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Review of *Business*

Interdisciplinary Journal on Risk and Society

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Launching Rockets: Introducing Hofstede Pairs to Business Analyses, and the Risks of Ignoring Them

Charles Lanier

Abstract

Motivation: Frequently, empirical studies stop short of considering the full implications of correlations, regressions, and other evidence of relationships between variables. The methods within, and their replication across studies, add distinct pairs of variables to cultural analyses. This approach was motivated in part from discussions on applications of compound variables—henceforth referred to as *Hofstede Pairs*—and their effects on predictive modeling resulting from previous studies utilizing this methodology. To overlook these types of mathematical relationships introduces risk to researchers attempting to explain observed phenomena.

Premise: This paper describes a methodological approach for discovery of mathematical relationships between national measures of behavior and compound variables created from Hofstede's Cultural Dimensions (Hofstede 1980; Hofstede 2001; Hofstede, Hofstede, and Minkov 2010). Weak, inversely correlated predictors referred to as "Hofstede Pairs" have yielded statistically significant contributions when used conjointly in a number of previous studies and scenarios.

Approach: An example from rocket science was used to demonstrate the methodology. In each of three cases, convolutions significantly contributed to an improved regression model, often displacing a previously dominant predictor established via multiple prior studies. The data originated from Hofstede's publications of cultural dimensions (Hofstede 1980; Hofstede 2001; Hofstede, Hofstede, and Minkov 2010); Transparency International's index of corruption per-

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ception, CPI (2016); the World Happiness Report (Helliwell, Layard, and Sachs 2017); and an annual report from The Coca-Cola Company (2011). Regression techniques were used to model each case, along with correlations and comparisons with previously published models.

Results: Outcomes described in this primer demonstrated that predicting the dependent variables of product consumption (Lanier 2011; Lanier and Kirchner 2013), happiness (Hordvik 2018), and corruption perception (Lanier and Kirchner 2018) resulted in statistically significant interactions between Hofstede's published dimensions: IDV \times UAI, both IDV \times MAS and LTO \times IVR, and LTO \times IVR, respectively. In each case, these convolutions were found to explain between 27% and 60% of variability in the dependent variable. Findings consistently indicated that extreme values of Hofstede's dimensions were less than ideal, and moderate values interacted for improved modeling of these dependent variables (maximizing consumption, minimizing corruption, and maximizing happiness).

Conclusions: Implications include improved understanding of relationships between culture and behavior. Further research is needed to establish other contexts where Hofstede Pairs dominate or strengthen the most parsimonious and effective regression models. The findings support both specific applications to a variety of fields, and general conclusions of the methods usefulness in studying mathematical relationships.

Consistency: These methods have met with success in several applications. Therefore, more applications should be explored. To overlook or ignore the importance of combinatorial pairs of variables can limit the full effect of many research efforts. The evidence provided in this paper can be directly applied to practices of business, education, and other topics influenced by national culture.

Keywords: Cola, Compound Variables, Convolution, Corruption, Culture, Happiness, Hofstede, Hofstede Pairs, Regression

INTRODUCTION

The main objective of this study was to further explore the potential of cross-product variables in the Hofstede paradigm to predict behavioral outcomes, thereby determining methods for investigating meaningful interaction effects among cultural dimensions. Hofstede's Cultural Dimensions as predictors, rather than correlates, of dependent variables measured at the national level were presented and discussed. Examples indicate that dependent variable measures were consistently shown to be driven by national cultural dimensions and particularly interactions (or mathematical convolutions) between two cultural dimensions.

Although culturally different, each country in these analyses has an opportunity to influence the behavior of its governmental units and citizens. Furthermore, each has exhibited a different profile of cultural dimensions (Hofstede 1980; Hofstede and Hofstede 2011). Using measures of culture, one may explore relationships between culture and the evolution of behaviors. In this case, these relationships are used to demonstrate the value of including cross-product terms during regression modeling procedures.

LITERATURE REVIEW

Hofstede's Cultural Dimensions

Seminal works from Geert Hofstede containing concepts applied directly to this research topic included *Culture's Consequences: International Differences in Work-Related Values* (Hofstede 1980), *Culture's Consequences: Comparing Values, Behaviors, Institutions, and Organizations Across Nations* (Hofstede 2001), and *Cultures and Organizations: Software of the Mind* (Hofstede, Hofstede, and Minkov 2010). Minkov's (2007; 2011) extension of cultural dimensions from the World Value Survey included the addition of Indulgence versus Restraint (IVR) as a relatively new variable to Hofstede's data matrix.

IVR was the most recently defined cultural dimension added in 2010 to Hofstede's five previously defined dimensions (Hofstede 1980; 2001):

1. Power Distance Index (PDI)
2. Individualism versus Collectivism (IND)
3. Masculinity versus Femininity (MAS)
4. Uncertainty Avoidance Index (UAI)
5. Long-Term versus Short-Term Orientation (LTO)

As a social psychologist, Geert Hofstede has been considered the father of cross-cultural research due to his creation of a paradigm for national cultures. His definition of culture in *Culture's Consequences* (Hofstede 1980, 25) was "the collective programming of the mind which distinguishes the members of one human group from another."

Before Hofstede's work, human nature was widely considered a tendency attributable to all humans. Hofstede determined that human behavior must be redefined in terms of cultural context. Since much of the world's business, social, and psychological research had been conducted in North America and Europe, the conceptual framework for human nature was incomplete. Hofstede's findings strongly influenced the fields of psychology, sociology, business, and many other areas.

Hofstede's research is ongoing and several areas were suggested for future research. For example, he suggested that Asian researchers have an important role to play in conversing with colleagues from other parts of the world in order to escape from the cultural restrictions of one's own Western research perspective (Hofstede 2001). Hofstede suggested future replications and simulations, and encouraged research in the business arena where he predicted that cultural norms of a long-term view and more responsibility toward society will outlast the focus on growth and personal wealth.

Standard criticisms of Hofstede's work include weaknesses of surveys in general, that nations are not suitable for studying culture, that the use of one company weakens the implications, that old data was used, and that more dimensions must be developed to explain human behavior. Even Hofstede himself raises questions about how American ideas for business may have been imported by businesses in other countries (Goodstein, Hunt, and Hofstede 1981). However, some of these weaknesses may also act as strengths, depending on the uses

of the data, because Hofstede's cultural dimensions have often proved to be concise and powerful.

Mathematical Statistics and Hofstede Pairs

As Draper and Smith (1981) indicated in their applied regression text, "Often there exists a functional relationship which is too complicated to grasp or to describe in simple terms." Therefore, one of the purposes of regression techniques is to explain "the main features of the relationships hidden or implied" by way of a mathematical equation.

Regression equations typically employ independent variables to help explain the variability in a selected dependent variable. However, Draper and Smith (1981) also pointed out that, "Terms for possible inclusion in the model might involve not only the principal variables but also variables such as cross products, squares, or other combinations, or transformations of the principal variables." These less-often-used variables are exactly the kind found to be useful in this study.

Mathematical combinations or transformations of two functions, used to create a third function, are referred to in literature as a convolution (Hogg and Craig 1978). However, examples are challenging to find in applied cross-cultural business literature. Still, cross-product terms and other combinations should be considered as independent variable candidates for regression equations when they can be used to improve modeling (Draper and Smith 1981). In this study, cross-product mathematical convolutions created from Hofstede's Cultural Dimensions (simply multiplying one cultural dimension score by another) will be referred to as *Hofstede Pairs*.

Culture, Correlation, and Regression

Notably, researchers have analyzed applications of Hofstede's work (Kirkman, Lowe, and Gibson 2006; Taras, Kirkman, and Steel 2010) to suggest limitations and make recommendations for researchers who plan to utilize Hofstede's paradigm. Taras, Kirkman, and Steel (2010, 405) noted that a quantitative examination of Hofstede's cultural value dimensions was "conspicuously absent" from the body of research. Therefore, they conducted a meta-analysis of nearly 600 empirical studies encompassing at least 200,000 participants. Relationships between cultural dimensions and measurable outcomes such as emotions, attitudes, behaviors, and job performance were explored.

One of the primary motivations for the extensive study conducted by Taras, Kirkman, and Steel (2010) was to determine the overall value of Hofstede's dimensions as predictors. Each of the four initially described cultural dimensions of PDI, IND, MAS, and UAI were analyzed for predictive power. Although IND was the most popular subject of study (Kirkman, Lowe, and Gibson 2006; Oyserman, Coon, and Kimmelmeier 2002), no evidence existed to suggest this dimension was the best predictor for expressions of culture (Taras, Kirkman, and Steel 2010).

The decision proposed by Taras, Kirkman, and Steel (2010) to refrain from making predictions about relationships between specific cultural dimensions and specific outcomes "but rather to take a higher level overview of Hofstede's cultural

value effects,” did not prevent them from publishing some very useful results. For example, regarding emotions and attitudes, cultural dimensions provided stronger predictive power than measures of personality. Furthermore, cultural dimensions proved to be a relatively valuable predictor of emotions, perceptions, and behaviors. Ultimately, the recommendation for scholars to continue using Hofstede’s framework in research was strongly supported as long as culture was relevant to the research question and national dimensions of culture were suitable.

The following statistically significant ($p < 0.05$) positive and negative correlation relationships, presented in Table 1, were reported when studying data at the national level (Taras, Kirkman, and Steel 2010):

TABLE 1. Correlations between Cultural Dimensions and Corruption, Happiness, or Consumption

<i>Individualism versus Collectivism (IDV)</i>			
Positive		Negative	
Wealth	0.70	Corruption	−0.84
Innovation	0.65	Family Importance	−0.55
Income Equality/Satisfaction	0.64	External Locus of Control	−0.46
<i>Individualism Masculinity versus Femininity (MAS)</i>			
Corruption	0.29	Gender Role Equality	−0.50
Wealth	0.11	Satisfaction	−0.16
<i>Power Distance Index (PDI)</i>			
Corruption	0.83	Income Equality	−0.60
Agreeableness	0.46	Openness	−0.54
Conformity	0.42	Gender Role Equality	−0.49
<i>Uncertainty Avoidance Index (UAI)</i>			
Neuroticism	0.59	Satisfaction	−0.49
Corruption	0.43	Innovation	−0.45
Conformity	0.26	Income Equality	−0.25

Results of these meta-analyses signify the importance of cultural dimensions as significant predictors of many emotions, attitudes, and behaviors. At the time of the above studies, Long-Term versus Short-Term Orientation (LTO) was a relatively new variable. Likewise, Indulgence versus Restraint (IVR) had been only recently defined by Minkov (2007; 2011). Therefore, neither LTO nor IVR were included in the comprehensive work by Taras, Kirkman, and Steel (2010).

Other studies (Getz and Volkema 2001; Davis and Ruhe 2003; Seleim and Bontis 2009; Tong 2014; Yeganeh 2013) from Western, Middle Eastern, and Asian perspectives have also reported findings relating behavior to dimensions of culture. This study rests on a methodology utilized in several previous studies applying Hofstede’s framework of cultural dimensions used to predict dependent behavioral measures. Lanier (2011) and Lanier and Kirchner (2013; 2018) previously employed linear regressions to study behavior within nations. These techniques revealed interactive relationships (or convolutions, now referred to as *Hofstede Pairs*) among two cultural dimensions that were otherwise masked by the independent variables. Such relationships may exist among cultural di-

mensions in the context of studying other behaviors, and this study serves as encouragement to such exploration.

The nature of cultural dimensions suggests that, although independent by design, some combination of such variables must be at work in any given context. This is intuitive to anyone who has spent time in a culture other than their own. It is not merely one variable that is of interest to the traveler, but a unique combination of differences that make for that unique experience. Therefore, previously unexplored Hofstede Pairs were expected to provide improved modeling information.

Another analogy: A single one of the five senses would not be considered sufficient information to describe any experience. Neither would a single dimension of culture be sufficient to describe any behavior. Therefore, it is the combination of variables, indeed the *relationship among variables*, that should prove useful in describing behavior.

METHODOLOGY

The general methodology considered appropriate for this study included correlations and least squares linear regression. Of particular interest was the possibility of discovering Hofstede Pairs that would be especially useful in explaining the variability within a dependent variable. Therefore, after initial model replications, the primary new research question revolved around interactions of variable pairs.

Moreover, useful mathematical convolutions in the form of Hofstede Pairs were discovered for studies of international behaviors regarding beverage consumption (Lanier 2011; Lanier and Kirchner 2013), happiness (Hordvik 2018), and corruption (Lanier and Kirchner 2018). Therefore, similar cases might exist when studying other international behaviors, and perhaps new behavioral models could be constructed.

As part of this methodology, a test case from rocket science was used to demonstrate the usefulness of paired variables. In the realm of physical sciences, many variable relationships are completely known. This test case may serve as a way to quantify some potential benefits of Hofstede Pairs. Perhaps more importantly, the case should quantify the potential risk of ignoring such pairs.

Correlations and Regressions

In each of the previous studies, the first step was to create a correlation matrix including the dependent variable and all six of Hofstede's Cultural Dimensions. Next, linear regressions were performed to construct a prediction equation for each of the independent cultural variables. These single-variable prediction equations took the following form:

$$Y = a + b_i X_i + e$$

where

X_i represents one of Hofstede's six cultural dimensions, and $i = 1$ to 6.

The first two research questions were, “Are correlations between the dependent variable and Hofstede’s Cultural Dimensions stable, as reported by earlier research?” and “Are Hofstede’s Cultural Dimensions significant predictors of the dependent variable in the constructed datasets, as previously observed by other researchers?” To replicate most of the studies reviewed in the literature, the multi-variable equation was purely additive. Using only Hofstede’s six dimensions resulted in

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + e$$

However, interaction effects—mathematical convolutions—were examined of the form

$$\text{CPI} = a + b_{ij}X_iX_j + e$$

where $i = 1$ to 6 ,

$j = 1$ to 6 , and

$i \neq j$

or more simply $\text{CPI} = a + b_{ij}X_{ij} + e$, where X_{ij} is a convolution of functions X_i and X_j . The term *Hofstede Pair* represents each given convolution. Fifteen such Hofstede Pairs exist:

PDI \times IDV, PDI \times MAS, PDI \times UAI, PDI \times LTO, PDI \times IVR

IDV \times MAS, IDV \times UAI, IDV \times LTO, IDV \times IVR

MAS \times UAI, MAS \times LTO, MAS \times IVR

UAI \times LTO, UAI \times IVR, and

LTO \times IVR (interestingly this last pair is highly significant in two of the three initial studies).

