44.
- Xiao, J. J., Sorhaindo, B., & Garman, E. T. (2006). Financial behaviors of consumers in credit counseling. *International Journal of Consumer Studies*, 30(2), 108–121. <http://dx.doi.org/10.1111/j.1470-6431.2005.00455.x>