The third, and perhaps most compelling, research question was “Do one or more Hofstede Pairs act as a statistically significant predictor of the dependent variable?” In theory, a new compound variable could displace one or more of the commonly identified cultural dimensions predicting consumption, corruption, or happiness. The null hypothesis is that such a variable does not exist (i.e., b_{ij} is not significantly different from zero).

Each pair of cultural dimensions, X_iX_j , represents a cross-product potentially resulting in a beneficial interaction effect between two cultural dimensions. That is, the function X_i and the function X_j can be expressed as a third function X_{ij} . Such an interaction may be referred to as a convolution of the original functions, and defines the term *Hofstede Pair* for this study.

For mathematical purposes, it is important to note here that each of Hofstede’s Cultural Dimensions does in fact behave as a “function.” That is, for each participating country there is only one value provided for each dimension. It is not possible for a country to have two values for Power Distance Index, for example.

Finally, the fourth research question was “Does a parsimonious model for predicting the dependent variable include one of the studied Hofstede Pairs?” The

expectation was that a statistically significant model constructed using stepwise regression procedures exists. However, whether or not one of the paired variables, X_{ij} , would be useful was completely unknown at the outset of each study.

Theoretically, these formulae could be extended further to include trios of variables, X_{ijk} , and even more complex functions. Future studies could potentially make pragmatic use of such constructions. However, this study was limited to pairs of variables to simplify the interpretation of outcomes.

Test Case

A test case from the physical sciences—rocket science to be specific—allowed for a comparison between regression models with and without paired variables. The variable *momentum* was used as the dependent variable. The singular pair of variables producing calculations of momentum is *mass* and *velocity*. Typically, mass is expressed in kilograms (kg), and velocity is expressed in meters per second (m/s). The mathematical product, interaction, or convolution of this pair of variables (similar to Hofstede Pairs) yields momentum in kg·m/s also called a Newton second.

That is, mass × velocity = momentum which is a completely known relationship in physics.

The value offered by this example would be to effectively analyze how least squares linear regression accounts for known relationships between variables and variable pairs. Additionally, pedagogical value existed because the relationship between mass, velocity, and momentum is widely known. Quantifying the risks of ignoring variable pairs, or the benefits of including them—especially Hofstede Pairs but also any variable pairs—is the primary goal of applying this methodology.

FINDINGS

The first research question of interest was, “Are correlations between the dependent variable and Hofstede’s Cultural Dimensions stable, as reported by earlier research?” This was found to be true in each study of consumption (Lanier 2011; Lanier and Kirchner 2013), happiness (Hordvik 2018), and corruption (Lanier and Kirchner 2018), and findings were presented in each of those articles. The purpose of this study was not to replicate those studies, but rather to identify a pattern in the results across the three studies. Verification of this first research question lays the foundation for each of the next questions.

However, the physics test case was new to this study. Correlations were performed and analyzed in a similar fashion to the initial studies of Hofstede Pairs (see Table 2).

TABLE 2. Correlations among Momentum, Mass, and Velocity

(n = 41)	Momentum	Mass (kg)	Velocity (m/s)
Momentum	1		
Mass (kg)	-0.711	1	
Velocity (m/s)	0.532	-0.967	1

The second research question was, “Are Hofstede’s Cultural Dimensions significant predictors of the dependent variable in the constructed datasets, as previously observed by other researchers?” Again, the findings in all three cases were consistent with published studies. Naturally, different variables were found to be statistically significant predictors of consumption, happiness, and corruption. However, the pattern of Hofstede’s Cultural Dimensions predicting outcomes was consistent across studies.

In the physics test case, regressions were performed and analyzed in a similar fashion to the initial studies of Hofstede Pairs (see Table 3).

TABLE 3. R-Square Calculations Dimensions When Predicting Momentum in Isolation (Alone)

This table shows the prediction strengths and significance of mass and velocity for momentum.

Momentum (n = 41)	Mass (kg)	Velocity (m/s)
Coefficient of determination	0.506*	0.283*
Probability	< 0.0001	< 0.0005

* Indicates very strong statistical significance.

To this point, one could be satisfied that findings were consistent with previously described relationships between consumption, happiness, corruption, and cultural dimensions. However, the third research question asks, “Do one or more Hofstede Pairs act as a statistically significant predictor of the dependent variable?” Alternatively stated, “Do interaction effects exist between cultural dimensions thereby improving prediction models of the same form when predicting the consumption, happiness, and corruption?” To answer this question, one must study pairs of variables.

In each of the previous studies, at least one or two Hofstede Pairs showed promise. An interesting interaction between LTO and IVR was found to be significant in two of the three studies. The analyses of this research question established two new pieces of evidence in each study:

1. Hofstede’s Cultural Dimensions were significant predictors in each case.
2. Prediction equations could likely be improved and refined when Hofstede Pairs were included in the regression models.

The results in Table 4 demonstrate the convolution represented by mass \times velocity. The Hofstede Pairs (also a convolution) behaved similarly, and in many ways the magnitude was similar(!):

TABLE 4. Selected Models from a Comprehensive Search for Interactions

This table shows univariate models to predict momentum, and one convolution.

(n = 41) Predictor Variables	Model’s R-Square	Statistical Significance	Change in R² Due to Interaction
Mass (kg)	50.6%	$p < 0.0001$	n/a
Velocity (m/s)	28.3%	$p < 0.0005$	n/a
Mass \times velocity	100.0%	$p = 0.0$	+21.1

Often the contributions of predictor variables may be expected to overlap, and therefore the model's overall effectiveness is less than the sum of its parts. However, it is possible for variables to interact in such a way that the overall effect is *greater* than the sum of its parts. This synergetic effect could be explained by mathematical convolution, and was present in some Hofstede Pairs.

Finally, the fourth research question could be answered. It was, "What form does a parsimonious model for predicting the dependent variable take, and does such a model include one of the studied Hofstede Pairs?" Stepwise linear regression procedures were employed to conduct the analyses. In the previous studies, LTO and IVR appeared to contribute little or nothing to the model's predictive power when used in isolation. Yet the compound variable LTO \times IVR was one of two Hofstede Pairs significant in predicting happiness, and represented the second-most significant contribution to predicting corruption.

In the physics test case, when the compound variable mass \times velocity was used to predict momentum, there was an increase of about 14% in effectiveness of the model over using mass and velocity in isolation (an increase of 0.122 in the coefficient of determination, R-square). Table 5 and Table 6 present the regression results.

TABLE 5. Linear Regression Results Using Mass and Velocity as Predictors (Unpaired)

This table shows the analysis of variance when mass and velocity are the lone predictors of momentum.

Analysis of Variance, R-square = 0.878					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	1.14E + 20	5.71E + 19	136.89	4.29E - 18
Error	38	1.59E + 19	4.17E + 17		
Corrected total	40	1.3E + 20			
Variable	Parameter Estimate	Standard Error		F-Value	Pr > t
Intercept	1.76E + 10	1.16E + 09		15.17909	1.02E - 17
Mass (kg)	-6566.29	481.87		-13.6267	3.31E - 16
Velocity (m/s)	-1255000	116467.1		-10.7756	4.11E - 13

Perhaps obviously, momentum is predicted perfectly by the product pair mass \times velocity because momentum is defined by this very product. However, it is helpful to see how this progression of steps follows closely the patterns established in each previous study. First, correlations between variables potentially involved are noted. Then results reveal that pairs of variables (mass \times velocity in the test case, but Hofstede Pairs when predicting consumption, happiness, or corruption) offer significant model improvements over regressions with the independent variables alone. Finally, it is recognized that a single pair (or Hofstede Pair) of variables may result in a better model than the full unpaired model.

TABLE 6. Linear Regression Results Using the Product Pair Mass × Velocity as a Predictor (Paired)

This table shows the analysis of variance when mass × velocity is the only predictor of momentum.

Analysis of Variance, R-square = 1.0					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	1.3E + 20	1.3E + 20	2.45E + 32	0
Error	39	2.07E – 11	5.31E – 13		
Corrected total	40	1.3E + 20			
Variable	Parameter Estimate	Standard Error		F-Value	Pr > t
Intercept	1.43E – 06	2.22E – 07		6.453079	1.22E – 07
Mass × velocity (kg·m/s or Ns)	1	6.39E – 17		1.57E + 16	0

CONCLUSIONS

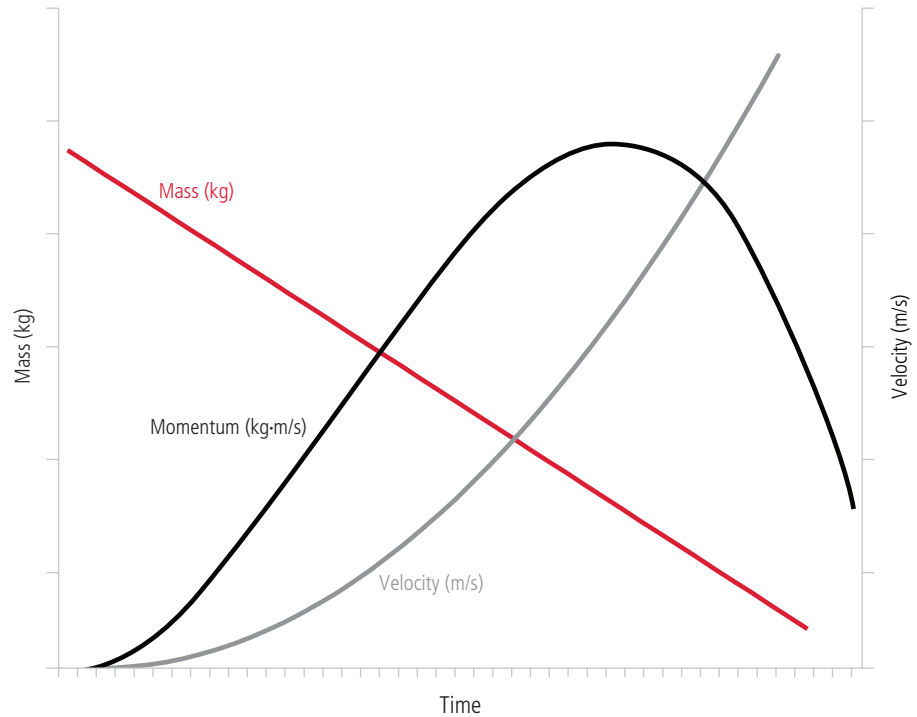
This study has taken a broad view of the relationships between Hofstede Pairs and 2010 product consumption data from The Coca-Cola Company; relationships between Hofstede Pairs and 2017 national data from the World Happiness Report; relationships between Hofstede Pairs and the 2017 Corruption Perception Index; and finally, relationships between paired mass and velocity to predict momentum (a known calculation). Hopefully, there is enough material contained within the above models, equations, and results to encourage further study of these and other relationships. Only some of the many potential findings, examples, and implications are given here.

Upon further review of the data, one discovers that each Hofstede Pair contained two, often inversely related, but related variables similar to mass and velocity (see Table 2). The statistically significant contribution of Hofstede Pairs may have been masked by the nature of these inverse relationships (as the potential seemed limited for either component of a Hofstede Pair to contribute in predictive modeling of consumption, happiness, and corruption). However, in each case a significant interaction between two cultural dimensions was observed:

- A Hofstede Pair of Individualism versus Collectivism with Uncertainty Avoidance Index enhanced the modeling of consumption in the first study (Lanier 2011; Lanier and Kirchner 2013); a Hofstede Pair (Individualism versus Collectivism with Indulgence versus Restraint) greatly enhanced the modeling of happiness; and the Hofstede Pair of Long-Term Orientation with Indulgence versus Restraint enhanced the understanding of corruption.

For comparative purposes, Figure 1 demonstrates the nature of the inverse relationship between mass, velocity, and momentum. One hundred percent of the variability in momentum is explained by the product pair mass and velocity. This relationship exists by the definition of momentum. Furthermore, momentum peaks slightly to the right of the intersection between the two independent variables.

FIGURE 1. Mass and Velocity Are Inversely Related; Momentum Is a Function of the Two



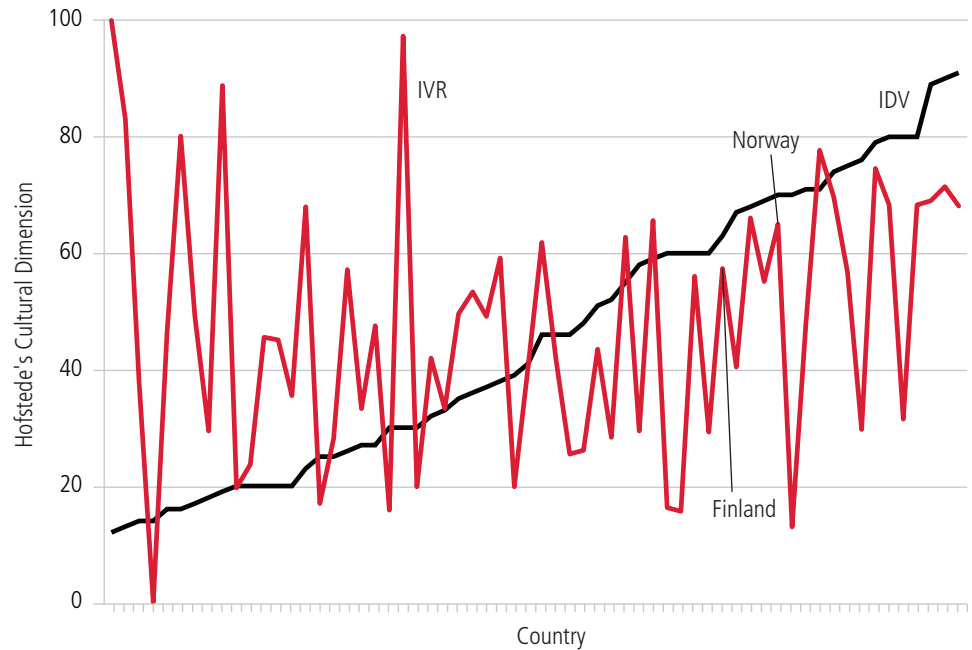
Similarly, Figure 2 represents the Hofstede Pair of Individualism versus Collectivism with Indulgence versus Restraint. Variability in this Hofstede Pair explained 60% of variability in the dependent variable measure of happiness (R-square = 0.60). This variable alone produced a more predictive regression model than those found in other studies reviewed. Where are the happiest countries found? Norway and Finland are the happiest, found slightly to the right of the intersection between these two variables.

When one interaction effect can be demonstrated among Hofstede's cultural dimensions, the promise exists for more. Hofstede Pairs in other contexts, with other variables, may help researchers understand complex cultural relationships. These cases support the development of new predictive equations for a variety of purposes. Business as a field is rich with data, but much of the available information may not be used to its fullest purpose. Opportunities abound for the business researcher to glean information from many sources of data, and produce meaningful models that enhance our understanding of human interactions.

When studying the Corruption Perception Index, the Hofstede Pair LTO \times IVR showed powerful potential. Extremes of neither LTO nor IVR appear to be ideal for minimizing corruption. The concept "more is better"—if LTO is good then higher is better, or if Indulgence is helpful then let's be more so—cannot apply to inversely related variables. More of one is, by definition, less of the other. Therefore, a balance must be struck between the two variables.

The interaction between these two variables is required for a better understanding of corruption. If extremes on these scales are shown to be problematic, perhaps there is a point of equilibrium balancing the forces of corruption. People

FIGURE 2. Happiness and the Hofstede Pair IDV × IVR Are Directly Related; Sorted by IDV



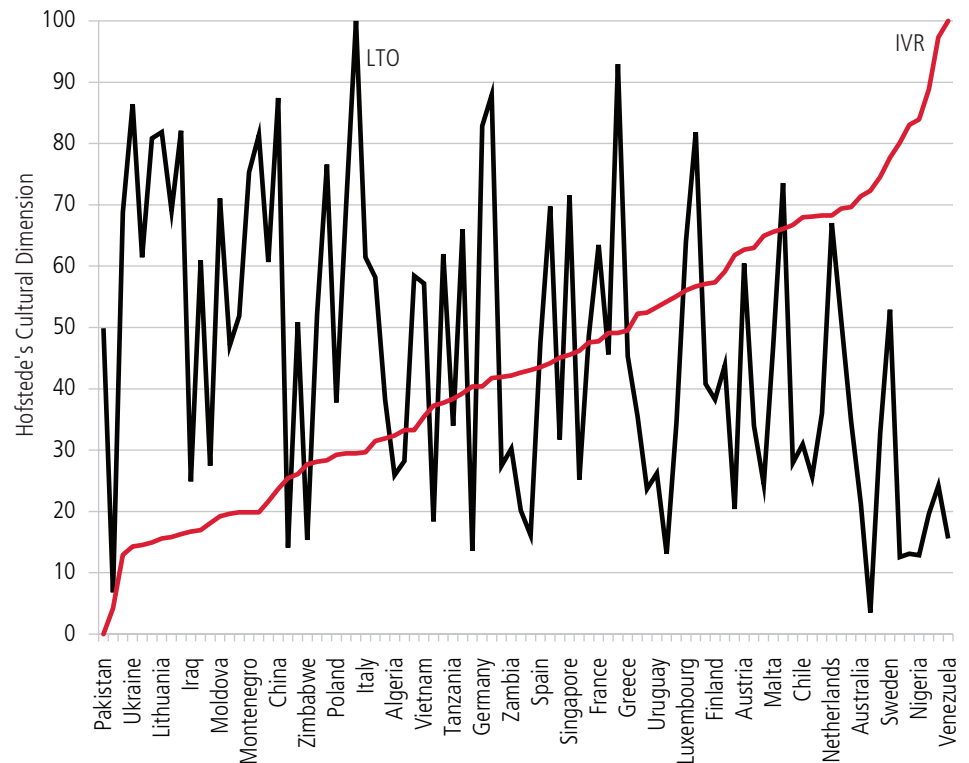
with a long-term view may indulge in corrupt behavior partly because participation in corrupt systems has, unfortunately, been rewarded over long periods of time. Long-Term Orientation then is not good or bad, but interacts with other cultural elements to deter or encourage corruption.

Only continued research will disclose the nature of relationships among these variables. In the case of modeling corruption, a Hofstede Pair of Long-Term Orientation with Indulgence versus Restraint may have uncovered the potential for other paired variables. These potential interactions and statistical techniques may facilitate research in any behavioral setting. Figure 3 demonstrates the nature of the inverse relationship between LTO and IVR.

The risk lies in leaving Hofstede Pairs and other mathematical convolutions unexplored. It is reasonable to conclude that the evolution of many other socio-political or socio-emotional behaviors take place differently among nations. Cultural variables are at least partially, if not largely, responsible for these patterns. What other behaviors might benefit from similar modeling?

Taras, Kirkman, and Steel (2010) alluded to the predictive power of Hofstede's Cultural Dimensions, but concrete business examples of predictive equations and interactions between dimensions were scarce. Therefore, the practical implications of these studies of Hofstede Pairs should be clear for business researchers, economists, political scientists, and many multinational companies. Theoretical implications are clear for researchers in psychology, sociology, business, and other fields: Interaction effects among cultural dimensions deserve further study. The cultural dimension Indulgence versus Restraint was only published in 2010, and it may be a powerful construct for better understanding culture in the context of behaviors.

FIGURE 3. Corruption and the Hofstede Pair LTO × IVR Are Directly Related; Sorted by IVR



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Does the Role of Relatives on Ownership Structure Affect Firm Value?

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Abstract

Motivation: This paper's motivation is to provide valuable information on the issue of firm value for both enterprises and investors, finding additional factors which may strongly affect firm value but have been rarely discussed, and revealing precious results to fill a gap in present literature.

Premise: Due to the importance of ownership structure and firm value to a firm, this paper investigates whether firm value would be affected by the shareowners' relatives, which has been seldom explored comprehensively in the existing literature.

Approach: By utilizing the data of Taiwan Stock Exchange-listed firms, this paper first applies panel data models and then Petersen regression models for further investigation to enhance the robustness of the empirical results.

Results: This paper reveals that the shareholding of directors' relatives positively relates to firm value, but the shareholding ratio of managers' relatives influences firm value negatively. Even in the opposite direction, relatives' shareholdings of the firm members do prominently impact firm value.

Conclusion: This paper shows that a firm should manage the board and ownership structures properly in order to enhance a firm's value. Additionally, investors should evaluate the board and ownership structures of a firm before investing.

Consistency: This paper illustrates that board and ownership structures are crucial determinants for firms to operate with financial success. By selecting firms with well-designed board and ownership structures, investors may decrease the risk of loss and reduce the investment uncertainty.

Keywords: firm value, ownership structure, shareholding of relatives

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INTRODUCTION

The importance of board and ownership structures to firm value has been extensively studied for over a decade (Demsetz and Villalonga 2001; Singh and Davidson 2003; Welch 2003; Garg 2007; Kapopoulos and Lazaretou 2007; Fauzi and Locke 2012). In essence, the board plans and administers the activities of a firm and plays a vital role in maintaining an effective firm management (Basyith, Fauzi, and Idris 2015). There are plenty of papers exploring the relationship between board structure and firm value, but with no integrated conclusion. For instance, many studies show that board composition is positively connected with firm financial performance because a larger board raises the percentage of independent directors, which may ensure a better performance (Callen, Klein, and Tinkelman 2003; Kiel and Nicholson 2003; Sheridan and Milgate 2005; Adams and Mehran 2012; Shukeri, Shin, and Shaari 2012). In contrast, lots of researchers find that board composition is inversely related to firm value when the benefits of larger boards' monitoring are offset by problems associated with the increased asymmetric information, and higher coordination costs, which reduce effective monitoring (Barnhart and Rosenstein 1998; Liang and Li 1999; Mak and Kusnadi 2005; Cheng 2008). Furthermore, several scholars reveal that there is no significant relationship between board structure and performance (Hermalin and Weisbach 1991; Bhagat and Black 2001; Chen et al. 2005).

With regard to ownership structure, Zhuang (1999) argues that ownership structure has the ability to shape the corporate governance system in any given country. However, until now, the relevance of ownership structure and firm value has not been found with consensus academically either. One strain of scholars claims that ownership structure influences firm performance positively (Claessens et al. 1999; Short and Keasey 1999; Krivogorsky 2006; Cho and Kim 2007). Fauzi and Locke (2012) also reveal that boards of directors, board committees, and managerial ownership are of positive and significant impact on firm performance. On the contrary, some papers show that ownership structure is negatively correlated to firm performance because excessive managerial ownership may allow managerial consumption of perquisites and reduce successful bidding by outside agents, thus reducing the firm value (Xu and Wang 1999; Villalonga and Amit 2006; Abor and Biekpe 2007; Lefort and Urzúa 2008; Belkhir 2009). In addition, the conclusion of no correlation between ownership structure and firm performance is reported by some other researchers (Cho 1998; Dalton et al. 2003; Nuryanah and Islam 2011).

As for the relatives of shareowners, Burkart, Panunzi, and Shleifer (2003) point out that most of the firms in the world are controlled by their founders or the founders' families and heirs. Therefore, we regard the firms owned by families and their relatives as family firms. In the meantime, we find many studies discussing the relationship between family firms and firm values in the academic research. For example, Sacristán-Navarro, Gómez-Ansón, and Cabeza-García (2011) reveal that family *ownership* does not influence profitability, but instead family *control* seems to matter. Kuan, Li, and Chu (2011) argue that family businesses are complex because they must consider the needs as well as the desires of the family owners, and the impact of corporate governance fluctuates between family-controlled and non-family-controlled firms. In general, firm per-

formance is hurt by the asymmetrical distribution of voting power among family and non-family blockholders (Fattoum-Guedri, Guedri, and Delmar 2018).

To sum up, we argue that ownership structure and firm value are two of the most crucial issues for a firm. Thus, we conduct this paper with the goal of demonstrating the relevance of firm value and ownership structure. Our motivation for achieving this goal is twofold. First, we endeavor to provide valuable information on this issue for both enterprises and investors. Second, we would like to find additional factors, such as shareholdings of owners' relatives, which might have an extreme effect on firm value, but is seldom explored comprehensively in the existing literature.

After reviewing the relevant literature aforementioned, we find that many studies focus on how the shareholding ratios of directors and managers, as well as the pledge ratio of directors, affect firm value. However, the relationship between the shareholding ratio of owners' relatives and company performance is rarely discussed. We realize that many directors and top managers take in their relatives to hold shares in order to dilute the concentration of shareholding, which might prevent the firm from appearing to be controlled by only a few people, and consequently, attract investors. Therefore, this paper examines whether the relatives of board members and managers influence firm value by employing the data of Taiwan Stock Exchange-listed firms.

We report several valuable findings in this study. First, the shareholding of directors' relatives is positively related to firm value, which is consistent with the positive impact of directors' shareholding on firm value. Second, the shareholding ratio of managers' relatives influences firm value negatively. We infer that the increase of shareholding of managers' relatives is linked to information leakage from the firm, thereby resulting in firm value weakened. Third, in terms of other variables employed, firm value is impacted positively by the shareholdings of top ten shareholders, independent directors, and asset turnover ratio, but is negatively related to board size and debt ratio. These results are rather consistent with the relevant literature and are valuable for investors to make investment decisions.

This study may contribute to the existing literature in several aspects. First, to the best of our understanding, we might be the pioneer to comprehensively examine whether firm value is affected by the role of relatives on ownership structure, and this might fill a gap in the existing literature. Second, our revealed findings might provide valued information for both enterprises and investors. The opposite outcomes for these two types of relatives to firm value might result from the different interests of theirs. In sum, the shareholding ratios of relatives in terms of board members and managers could be important elements for evaluating the future values of firms.

The rest of this paper is organized as follows:

- The literature review and hypotheses proposed are presented next.
- Following that, the data and methodology employed in this study are introduced.
- The section that follows presents the empirical results and analysis.
- The final section provides the concluding remarks.

LITERATURE REVIEW AND HYPOTHESES PROPOSED

To familiarize ourselves with relevant studies, we conducted a survey related to firm value, ownership structure in terms of relatives, ownership structure in terms of relatives and firm value, as well as financial statements and firm value in this study.

Firm Value

Firm value, the main objective for corporates, is regarded as an important element for firms and investors. In general, we consider that firm value could be affected by several aspects. Morck, Shleifer, and Vishny (1988) report that managers owning share percentage between 0 and 5 percent will make decisions in the interest of management and the firm's owners. Nevertheless, beyond 25 percent of the share, managers are likely to act toward their own perquisite, which leads to board entrenchment. Moreover, Brick and Chidambaran (2010) point out that prior performance, firm characteristics, and governance characteristics are important determinants of board activity which have positive impacts on firm value. In addition, Pérez-González and Yun (2013) claim that risk management has real consequences on firm outcomes, while Krause and Tse (2016) argue that proper risk management would increase firm value and reduce cash flow volatility. Besides, Gupta, Mortal, and Yang (2018) find that entrepreneurial orientation to firm value enhancement is economically meaningful. Jiang et al. (2017) demonstrate that efficiency is positively related to firm value. Li et al. (2018) show that improving transparency and accountability would boost firm value. However, Lins (2003) reveals that firm values are lower when a management group's control rights exceed its cash flow rights, while firms with greater agency and monitoring problems exhibit a negative association between Tobin's q and derivative usage (Fauver and Naranjo 2010).

With regard to corporate governance, Basyith, Fauzi, and Idris (2015) report that, apart from the independent commissioner and audit committee, variables including board of directors, managerial ownership, and blockholders significantly affect firm performance. Moreover, board size has a strong negative impact on profitability, Tobin's q , and share returns (Yermack 1996; Eisenberg, Sundgren, and Wells 1998; Upadhyay, Bhargava, and Faircloth 2014). The negative relation is strongest for large firms, which tend to have larger boards (Guest 2009; O'Connell and Cramer 2010). In general, board membership is recommended at eight or nine (Lipton and Lorsch 1992), and any additional benefits from augmented monitoring gained by additional membership will offset the costs associated with slow decision making, the effort problem, and easier control by the CEO (Jensen 1993). Furthermore, Black and Kim (2012) claim that outside directors and audit committees are widely considered to be central essentials of good corporate governance. Joh and Jung (2012) point out that independent directors are correlated with higher firm value when the firm has lower information transaction costs, suggesting that the monitoring role of independent directors is limited when transferring firm-specific information is costly.

Furthermore, the importance of firm value could be represented by stock performance and stakeholders. For stock performance, previous studies show that the price of a firm's common stock tends to decrease when the firm issues

new public securities (Billett, Flannery, and Garfinkel 1995), which might cause a firm's value to diminish. Bertoni, Meoli, and Vismara (2014) argue that board independence is a critical factor in the valuation of IPO firms, which supports both the value-creation and value-protection roles of the board of directors. Furthermore, Nguyen, Duong, and Singh (2016) discover a positive relation between stock liquidity and firm value. With regard to stakeholders, Jiao (2010) claims that stakeholder welfare is associated with positive valuation effects. However, Konijn, Kräussl, and Lucas (2011) report that there is a negative correlation between Tobin's q and blockholder dispersion. As for customer satisfaction, O'Sullivan and McCallig (2012) find that customer satisfaction has a positive impact on firm value. In general, customer satisfaction positively and significantly moderates the earnings–firm value relationship.

Ownership Structure in Terms of Relatives

Paniagua, Rivelles, and Sapena (2018) point out that there are two significant ownership-related features affecting financial performance: ownership dispersion and ownership costs. Certain scholars argue that firm ownership dispersion is an important component of financial performance. For example, Fama and Jensen (1983) discuss the concept of entrenchment, or the adverse effect of a high share of management ownership driven by short-term opportunism. Anderson and Reeb (2003) argue that family influence can provide competitive advantages which cause family firms to outperform non-family firms.

As mentioned earlier, Burkart, Panunzi, and Shleifer (2003) find that most firms in the world are controlled by their founders or the founders' families and heirs. Such family ownership is nearly universal among not only privately held firms but also publicly traded firms. In Western Europe, South and East Asia, the Middle East, Latin America, and Africa, the vast majority of publicly traded firms are family controlled (La Porta, Lopez de Silanes, and Shleifer 1999; Faccio and Lang 2002). Even some of the largest publicly traded firms in the United States and the United Kingdom, such as Wal-Mart and Ford Motor, are controlled by families. In addition, Claessens, Djankov, and Lang (2000) find that, with the exception of Japan, more than 50 percent of all publicly traded firms in several East Asian countries are controlled by families and that the top 15 families control significant shares of the country's wealth.

More evidence about family firms are found by researchers. For example, family firms, on average, tend to be smaller than non-family firms, have lower performance and weaker governance structures, and are often concentrated in older, as well as more regulated, industries (Morck, Stangeland, and Yeung 1998; Claessens et al. 2002; Bertrand and Schoar 2006). Aguilera and Crespi-Cladera (2016) reveal that powerful and dominant shareholders have incentives to monitor and supervise managers properly. In general, large shareholders have stronger incentives than managers to act in the interest of the corporation as they control corporate operations. Moreover, Mullins and Schoar (2016) demonstrate that family firms and widely held firms are different, not only in their explicit governance structures, but also in terms of the softer factors that affect management effectiveness, such as the way they set up their operations or their business philosophy.

In sum, founders and their families are more likely to retain control to provide the firm with a competitive advantage which thereby benefits all shareholders. Families are more likely to maintain control when the efficient scale is small, the need to monitor employees is high, and investment horizons are long (Villalonga and Amit 2010).

Ownership Structure in Terms of Relatives and Firm Value

There is a growing acceptance of the view that a corporate board is an essential mechanism in promoting corporate governance, firm performance, and firm value (Chen 2015). Moscatello (1990) also points out that the concentration of shares in family management hands leads to a strong sense of mission, well-defined long-term goals, a capacity for self-analysis, and the ability to adapt to major changes without losing momentum. Nevertheless, the relationship between board composition and firm financial performance is inconclusive (Paniagua, Rivelles, and Sapena 2018).

Many studies demonstrate that family firms have better performance than non-family firms (Khanna and Palepu 2000; Anderson and Reeb 2003; Sraer and Thesmar 2007; Mehrotra et al. 2013). Chen and Hsu (2009) claim that family influence for a firm is central in Asian countries. McConaughy, Matthews, and Fialko (2001) argue that firms controlled by the founding family have greater value, are operated more efficiently, and carry less debt than other firms. Kowalewski, Talavera, and Stetsyuk (2010) find an inverted U-shaped relationship between the share of family ownership and firm performance. They also reveal that firms with family CEOs are likely to outperform their counterparts that have non-family CEOs. Lee (2006) argues that family firms tend to experience higher employment, revenue growth over time, and profits. Moreover, firm performance is improved when founding family members are involved in management. Morck, Shleifer, and Vishny (1988) claim that Tobin's q first increases, then declines, and finally rises slightly as the ownership of the board of directors rises.

In contrast, a lot of researchers argue that the lower average rates of return and stock market valuation of family firms seem to be associated with the passing of control from the founder to the heirs (Pérez-González 2006; Bloom and Van Reenen 2007; Bertrand et al. 2008). Moreover, Haniffa and Hudaib (2006) reveal that concentrated shareholdings produce opposite results for Malaysian corporations. Accounting performance measures suggest better performance with concentrated ownership while the market perceives otherwise, implying that concentrated ownership is not ideal for an emerging market that tries to attract investors and encourages diffused shareholding. Besides, Prabowo and Simpson (2011) find that the proposition of family control, including family ownership and family involvement on the board, is negatively related to firm performance. However, the significant effect of family ownership disappears when family involvement on the board is taken into account, indicating that family ownership is more detrimental to firm performance whenever the family is highly involved in control decisions.

With the aforementioned review, we claim that there is a shortage of relevant studies focusing on the role of relatives on ownership structure. Hence, we

employ several factors to discuss this issue and propose hypotheses as shown below.

Hypothesis 1: *The shareholding ratio of directors' relatives would have positive effect on firm value.*

Hypothesis 2: *The shareholding ratio of managers' relatives would have positive effect on firm value.*

Hypothesis 3: *The pledge ratio of directors' relatives would have positive effects on firm value.*

Financial Statements and Firm Value

With regard to financial statements, Yasser, Entebang, and Mansor (2015) argue that there is a significantly positive relationship between financial performance, including return on equity and profit margin, and three corporate governance mechanisms, which are the board size, the board composition, and the audit committee. The implication is that the board size should be limited and the board must be the right mixture of executive and non-executive directors. Geng, Bose, and Chen (2015) discover that financial indicators, such as net profit margin of total assets, return on total assets, earnings per share, and cash flow per share, act as chief roles in the prediction of deterioration in profitability. Cai and Zhang (2011) declare that employing high leverage has a significantly negative effect on stock prices. Borokhovich et al. (2004) claim that financial risk declines in firms with a relatively high current ratio. Moreover, firm value might be influenced by the issue of return on assets, which is regarded as the proxy for firm profitability (Allayannis and Weston 2001; Jin and Jorion 2006).

Based on the review of studies mentioned above, we argue that the variables related to corporate governance and financial statement are related to firm value. Therefore, we take these factors into account as controlling variables while exploring whether firm value would be affected by the relatives' shareholdings.

DATA AND METHODOLOGY

Data

We use the data of 4,431 firms listed on the Taiwan Stock Exchange (TWSE) from Taiwan Economic Journal (TEJ) during the period of 2013 to 2017 as our samples. The definitions of variables employed in this study are shown in Table 1.

In this paper, we apply Tobin's q —defined as the ratio of the market value of a firm to the replacement cost of its assets—that is book value (Chung and Pruitt 1994), to be the proxy for firm value because Tobin's q has been employed to explain a number of corporate phenomena including the relationship between managerial equity ownership and firm value.

In addition, although there are numerous control variables in the existing literature, including growth and liquidity of a firm, this paper focuses on the probability and leverage because we consider that better probability may increase firm value directly, while low leverage would decrease the liquidity issue of the firm. Besides, some studies also measure the relation between profitability

TABLE 1. Definitions of Variables

Variable	Definition
Tobin's q	(market values of equities + book values of liabilities) divided by total book values of assets
Return on assets	Total return divided by total assets
Return on equity	Total return divided by total equities
Shareholding ratio of directors' relatives	Total shareholdings of directors' relatives divided by total shares outstanding
Shareholding ratio of managers' relatives	Total shareholdings of managers' relatives divided by total shares outstanding
Pledge ratio of directors' relatives	Total pledged shares of directors' relatives divided by total shareholdings of directors' relatives
Directors' shareholding ratio	Total directors' shareholdings divided by total shares outstanding
Managers' shareholding ratio	Total managers' shareholdings divided by total shares outstanding
Directors' pledge ratio	Directors' pledged shares divided by total directors' shareholdings
Top ten shareholding ratio	Top ten shareholders' holdings divided by total shares outstanding
Board size	Total number of directors on the board
Independent directors	Total number of independent directors on the board
Net profit ratio	Net profit of all types incomes divided by total book values of sales
Debt ratio	Total book values of debts divided by total book values of assets
Assets turnover ratio	(total sales – property sales – investment incomes) divided by total book values of assets
Electronic dummy	Set to 1 for electronic firms; otherwise, set to 0
Firm size	ln (market value)

and firm value by using the ratio of return on assets (Allayannis and Weston 2001; Jin and Jorion 2006). In the same vein, we consider that return on equity could be the other ratio to present the profitability of a firm. Therefore, we utilize return on assets (ROA) and return on equity (ROE) to be the proxies for firm value in this paper.

Models

The model, shown below, is set to examine whether firm value would be affected by relatives' ownership structure after controlling corporate governance, financial statements, and other variables.

$$Y_{i,t} = \beta_0 + \beta_1$$

$$\text{Shareholding ratio of directors' relatives}_{i,t} + \beta_2$$

$$\text{Shareholding ratio of managers' relatives}_{i,t} + \beta_3$$

$$\text{Pledge ratio of directors' relatives}_{i,t} + \beta_4$$

$$\text{Directors' shareholding ratio}_{i,t} + \beta_5$$

$$\text{Managers' shareholding ratio}_{i,t} + \beta_6$$

$$\text{Directors' pledge ratio}_{i,t} + \beta_7$$

$$\begin{aligned}
& \text{Top ten shareholding ratio}_{i,t} + \beta_8 \\
& \text{Board size}_{i,t} + \beta_9 \\
& \text{Independent directors}_{i,t} + \beta_{10} \\
& \text{Net profit ratio}_{i,t} + \beta_{11} \\
& \text{Debt ratio}_{i,t} + \beta_{12} \\
& \text{Assets turnover ratio}_{i,t} + \varepsilon_{i,t} \\
& i = 1 \text{ to } 3
\end{aligned} \tag{1} - (3)$$

where

$Y_{i,t}$ is Tobin's q as $i = 1$

Return on assets as $i = 2$

Return on equity as $i = 3$

In addition, we use variance inflation factor (VIF) tests to detect the existence of multicollinearity problems for the employed independent variables in the beginning and discover that all of the VIF values are less than 1.6, representing that multicollinearity concerns are not severe in this study.

EMPIRICAL RESULTS AND ANALYSIS

Descriptive Statistics

The descriptive statistics, including the number of observations, means, medians, standard deviations, minima, and maxima, as well as the variables involved in this study are presented in Table 2. We assess firm value by using Tobin's q, which is defined as the amount of market value of equities plus book values of liabilities, and then divided by book values of assets. Table 2 shows that most of the firms listed on the TWSE have good business performance since the average of Tobin's q is 1.37, greater than 1.0, meaning that the market value of assets is greater than the book value. We speculate that there are huge differences in the evaluation of the firms because of the widely ranged minimum and maximum values of Tobin's q.

With regard to the variables of financial statement, the average ROE is about 0.048 percent, while the minimum and maximum values are -19.11 percent and 1.28 percent, respectively. This consequence indicates that some of these firms might not have positive returns, which undoubtedly affects the values of firms. Additionally, the minimum and maximum values of net profit ratio (-12951.16 percent and 776.7 percent) also vary widely, implying that these firms have an enormous difference in profit-making capability, which could influence the firm's financial performance. Moreover, the mean of debt ratio is about 44 percent, meaning that some TWSE-listed firms make leverage by debt, which increases the interest payment and certainly affects the value of the firm.

As for the variables of board structure, we realize that most shares (over 22 percent) are held by the board members, while managers have a very low shareholding ratio (about 1 percent). Based on the statistics, we speculate that the board, for their own interests, might monitor managers more intensively,

expecting more profit, which consequently increases firm value. Nevertheless, the shareholding percentage of managers' relatives to managers (nearly 25 percent) is notably higher than the ratio of directors' relatives to directors (about 10 percent). This circumstance might encourage managers to operate the firm seriously, which is a positive driving force for firm value enhancement. Moreover, the mean number of board members is seven directors and the independent directors are about 20 percent of the board, which seems appropriate for the board combination.

Table 2 reports the means, medians, standard deviations, minima, and maxima of the dependent and independent variables. We explore how firm value would be affected by financial statement, board structure, and others as controlling variables.

The financial statement variables include:

- *Net profit ratio* defined as net profit of all types incomes divided by the total book values of sales
- *Debt ratio* defined as total book values of debts divided by the total book values of assets
- *Assets turnover ratio* defined as total sales excluding property sales and investment incomes divided by the total book values of assets

The board structure variables include:

- *Shareholding ratio of directors' relatives* defined as total shareholdings of directors' relatives divided by the total shares outstanding
- *Shareholding ratio of managers' relatives* defined as total shareholdings of managers' relatives divided by the total shares outstanding
- *Pledge ratio of directors' relatives* defined as total pledged shares of directors' relatives divided by the total shareholdings of directors' relatives
- *Directors' shareholding ratio* defined as total directors' shareholdings divided by the total shares outstanding
- *Managers' shareholding ratio* defined as total managers' shareholdings divided by the total shares outstanding
- *Directors' pledge ratio* defined as directors' pledged shares divided by the total directors' shareholdings
- *Top ten shareholders' ratio* defined as top ten shareholders' holdings divided by the total shares outstanding
- *Board size* defined as the total number of directors on the board
- *Independent directors* defined as total number of independent directors on the board

Electronic dummy is set to 1 for electronic firms; otherwise, set to 0.

TABLE 2. Descriptive Statistics

Variables	Obs	Mean	Median	Std. Dev.	Min.	Max.
Tobin's q	4431	1.3724	1.0913	1.0100	0.3926	25.6311
ROA	4431	0.0364	0.0363	0.0821	-0.9843	1.0654
ROE	4431	0.0481	0.0722	0.3804	-19.1107	1.2811
Shareholding ratio of directors' relatives	4431	2.4116	0.4100	5.7768	0	78.5500
Shareholding ratio of managers' relatives	4431	0.2978	0	1.6358	0	37.2200
Pledge ratio of directors' relatives	4431	3.3566	0	13.7941	0	100.0000
Directors' shareholding ratio	4431	22.1723	18.5600	15.3770	0	96.4600
Managers' shareholding ratio	4431	1.1578	0.2600	2.7110	0	44.4900
Directors' pledge ratio	4431	8.2331	0	16.1149	0	100.00
Top ten shareholders' ratio	4431	23.7003	21.3400	12.9563	0	94.2600
Board size	4431	7.7371	7.0000	2.4207	0	21.0000
Independent directors	4431	1.9400	2.0000	1.2368	0	6.0000
Net profit ratio	4431	-0.9638	5.5200	264.8030	-12,951.16	776.7000
Debt ratio	4431	44.2189	43.7500	19.8183	0.9000	99.7600
Assets turnover ratio	4431	0.8226	0.7300	0.5782	0	5.4600
Electronic dummy	4431	0.4484	0	0.4974	0	1.0000
Firm scale	4431	15.7317	15.5624	1.4190	11.6160	22.5068

Empirical Results

Due to the firm-year observations employed in this study, we argue that panel data models might be more appropriate than traditional multiple regression models. In addition, due to the shortcomings of traditional panel data models proposed by Petersen (2009), we use the model proposed by Petersen for clutching the relative accuracy after taking into account the structure of the data.

Multiple Regression Models

In Table 3, we employ Models (1) through (3) by exploring whether the dependent variables, including Tobin's q, ROA, and ROE would be affected by financial statement variables, including net profit ratio, debt ratio, and assets turnover ratio, and board structure variables including shareholding ratio of directors' relatives, shareholding ratio of managers' relatives, pledge ratio of directors' relatives, directors' shareholding ratio, managers' shareholding ratio, top ten shareholders' ratio, board size, and independent directors. The standard errors (SEs) of the estimated values are presented in parentheses below the estimated values. Models (1) through (3) show the results derived from by excluding 1 percent outliers on both sides. The t-statistics are based on the standard errors that are adjusted by heteroscedasticity (White 1980) in Models (1) through (3).

Table 3 shows that the shareholding ratio of directors' relatives is significantly positively related to ROA and ROE, indicating that a higher shareholding ratio of directors' relatives might bring out better monitoring, which could

enhance the performance and profit of the firm. However, since both pledge ratio of directors' relatives and directors' pledge ratio impact negatively to Tobin's q, ROA, and ROE, we speculate that the increase of these two ratios might surge the profitability of financial crisis.

In addition, although managers' shareholding ratio impacts firm value positively, the shareholding ratio of managers' relatives has a negative relation with firm value. We deduce that managers' relatives probably increase their shareholdings due to the inside information from managers, which can be a problem for firm transparency. As a result, firm value might be decreased gradually.

Table 3 also shows that board size and debt ratio are related to firm value negatively. We presume that large board size might result in a challenge for the efficiency of strategy making and high debt ratio could cause more interest expense, which reduces the profit of the firm. Consequently, these two issues lead the opposite way from firm value enhancement.

As for other controlling variables, firm scale has a positive impact on firm value. We infer that, for large firms, the higher shareholding ratio of the relatives might enhance the advantages in market developing and business maintaining for the firm. A corollary example: the lower shareholding ratio of the relatives might reflect poor results in firm performance and asset turnover rate.

Petersen Models

In Table 4, we employ Models (1) through (3) by exploring whether the dependent variables including Tobin's q, ROA, and ROE would be affected by financial statement variables, including net profit ratio, debt ratio, and assets turnover ratio, and board structure variables, including shareholding ratio of directors' relatives, shareholding ratio of managers' relatives, pledge ratio of directors' relatives, directors' shareholding ratio, managers' shareholding ratio, top ten shareholders' ratio, board size, and independent directors. The standard errors (SEs) of the estimated values are presented in parentheses below the estimated values. Models (1) to (3) show the results derived from by excluding 1 percent outliers on both sides. The t-statistics are based on the standard errors that are adjusted by the two-way clusters that exist in each firm and year (Petersen 2009) in Models (1) through (3).

Table 4 shows almost the same results with Table 3. The shareholding ratio of directors' relatives is significantly and positively related to ROA and ROE, indicating that the relatives of directors expect better yields in the future in terms of high shareholding level. Therefore, firm value is enhanced. Besides, as for financial statement variables, Table 4 reveals that asset turnover ratio is significantly correlated to Tobin's q, ROA, and ROE, meaning that higher asset turnover ratio would increase firm value as well as rate of return. We interpret the finding probably due to the efficiency of business operation, which might generate profit and firm value consequently. On the contrary, debt ratio has a negative relation with Tobin's q, ROA, and ROE. We deduce that a firm with a high debt ratio might surge interest expense and even lift financial risk, which does not increase firm value.

In addition, similar to the result of Table 3, the pledge ratio of directors' relatives and directors' pledge ratio impact negatively to Tobin's q, ROA, and ROE, indicating that the higher directors' pledge ratio, the lower value of the

TABLE 3. Multiple Regression Models

	Model (1)	Model (2)	Model (3)
Independent Variables	Tobin's q	ROA	ROE
Shareholding ratio of directors' relatives	0.0025	0.0009***	0.0022***
	(0.0023)	(0.0001)	(0.0005)
Shareholding ratio of managers' relatives	-0.0227***	-0.0005	0.0018
	(0.0060)	(0.0004)	(0.0013)
Pledge ratio of directors' relatives	-0.0011*	-0.0000	-0.0001
	(0.0006)	(0.0001)	(0.0002)
Directors' shareholding ratio	0.0101***	0.0005***	0.0011**
	(0.0009)	(0.0001)	(0.0005)
Managers' shareholding ratio	0.0403***	0.0016***	0.0024
	(0.0089)	(0.0005)	(0.0019)
Directors' pledge ratio	-0.0031***	-0.0003***	-0.0001
	(0.0007)	(0.0001)	(0.0004)
Top ten shareholders' ratio	0.0092***	0.0005***	0.0009
	(0.0011)	(0.0001)	(0.0006)
Board size	-0.0361***	-0.0044***	-0.0056*
	(0.0065)	(0.0005)	(0.0031)
Independent directors	0.0492***	-0.0014	-0.0048*
	(0.0136)	(0.0010)	(0.0026)
Net profit ratio	0.0001	0.0000	0.0000
	(0.0001)	(0.0000)	(0.0000)
Debt ratio	-0.0094***	-0.0014***	-0.0039***
	(0.0010)	(0.0001)	(0.0010)
Assets turnover ratio	0.2212***	0.0299***	0.0691***
	(0.0244)	(0.0019)	(0.0073)
Electronic dummy	0.0107	-0.0165***	-0.0552***
	(0.0357)	(0.0027)	(0.0118)
Firm scale	0.1877***	0.0264***	0.0702***
	(0.0145)	(0.0012)	(0.0087)
Year dummy	Yes	Yes	Yes
Adj. R ² /Wald χ^2 (prob.)	0.165	0.3158	0.0999
Coefficient estimates	OLS	OLS	OLS
Standard errors	White	White	White

*Significant values in statistics at the 1, 5, and 10 percent levels are denoted by ***, **, and *, respectively.

OLS, ordinary least squares

firm. We speculate that high directors' pledge ratio might be due to financial crisis of the directors, which definitely causes the decrease of firm value. Moreover, the shareholding ratio of managers positively affects firm value; however, shareholding ratio of managers' relatives is negatively influenced firm value.

With regard to the electronic dummy, because of the high competition worldwide, the electronic firms listed on TWSE have weakened their advantages recently, which generates the significant decline on ROA and ROE.

TABLE 4. Petersen Models

	Model (1)	Model (2)	Model (3)
Independent Variables	Tobin's q	ROA	ROE
Shareholding ratio of directors' relatives	0.0026 (0.0037)	0.0009*** (0.0003)	0.0021*** (0.0007)
Shareholding ratio of managers' relatives	-0.0226** (0.0089)	-0.0005 (0.0005)	0.0019 (0.0020)
Pledge ratio of directors' relatives	-0.0011 (0.0010)	-0.0000 (0.0001)	-0.0001 (0.0002)
Directors' shareholding ratio	0.0102*** (0.0015)	0.0005*** (0.0001)	0.0011** (0.0005)
Managers' shareholding ratio	0.0401*** (0.0135)	0.0016** (0.0006)	0.0025 (0.0026)
Directors' pledge ratio	-0.0031*** (0.0010)	-0.0003*** (0.0001)	-0.0001 (0.0005)
Top ten shareholders' ratio	0.0092*** (0.0019)	0.0004*** (0.0001)	0.0009 (0.0007)
Board size	-0.0361*** (0.0103)	-0.0044*** (0.0007)	-0.0055** (0.0028)
Independent directors	0.0452*** (0.0163)	-0.0010 (0.0011)	-0.0073** (0.0034)
Net profit ratio	0.0001 (0.0001)	0.0000 (0.0000)	0.0000 (0.0000)
Debt ratio	-0.0094*** (0.0019)	-0.0014*** (0.0001)	-0.0039*** (0.0013)
Assets turnover ratio	0.2238*** (0.0368)	0.0298*** (0.0039)	0.0697*** (0.0147)
Electronic dummy	0.0123 (0.0749)	-0.0166*** (0.0046)	-0.0542*** (0.0182)
Firm scale	0.1902*** (0.0239)	0.0263*** (0.0021)	0.0704*** (0.0120)
Year dummy	Yes	Yes	Yes
Adj. R ² /Wald χ^2 (prob)	0.1626	0.3151	0.0993
Coefficient estimates	OLS	OLS	OLS
Standard errors	Cluster F and T	Cluster F and T	Cluster F and T

*Significant values in statistics at the 1, 5, and 10 percent levels are denoted by ***, **, and *, respectively.

CONCLUSION

We examine the relevance of firm value, board structure, and ownership structure because we argue that board structure, ownership structure, and firm value are three main issues for a firm. After surveying the relevant literature, we find that many studies focus on how the shareholding ratios of directors and managers, as well as the pledge ratio of directors, affect firm value. However, the relationship between the shareholding ratio of owners' relatives and company performance is rarely discussed. We document that many directors and top man-

agers have their relatives hold shares in order to dilute the concentration of shareholding, which might prevent the firm from appearing to be controlled by only a few people, and consequently, attract more investors.

By using the firms listed on the Taiwan Stock Exchange as our sample, we reveal several important findings. First, the shareholding ratio of directors' relatives positively affects firm value consistent with the observation that the shareholding ratio of directors positively affects firm value. Second, the shareholding ratio of managers' relatives has a negative impact on firm value. We deduce that the increase of shareholding of managers' relatives might be in relation to information leakage, which might not be regarded as a positive signal, thereby weakening firm value. Third, we also reveal that firm value is impacted positively by the shareholdings of top ten shareholders, independent directors, and asset turnover ratio, but is negatively related to board size and debt ratio. These revealed results seem consistent with the relevant literature.

We argue that this study may contribute to the relevant literature as follows. First, to our understanding, we might be the first to examine how relatives of board members and managers impact firm value deliberately, which might fill a gap in the present literature. Second, our findings might provide valuable information for both enterprises and market participants. The opposite results for these two types of relatives to firm value might be due to the different interests of theirs. To sum up, we document that the shareholding ratios of relatives in terms of directors and managers could be essential factors for gauging the future values of firms.

In general, this study provides valuable implication in two aspects. First, for the corporate governance, relatives' shareholdings of the firm members do impact firm value in a different way, even in the opposite direction. To enhance the value, a firm should properly manage the board and ownership structures. Second, we suggest investors ensuring the board and ownership structures of a firm before investing. After all, board and ownership structures are crucial determinants for firms to operate with financial success. By selecting firms with well-designed board and ownership structures, investors may increase the probability of higher rates of return.

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Prospects for a Sustainable Future: Mapping Sustainable Behaviors According to Consumer Perceptions

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Abstract

Motivation: The transition to a green, circular economy requires mainstreaming consumers' sustainable behaviors (SBs). Some argue that to achieve sustainable consumption only improvements in technology are needed. Others argue for a quantitative reduction in consumption. This paper explores the idea of a sustainable behavior perception matrix as first proposed by Peattie (1999) and later by McDonald and Oates (2006) to investigate the likelihood of a reduction in consumption.

Premise: It is possible to identify individual behaviors that promote sustainability by reducing/modifying consumption.

Approach: This paper uses data from a nationwide online survey, conducted in 2016 on a sample of 1112 adult Poles. The paper uses this data to identify how consumers perceive a wide range of SBs and how they recognize differences in the perception of such behaviors. We model SBs according to their specific types and analyze two psychological variables—perceived consumer effectiveness (PCE) and perceived difficulty (PD).

Results: Our results show that frugal/non-consumption behaviors all closely associated with the idea of sustainable behaviors, which are perceived as the easiest and the most effective ones represent the type named. This type also turned out to be the most frequent one.

Conclusion: The results of this paper confirm an assumption that PCE and PD can serve as criteria for classifying sustainable behaviors and creating a sustainable behavior perception matrix.

Consistency: Knowledge on how consumers perceive SBs undertaken while using innovative products or sustainable solutions can contribute to the development of green businesses. Such knowledge not only enables a reduction in the risk of an unsuccessful product introduction, but also minimizes the impact of consumption of that product on society's stock of resources.

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Keywords: consumer behavior, perceived consumer effectiveness, perceived difficulty, perception matrix, sustainable consumption

INTRODUCTION

The conviction that individuals can contribute significantly to achieving long-term sustainability goals by adopting sustainable behavior patterns is one of the main premises of sustainable consumption (SC). Thus, it should not be surprising that researchers seek to answer the questions: Which behaviors can be identified as sustainable ones? How often do consumers incorporate them into their everyday lives? What makes consumers behave in sustainable ways and what stops them from behaving in such a way? In the field of consumer behavior, this has led to numerous attempts to describe patterns of SBs and to indicate factors that underlie them. Different authors used different conceptual approaches, and most empirical investigations were focused only on chosen types of sustainable behaviors. Only a few researchers like McDonald and Oates (2006) or Papaoikonomou (2013) have considered the necessity of addressing a broad range of SBs. Their holistic approach is thus charting a new direction of scientific research which we decided to apply in our investigations. In terms of researching motivational factors underlying environmental behaviors, Steg and Vlek (2009, 311) identified three main research paths, namely, perceived costs and benefits, moral and normative concerns, and affective premises. Following this line of thinking, Onel and Mukherjee (2015) indicated the theories which would reflect all of these approaches. A good example of cost/benefit approach is Ajzen's theory of planned behavior (TPB) (Ajzen 1985; Ajzen 2011; de Leeuw et al. 2015). It is widely employed by scholars who assume reasonable, purposive nature of pro-environmental (Johnstone and Tan 2015; Moser 2015) and ethical (Shaw and Shiu 2002; Chatzidakis, Hibbert, and Smith 2007; Chatzidakis, Kastanakis, and Stathopoulou 2016) behaviors. The moral and normative approach is reflected, e.g., in the value-belief-norm (VBN) theory of environmentalism (Stern 1999; Stern et al. 1999). Study of the affective and symbolic background of sustainable behaviors focuses on consumers' emotions (Gregory-Smith, Smith, and Winklhofer 2013; Antonetti and Maklan 2015) and draws from achievements of neuroscience (Menzel 2013). There are also numerous efforts that simultaneously incorporate motivational factors of various types, which aim at explaining SBs in a more complex way (Grob 1995; Onel and Mukherjee 2015). In fact, finding a complete and unequivocal explanation of sustainable behavior has become harder since empirical studies revealed the discrepancy between consumers' positive attitudes toward sustainability and their unsustainable behaviors. This phenomenon, called by Boulstridge and Carrigan (2000) the *attitude-behavior gap*, shed a new light on the problem of the prerequisites for sustainable behavior.

Since our scientific interest focuses on Polish consumers' SBs, we cannot directly utilize any existing data. Studies on sustainable consumption among Poles are not developed enough to draw general conclusions. Economic conditions, Polish consumers' behaviors and habits, and particularly their attitudes and beliefs, cannot be compared to those of Western consumers. Thus, we needed to apply new methods of analysis. To assess the popularity of sustainable behaviors among Polish consumers and to recognize the way in which Poles perceive SBs,

we decided to address a broad range of SBs and create a model for classifying them. In this paper we focus on two variables recognized as prerequisites of consumers' sustainable actions, i.e., perceived consumer effectiveness (PCE) and perceived difficulty (PD) of SBs. Since both were included in the research conducted under the TPB assumptions, our investigations represent the cost/benefit approach (Ajzen 1985; Ajzen 2011; de Leeuw et al. 2015).

THEORETICAL BACKGROUND

Sustainable Consumption and Sustainable Behaviors

The sustainable consumption (SC) concept emerged at the United Nations Conference on Environment and Development (widely known as the Rio Summit or the Earth Summit) organized in Rio de Janeiro in 1992. It was a direct consequence of decoupling consumption and production issues from each other within discussions on sustainable development (Schrader and Thøgersen 2011, 3–8; Sedlacko et al. 2012, 20–42). Although the significance of importing sustainability into analyses of consumption was clearly shown by participants at the Rio Summit, the Summit did not provide any precise definition of sustainable consumption. It was conceptualized a bit later, during two UN gatherings in Oslo in 1994 and 1995. At the first, the Oslo Symposium on Sustainable Consumption, it was agreed that sustainable consumption should be defined as “the use of services and related products, which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardize the needs of future generations” (Norwegian Ministry of the Environment 1994). During the second meeting, the Oslo Ministerial Roundtable on Sustainable Production and Consumption (also known as the Nordic Roundtable), this initial working definition was supplemented by a statement that “sustainable consumption is an umbrella term that brings together a number of key issues, such as meeting needs, enhancing the quality of life, improving resource efficiency, increasing the use of renewable energy sources, minimizing waste, taking a life cycle perspective and taking into account the equity dimension” (Oslo Roundtable on Sustainable Production and Consumption 1995).

The so-called Oslo definition has gained great popularity among both policymakers and scholars. Somewhat in the shade of it, an alternative approach toward SC was developed by Opschoor. At the beginning of the 1990s, while striving to estimate the maximum threshold value of resources' exploitation that would allow for their long-term accessibility, he introduced the notion of environmental space (ES) (Opschoor and Reijnders 1991, 8–27). The ES concept has been further elaborated by Spangenberg (2002, 297). He stated that environmental space mirrors a certain range of consumption possibilities. From the top the ES is limited by the environment's capacity to recreate natural resources (the so-called “ceiling”); from the bottom, it is limited by the minimum resource accessibility that permits leading a dignified life in a given society (the so-called “floor”). Accordingly, SC includes all the free choices being made within available environmental space, i.e., between the borders of social and environmental sustainability (Spangenberg 2014, 63). According to this view, the lack of sustainability in consumption can be noticed not only in well-developed countries which have experienced hyperconsumption

since the 1960s. Developing countries also struggle with unsustainability. In their case, unsustainability occurs in the form of underconsumption, which according to Sheth, Sethia, and Srinivas may currently affect up to two-thirds of the world population (Sheth, Sethia, and Srinivas 2011, 25). In this paper we adopt Spangenberg's way of defining SC and postulate that in the consumption sphere sustainability is not restricted to a single lifestyle. Within the limits of environmental space there are different kinds of consumers' lifestyles manifesting themselves by different behaviors which can be defined as sustainable.

Two different approaches to achieving the goals of sustainability and sustainable consumption have been developed, namely a weak one and a strong one. The first argues that to achieve the aims of sustainable consumption we need only to improve the efficiency of economic processes and technology. This condition is fulfilled by searching for technological innovations and marketing them as quickly as possible to make them available to consumers (Lorek and Fuchs 2013, 37). From this perspective, supply is the main source of incentives leading to more sustainable consumption. There is little room for consumers' own effort to consciously change and decrease their consumption for the sake of gaining sustainability (Laperche, Levratto, and Uzunidis 2012, 75). Such thinking neglects the problem of hyperconsumption and seems to be insufficient to achieve and maintain SC, especially in well-developed countries (Fuchs and Lorek 2005, 261; Cohen 2011, 177). By contrast, the second, strong approach argues against introducing changes in consumption patterns without reducing the quantity of resources in use, i.e., introducing solely qualitative changes not accompanied by appropriate quantitative ones. We fully agree with this point of view because the most visible evidence against weak SC is its often-noted rebound effects. These manifest themselves when gains in sustainability derived from the increased production and products efficiency lead to an increase in resource use. This reduces sustainability gains, neutralizes them, or even (in the most extreme cases) creates costs that exceed the initial gains (Di Giulio et al. 2014, 57; O'Rourke and Lollo 2015, 241). Rebound effects may be observed directly, e.g., when a hybrid car owner uses it more frequently than a regular car, or indirectly, when the same consumer decides to spend the money saved on gasoline to fly more frequently. In each case, despite using innovative technology (hybrid car), the general pollution will probably stay nearly the same or even increase. This happens first because of increased car usage, and second because airplanes pollute the environment more than cars.

Using this background, we perceive sustainable consumption as a broad concept that may manifest itself in consumers' behavior through many different actions and activities. Antonides and van Raaij (2003, 24) define consumer behavior as a set of physical and mental actions of individuals and small groups (together with their motivations), which include considering, buying, using, maintaining, and disposing of products from the market (consumption cycle) and household production (do-it-yourself), (rare) goods and services from the market, public, and household sectors. These behaviors enable consumers to function and to achieve their goals, and thereby to attain satisfaction and prosperity, while taking into account the short-term and long-term effects as well as the individual and social consequences. Accordingly, the specific nature of sustainable consumer behavior is reflected in the fact that the consequences of listed actions, evaluated in each stage of the consumption and household production

cycle, favor considering sustainability in all of its dimensions, including environmental, social, and economic ones.

PCE and PD as Perceptual Stimuli of Sustainable Behaviors

The idea of creating a sustainable behavior perception matrix was put forward by Peattie (1999) and improved by McDonald and Oates (2006). We decided to implement this idea, using as matrix dimensions perceived consumer effectiveness of SBs and perceived difficulty of SBs. The first variable (PCE) was introduced by Kinnear, Taylor, and Ahmed in the context of ecologically concerned consumers. They defined PCE as “a measure of the extent to which a respondent believes that an individual consumer can be effective in pollution abatement” (Kinnear, Taylor, and Ahmed 1974, 21). Further research in this field resulted in more general definitions applicable not only to the case of pro-environmental behaviors, but also investigating the motivations of other sustainable behaviors. Accordingly, Ellen, Wiener, and Cobb-Walgreen stated that in broad terms PCE should be understood as “domain-specific belief that the efforts of an individual can make a difference in the solution to a problem” (Ellen, Wiener, and Cobb-Walgreen 1991, 103). The importance of perceived consumer effectiveness in influencing SBs has been empirically proven and a significant body of research has concluded that PCE has had a potential to shape sustainable behaviors in both direct and indirect ways (e.g., Roberts 1996; Lee and Holden 1999; Straughan and Roberts 1999; Pandey and Sunaina 2012; Jang, Chung, and Kim 2015, Heo and Muralidharan 2017). Inspired by these findings, we hypothesized that PCE level also plays an important role in the case of Polish consumers. The second variable, perceived difficulty of sustainable behavior, did not have as much research interest as the first one. Identified at the beginning of the 1990s, the PD concept initially appeared mainly in psychological deliberations. As such it was combined into the overall mechanism of human behavior, rather than connected with specific behaviors such as SBs. When analyzing Ajzen’s concept, Trafimow et al. (2002) concluded that the variable known in TPB as perceived behavioral control (PBC) in fact consisted of two components. They named one *perceived difficulty* and defined it as the extent to which an individual perceives the difficulty of performing the behavior. Ajzen put forward a similar assertion when he described the multidimensionality of PBC. Concerning the difficulty issue, he used a different name, *self-efficacy* (Ajzen 2002, 676). Utilizing supplemented TPB to describe determinants of ethical consumer behaviors, Chatzidakis, Kastanakis, and Stathopoulou (2016) revealed that perceived difficulty (treated by them not as a component of PBC but as an independent variable) is a significant factor which allows the prediction of an intention. They concluded that the more difficult a given behavior, the weaker the individual’s intention is to behave in this way. These findings assured us that including PD in the sustainable behavior perception matrix may be a good conceptual solution in the case of Polish consumers too.

METHODOLOGY

Sample Characteristics and Research Assumptions

This paper shows selected outcomes of a broader research project on sustainable consumption and consumers’ knowledge which was conducted among Polish consumers during the first two quarters of 2016. The data were collected using

an online survey. Although a purposive sampling technique was applied at the first stage of the research (a link to the survey platform was sent by email to generate a snowball effect), the final set of responses was drawn at random from completed questionnaires (1472) to obtain a sample structure similar to the structure of the Polish Internet users' population in terms of consumers' age and education level. Thus, we may treat the final sample of 1112 consumers as being obtained through a quota sampling procedure. Table 1 summarizes the respondents' demographic profile.

Considering our research problem and the goals of this paper we introduced the hypothesis that:

The individual perception of impact that selected sustainable behaviors may have over the natural and social environment, i.e., perceived consumer effectiveness, and the individual perception of effort which is needed to undertake selected SBs, i.e., perceived difficulty, may serve as criteria for classifying sustainable behaviors and creating a sustainable behavior perception matrix for Polish consumers.

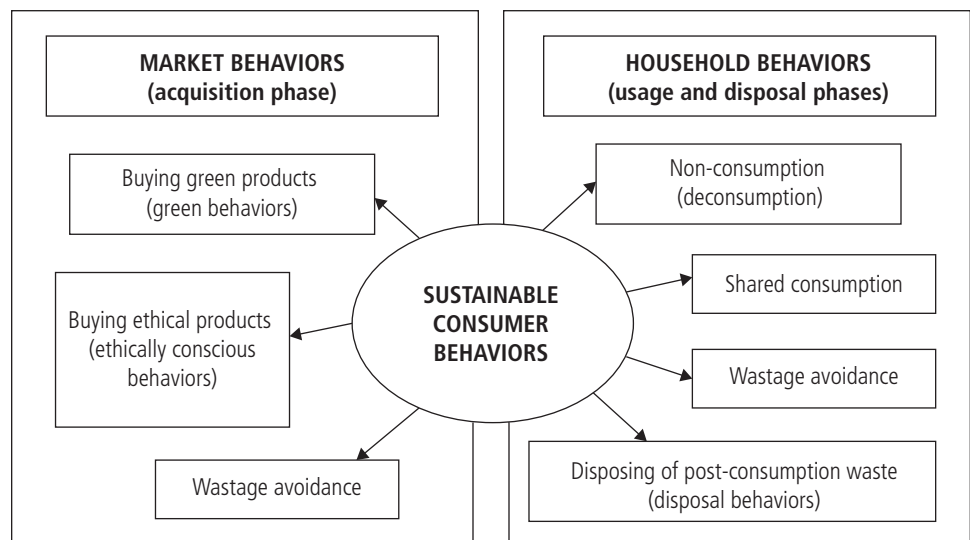
TABLE 1. Demographic Profile of the Respondents

Demographic Features	Number (N)	Percent (%)
<i>Gender</i>		
Male	555	49.9
Female	557	50.1
<i>Age</i>		
from 18 to 29 years	407	36.6
from 30 to 39 years	327	29.4
from 40 to 49 years	201	18.1
50 years and older	177	15.9
<i>Education level</i>		
Elementary or vocational	189	17
Secondary or post secondary	489	44
University education (bachelor degree, master degree, and higher)	434	39
<i>Financial status</i>		
Very bad and bad	82	7.5
Average	457	41.8
Good	496	45.4
Very good	58	5.3
<i>Household monthly income (in zloty)</i>		
Below 1,500	54	5.5
1,500 to 4,000	400	41
4,001 to 7,000	332	34.1
7,001 to 10,000	118	12.1
Over 10,000	71	7.3

Conceptual and Empirical Issues in Modeling Sustainable Behaviors

To measure the frequency of sustainable behaviors as well as to evaluate the level of their PCE and PD, we needed to introduce such a theoretical model that would properly reflect SBs' diversity. We decided to adopt the premises of strong sustainability and used a classification proposed by Rudnicki (2012, 11). He differentiated consumer behaviors according to the context in which they are realized. In consequence, our initial conceptual model of SBs encompasses behaviors divided into two groups—those which occur in the phase of acquiring products and services (market behaviors), and those connected with the phase of using and disposing of products (household behaviors). Figure 1 reflects the further details of this theoretical model.

FIGURE 1. Theoretical Model of Sustainable Consumer Behaviors



In the next step we operationalized the model by assigning behavioral representatives to each indicated area. Our setup of detailed sustainable behaviors was inspired by the one utilized by McDonald and Oates (2006) in their research concerning British consumers. In our study, the list of behaviors was pre-tested during the qualitative research phase¹ and revised in the course of subsequent discussions between the authors. We necessarily paid a great deal of attention to choosing criteria that led to classifying a behavior as a sustainable one. Instead of following Stern's suggestion of applying an intent-oriented approach (2000, 408), we opted for adopting an impact-oriented one. While not including consumers' motivations, we focused on the results of behaviors by judging their consistency with SC goals. This approach resulted in the set of SBs analyzed in our study being broad and diversified. It also encompassed activities that consumers may undertake possibly even without a conscious intention to support sustainability.

The final list containing chosen SBs consisted of 22 activities. Because they were first evaluated by respondents in terms of frequency with which they under-

¹In-depth individual interviews conducted in September 2015 with 16 consumers living in the Upper Silesia area.

take a given behavior, we were able to transform a theoretical model into an empirical one, i.e., one reflecting the real actions of consumers. To do so we utilized exploratory principal component analysis (PCA) with Varimax rotation. The responses were measured on a seven-point frequency scale² and they met all the factor analysis requirements.³ Applying procedures led to reduction of the initial seven dimensions considered in the theoretical model (seven groups of SBs) to five dimensions reflecting five classes of SBs⁴. This five-factor solution accounts for 61.9% of the total variance. Obtained factor loadings are displayed in Table 2. To keep the results clearer, the loadings below 0.5 have not been disclosed.

TABLE 2. Factor Loadings Designating the Five Dimensions of the SBs

Variables	Component				
	1	2	3	4	5
10. Switching off lights	0.820				
12. Limiting water usage	0.780				
15. Using the product until it stops working, even if earlier there are innovations (new products) available on the market	0.722				
4. Using one's own shopping bags (reusable) instead of buying new ones during each purchase	0.694				
20. Recycling	0.677				
6. Shopping with a list to avoid buying unnecessary items	0.609				
19. Intentional limitation of waste in the household	0.582				
3. Buying efficient appliances	0.580				
14. Repairing products instead of buying new ones	0.533				
11. Unplugging electronics when they are not in use	0.505				
8. Buying fair trade products		0.802			
9. Buying traditional products/regional specialties		0.753			
7. Buying locally produced items		0.687			
5. Buying frugally packaged items		0.545			
17. Carpooling			0.683		
22. Buying and selling secondhand items			0.620		
18. Using products together with other consumers			0.590		
21. Giving unwanted, used items to others			0.542		
1. Buying organic food and ecological cosmetics				0.864	
2. Buying green detergents				0.847	
13. Using public transportation or walking instead of driving by car					0.729
16. Upcycling					0.551

Extraction method: Principal component analysis.

Rotation method: Varimax. Rotation has reached convergence in ten iterations.

²From 1: never, to 7: always/continuously.

³There is an adequate sample size—1112 respondents. Ratio of variables number to observations number exceeds 1:5. There are significant correlations between variables, the measure of Kaiser-Meyer-Olkin (KMO) sample adequacy = 0.917, Bartlett's test for sphericity $\chi^2 = 9371,273$ (df = 231, $p \leq 0,000$), the MSA (measure of sampling adequacy) for all individual variables exceeded the critical value of 0.5 (thus none of them needed to be excluded from further analysis).

⁴Calculations resulted in five factors with eigenvalues higher than 1.

Based on the magnitude of the factor loadings, each dimension was given a descriptive label. Considering the original division into market and household behaviors, we obtained the following types of SBs:

1. Frugal/non-consumption behaviors (component 1): The biggest (ten items) and the most popular group of activities taking place both on the market and in the household.
2. Conscious buying (component 2): A comparatively small group (four items) of relatively unpopular activities related solely to the acquisition phase.
3. Active behaviors involving social interactions (component 3): A comparatively small group (four items) of infrequent activities that may be observed both in the market and in the household.
4. Buying green products (component 4): A very small group (two items) of rather unpopular activities related solely to the acquisition phase.
5. Active behaviors with no need of social interactions (component 5): A very small group (two items) of rather unpopular activities related solely to the usage and disposal phase.

This empirically modified model of sustainable behaviors served as the starting point for further analysis concerning the level of PCE and PD and became a framework for creating a sustainable behavior perception matrix. As with frequency of the SBs, both perceptual variables were measured on seven-point scales⁵ which enabled their joint analysis. For classification purposes we calculated the mean PCE and PD value for each behavior listed in the model. On this basis we could create a graphical presentation of the analysis outcomes in a form of a four-field matrix. Its respective quadrants represented the following types of behaviors: difficult and effective, easy and effective, difficult and ineffective, easy and ineffective.

Empirical Findings

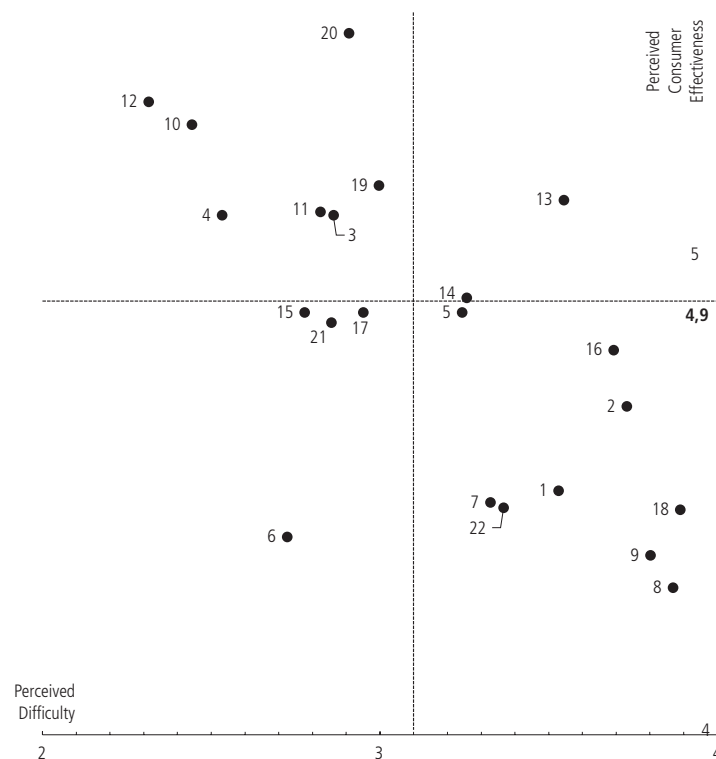
Considering the attributes of the measurement scales used in our study, we initially decided to set an intersection point of matrix axes at the most obvious value of four, representing the middle point of each scale. These absolute measures would have led us to bracket all 22 behaviors into the same quadrant, i.e., actions perceived as easy and effective. In terms of the prospects of mainstreaming sustainable consumption in Poland, this might be interpreted as a promising sign. However, in analyzing our outcomes we must not ignore the possible impact of so-called social desirability bias.⁶ Omitting it would lead to unreasonable simplification, and thus to overoptimistic conclusions. For these reasons we decided to conduct the analysis of the relative positions of the examined behaviors in a way that seemed to be not only much more justified but also more interesting.

⁵In case of perceived consumer effectiveness 1 indicated “lack of impact,” and 7 “very large impact.” In case of perceived difficulty 1 indicated “lack of effort,” and 7 “very large effort.”

⁶Since the issue of sustainable behaviors (as any socially desirable behaviors) is an object of the normative social influences, the respondents might have been trying to present themselves as more sustainable consumers than they really are (Antonetti and Maklan 2014, 53; Carrington, Neville, and Whitwell 2014, 2760; Caruana, Carrington, Chatzidakis 2016, 215).

We focused solely on the second quadrant of the matrix and used mean values for each variable calculated for all 22 behaviors as a point of axes intersection: 3.1 for PD and 4.9 for PCE. This enabled us to notice some subtler differences in perceiving sustainable behaviors and to distinguish the following perceived groups of behaviors: very easy and very effective (PD below 3.1 and PCE above 4.9 scores), very easy and effective (PD below 3.1 and PCE equal or below 4.9 scores), easy and very effective (PD equal or above 3.1 and PCE above 4.9 scores), easy and effective (PD equal or above 3.1 and PCE equal or below 4.9). To be more clear, we can also use the names: behaviors with comparatively low level of PCE/PD and behaviors with comparatively high level of PCE/PD or the most/the least difficult/effective. Figure 2 shows the matrix that we obtained from this analysis.

FIGURE 2. Detailed Sustainable Behavior Perception Matrix



The numbered dots identify the following SBs:

1. Buying organic food and ecological cosmetics.
2. Buying green detergents.
3. Buying efficient appliances e.g., TV, dishwasher, refrigerator (A, A+, A++, A+++).
4. Using one's own shopping bags (reusable) instead of buying new ones during each purchase.
5. Buying frugally packaged items (bulk products, products in biodegradable or recyclable packages).
6. Shopping with a list to avoid buying unnecessary items.
7. Buying locally produced items.
8. Buying fair trade products.
9. Buying traditional products/regional specialties.
10. Switching off lights (in the rooms that are not in use at the moment).
11. Unplugging electronics when they are not in use (computers, TV, and so on).

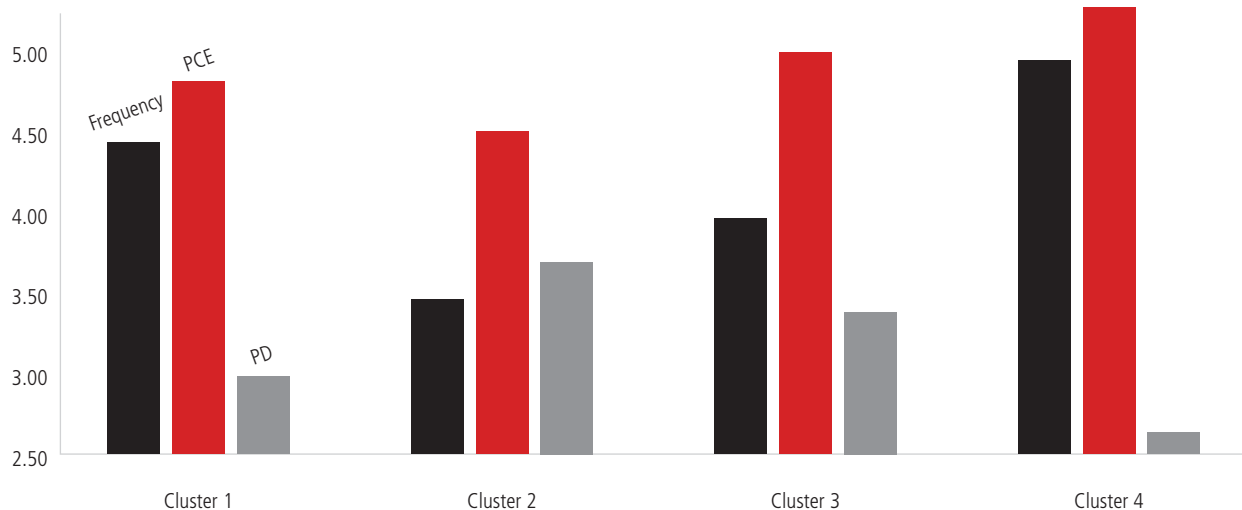
12. Limiting water usage e.g., turning off the faucet while brushing teeth.
13. Using public transportation or walking instead of driving a car.
14. Repairing products instead of buying new ones (e.g., mending apparel, repairing shoes, fixing home or electronic equipment).
15. Using the product until it stops working, even if there are innovations (new products) available on the market.
16. Upcycling.
17. Carpooling.
18. Using products together with other consumers (e.g., using one lawn mower together with the neighbors).
19. Intentional limitation of waste in the household.
20. Recycling.
21. Giving unwanted, used items (e.g., apparel, electronics, books, furniture) to others for free.
22. Buying and selling secondhand items.

Sustainable behaviors perceived by respondents as the easiest and the most effective ones include seven actions, all of which represent frugal/non-consumption type of behaviors. The opposite group—behaviors assessed as the most difficult and the least effective ones, according to our SBs model contains: conscious buying, buying all types of green products, a few active behaviors involving social interactions, and one active behavior not requiring such interactions. Perceptions of the remaining SBs are ambiguous. Using public transportation or walking instead of driving a car (representing active behaviors not requiring social interactions) and repairing products instead of buying new ones (identified as an example of frugal/non-consumption behavior) turned out to be perceived as having a high impact on the natural and social environment, but simultaneously as the most difficult behaviors to implement. Such frugal/non-consumption behaviors like shopping with a list, using a product until it stops working, as well as active behaviors involving social interactions like carpooling and passing the unwanted items to the others for free, were found as comparatively easier but also less effective than others. Changing how these activities are seen by consumers and moving them to the group of the most effective and the easiest ones thus requires introducing changes in the perception of one variable while maintaining the perception of the other.

To complement the perception matrix, we wanted to shed new light on an overall SBs classification considering simultaneously all three researched aspects, i.e., their PCE, PD, and frequency. To this end we used a non-hierarchical cluster analysis, the K-means method. We examined several solutions as far as the number of clusters is concerned and a four-cluster solution came up as the best option. Figure 3 shows the mean values of variables for each of them.

Deepened examination of cohorts description revealed that two of them, i.e., cluster 4 and cluster 2 remain in opposition, reflecting the division between the most frequent, the easiest, and the most effective behaviors (cluster 4) and the least frequent, the most difficult, and the least effective behaviors (cluster 2). Importantly, cluster 4 contains six behaviors corresponding with the previously distinguished group of frugal/non-consumption behaviors. Cluster 2 includes

FIGURE 3. Cluster Means for Frequency, PCE, and PD



seven highly diversified behaviors representing four out of five groups of SBs distinguished before, i.e., buying green products (2), conscious buying (2), active behaviors involving social interactions (2), and active behaviors with no need of social interactions (1). Cluster 1 comprises seven, also rather diverse activities which belong to three categories, i.e., frugal/non-consumption behaviors (remaining four out of ten), active behaviors involving social interactions (remaining two out of four), and conscious buying (1). In terms of the composition, cluster 1 resembles cluster 4, however, in cluster 1 there are significantly lower mean values of frequency and PCE, and higher mean value of PD—although the mean frequency is higher than that of clusters 2 and 3. Thus, we decided to name this cluster “relatively frequent, easy, and effective behaviors.” Finally, cluster 3 is an interesting combination of only two behaviors representing conscious buying and active behaviors with no need of social interactions. We named this cluster “relatively rare and difficult but highly effective behaviors.” Table 3 details the structure of each cluster.

TABLE 3. Sustainable Behaviors Classification Concerning Their Average Frequency, Difficulty, and Effectiveness

No*	Behaviors	Mean Frequency	Mean PD	Mean PCE
Cluster 4: The most frequent, the easiest, and the most effective behaviors		4.95	2.64	5.18
3	Buying efficient appliances	4.67	2.86	5.1
4	Using one's own shopping bags (reusable)	4.84	2.53	5.08
10	Switching off lights	5.19	2.44	5.27
12	Limiting water usage	5.03	2.31	5.31
15	Using the product until it stops working	4.99	2.78	4.88
20	Recycling	4.97	2.91	5.46
Cluster 1: Relatively frequent, easy, and effective behaviors		4.44	2.99	4.82
6	Shopping with a list	4.65	2.72	4.41
7	Buying locally produced items	4.29	3.33	4.48
11	Unplugging electronics when they are not in use	4.43	2.82	5.09
14	Repairing products instead of buying new ones	4.46	3.26	4.91
17	Carpooling	4.26	2.95	4.88
19	Intentional waste reduction	4.52	2.99	5.14
21	Giving used items to the others for free	4.45	2.86	4.85
Cluster 3: Relatively rare and difficult, but highly effective behaviors		3.97	3.39	5.00
5	Buying frugally packaged items	3.97	3.24	4.88
13	Using public transportation or walking instead of driving a car	3.97	3.55	5.11
Cluster 2: The scarcest, the most difficult, and the least effective behaviors		3.48	3.7	4.51
1	Buying organic food and ecological cosmetics	3.45	3.52	4.5
2	Buying green detergents	3.1	3.73	4.68
8	Buying fair trade products	3.7	3.87	4.3
9	Buying traditional products/regional specialties	3.65	3.8	4.37
16	Upcycling	3.64	3.69	4.8
18	Shared consumption	3.13	3.89	4.47
22	Buying and selling second hand items	3.62	3.37	4.47

*The number corresponds with an item position in the original scale.

CONCLUSIONS

The data collected during the research confirm the basic hypothesis of this paper. They show that PCE and PD level may be used as the criteria (dimensions) allowing for SBs classification and for creating an SBs perception matrix. Although the analysis using middle points of the scales as the reference points did not offer a satisfying solution, once we used the relative approach with the reference points indicated by the mean values of the variables we were able to identify sufficiently different matrix quadrants, and we also revealed slight but significant differences in the perception of the examined behaviors. Our most important achievement is showing that behaviors perceived by Poles as the easiest and most effective all represent the category which we named frugal/non-consumption SBs. Accordingly, this type of SB can be treated as the most easily implementable for Poles. Figure 4 presents the perception matrix supplemented by the frequency means for every behavior.

Comparing the frequency of certain SBs with their position in the matrix it can be noticed that behaviors placed in the second quadrant emerge much more often than the ones placed in the fourth quarter. Nevertheless, this observation cannot serve as a base for formulating any general rule. Using cluster analyses to classify sustainable behaviors according to three variables—PD, PCE, and frequency—we obtained groups of SBs which differ from the ones identified in the perception matrix.

The main practical implications of our results refer to the possibility of achieving SC goals in Poland. A sustainable behaviors perception matrix may

FIGURE 4. Sustainable Behavior Perception Matrix Supplemented by the Frequency Means

<p>THE EASIEST AND THE MOST EFFECTIVE SBs</p> <ul style="list-style-type: none"> • Switching off the lights [5.19]* • Limiting water usage [5.03] • Recycling [4.97] • Using one’s own shopping bags (reusable) [4.84] • Buying efficient appliances [4.67] • Intentionally limiting waste in the household [4.52] • Unplugging electronics when not in use [4.43] 	<p>THE MOST DIFFICULT AND THE MOST EFFECTIVE SBs</p> <ul style="list-style-type: none"> • Repairing products instead of buying new ones [4.46] • Using public transportation or walking instead of driving a car [3.97]
<p>THE EASIEST AND THE LEAST EFFECTIVE SBs</p> <ul style="list-style-type: none"> • Using the product until it stops working [4.99] • Shopping with a list [4.65] • Carpooling [4.46] • Giving unwanted used items to others for free [4.45] 	<p>THE MOST DIFFICULT AND THE LEAST EFFECTIVE SBs</p> <ul style="list-style-type: none"> • Buying locally produced items [4.29] • Buying frugally packaged items [3.97] • Buying fair trade products [3.7] • Buying traditional products/regional specialties [3.65] • Upcycling [3.64] • Buying and selling secondhand items [3.62] • Buying organic food and ecological cosmetics [3.45] • Using products together with other consumers [3.13] • Buying green detergents [3.1]

* Mean frequency values

serve as a simple and convenient tool, ready to be used by public and private institutions responsible for developing sustainability policy and putting it into practice. The matrix can help to determine a way of perceiving sustainable behaviors and, if the study is repeated, to recognize the changes in their perception over time considering opinions of various consumer groups. Furthermore, the proposed set of SBs may be complemented or changed to reflect changes in the scope and character of sustainable activities prevalent among Poles.

Although the flexibility of this sustainable behaviors perception matrix has usefulness, it may limit its cognitive and applicational value. The main limitations of this paper lay in some arbitrary decisions we made to create the matrix. First, by introducing and operationalizing our model of sustainable behaviors, we limited the scope of SBs. Second, the values of PD and PCE used as reference points were determined arbitrarily. Looking at the final matrix we can easily recognize that even slight changes in these decisions might in some cases significantly change the interpretation of our findings.

Despite these problems, the concept of the sustainable consumer behavior matrix is worthy of further development. By comparing the matrix with the frequency of behaviors we found that neither PD nor PCE influences SBs in a direct way. We are confident that this finding, as well as the more general problem of what stimulates SBs, indicates promising directions for further research. Willingness to broaden knowledge on this topic should also serve as a stimulus for conducting research in other countries, especially the well-developed ones.

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Investment Strategies and Returns of University Endowment Funds

K. Thomas Liaw

Abstract

Motivation: Investment management of university endowments has been the focus of increased attention. This study extends the literature to examine the linkage between the increased allocation to alternative assets and investment returns for different-sized funds.

Premise: University endowment funds shifted asset allocation from public listed securities to alternative assets in recent years. We investigate if such strategy resulted in better investment performance. We also review spending rate and investment performance.

Approach: This research uses variables such as size of endowment, rate of return, asset allocation (percentage in equities, fixed-income, and alternative assets), and spending rate. Annual data for 2002 to 2017 are used to perform panel data regression analysis.

Results: Spending rates are similar for all endowments. Increasing investments in alternatives did not lead to higher returns for small and midsize endowments. The average returns for large endowments underperformed the passive benchmark after the 2008 financial crisis. The regression results do not show positive marginal impacts of alternatives on investment returns.

Conclusions: The strong returns of high-profile endowments could not be duplicated by endowments of all sizes during the sample period. Successful investing in alternatives is more than allocating money. Identification and access to top-performing managers at the right time are important.

Consistency: University endowments are managed to provide a permanent funding source that maintains the university's mission of teaching, research, and public service. This study shows the risk of underperformance with strategies that outperformed the market for mega endowments. Such risk impacts the university's ability to fulfill its mission.

Keywords: alternative assets, asset allocation, endowment model, investment strategies, spending rate, university endowment fund

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INTRODUCTION AND LITERATURE REVIEW

Large university endowments have performed strongly since they started increasing allocation from public investments of stocks and bonds to illiquid alternative assets such as hedge funds, private equity, and venture capital in 1980s (the so-called endowment model). Observers often cited the successes of Harvard, Yale, and Princeton universities as evidence of higher returns from investing in alternative assets. Many smaller university endowments have followed, increasing exposure to alternatives. Data from National Association of College and University Business Officers (NACUBO) showed university endowment funds of all sizes have significantly increased asset allocation to alternatives. Data also showed a positive relationship between university endowment size and asset allocation in alternatives. In addition, large university endowments (with more than \$1 billion in assets) have generated better investment returns. However, the majority of university endowments, especially those with less than \$1 billion, have not been able to replicate the same strong investment performance. This is the primary reason that Wallick, Wimmer, and Balsamo (2014) concluded that the majority of endowments would have been better off had they simply invested in passive market indexes.

There is rich literature on asset allocations of university endowments. Cejnek et al. (2013) provided a comprehensive review of publications looking at how university endowments managed their money. They classified papers in four areas. First on the subject of asset allocation, they discussed the theoretical framework and relevant observations across time and across types of endowments. On the subject of performance, they reviewed risk-adjusted performance by type and size of endowment. Third, they reviewed literature on spending and what endowments did in practice. The fourth area in their discussions is organization. They reviewed governance structure and discussed the investment policy statement. Brown et al. (2011) reported results of a survey of university endowments related to structure with a focus on the composition of the investment committee. They found that most investment committee members have some financial credentials and are donors to the university. The characteristics of the committee (such as number of non-donors) is related to the key decisions of the committee (such as whether to outsource portfolio selection and how much risk to take).

Goetzmann and Oster (2012) analyzed the factors that contributed to the shift in asset allocation of university endowments toward alternative investments. They found that universities competing in the same markets for students followed similar asset allocation policies and universities used alternatives to catch up to their close rivals in competing for undergraduate applications. They showed evidence that when a school's return lagged behind its immediate rival, it tended to change its asset allocation. In addition, endowments with recent positive experience with alternative strategies tended to increase exposure as well.

Lerner, Schoar, and Wang (2008) discussed trends in university endowment returns and investments in the United States between 1992 and 2005. Their study showed that ivy league schools, private schools, and universities with large endowments and high Scholastic Aptitude Test (SAT) scores had better performances. The allocation in alternative assets contributed to better returns as well. The skill and experience of investment managers also played a role in the suc-

cess of an endowment investment. In addition, the levels of compensation were positively correlated with excess returns, size of endowments, and SAT scores. Across endowments, institutional characteristics such as endowment size and admissions selectivity are better predictors of success than the allocation to risky asset classes. Moreover, top endowments might possess superior asset selection ability beyond their strategies for allocating funds to certain asset classes.

Brown, Garlappi, and Tiu (2010) examined asset allocation and performance of university endowment funds. They found that asset allocation accounted for about 75 percent of return level and variation in the time series. However, the average contribution of an endowment manager's asset allocation to cross-sectional variation was only about 10 percent. They also showed that actively managed funds generated significantly larger alphas than passive ones because active managers exploited their security selection abilities by over-weighting asset classes in which they had superior skills.

Dimmock (2010) tested the effect of background risk (the volatility of other income) on the investment strategies of university endowment portfolios. The results showed that higher background risk was associated with lower portfolio standard deviations. Universities with higher background risk invested significantly more in fixed income and less in alternative assets. A one standard deviation increase in background risk increases the allocation to fixed income by about 15 percent relative to the mean. Rosen and Sappington (2015) also examined how other flows of income to the university (background income) affected asset allocation decisions by university endowment funds. They looked at both the decision to invest in alternative assets and the proportion of portfolio allocated to such assets. They showed that managers incorporated expected level and variability of background income into their portfolio allocation decisions. Universities that expected higher levels of background income were more likely to invest in alternative assets and allocated a larger percentage of their endowments to alternative assets. The decision to include alternative assets increased by 11.3 percent with a one standard deviation increase in expected background income and decreased by 8.2 percent with a one standard deviation increase in the variability of background income. In addition, the allocation to alternative assets increases by 7.5 percent and decreases by 1.1 percent with a one standard deviation increase in expected background income and its variability, respectively.

In spending area, Brown, et al. (2014) used large financial market fluctuations to analyze endowment payout behavior. They found that university endowments reduced payouts relative to their stated policies following negative shocks, and that endowments tended to leave current payouts unchanged in response to contemporaneous positive shocks. Such endowment-hoarding behavior is evident especially among endowments whose current value is close to the benchmark value at the start of the university president's tenure. They also documented the effect of negative endowment shocks on university operations.

In this paper, we examine the perceived linkage between investment performance and exposure to alternative assets for different-sized university endowment funds. The analysis is based on portfolio asset allocation and return statistics published by NACUBO from 2002 to 2017. We discussed observations from the data and employed panel data regression to analyze the relationships between investment performance and asset allocation (in alternatives, fixed-

income, and equities). In addition, we also divided the sample period into two sub-periods, 2002 to 2008 (before the global financial crisis) and 2009 to 2017 (after the global financial crisis). As such, the paper contributes to the literature in providing additional insights into how asset allocation impacts performance, especially for time periods before and after the global financial crisis.

The article proceeds as follows.

- The next section provides an overview of university endowment spending rates and investment returns.
- The section Investment Strategies and Asset Allocation discusses changes in asset allocation and the resulting returns in recent years. This section includes statistics for endowments of different sizes and the variability over time as well.
- In the section Empirical Analyses, we use panel data regression to analyze the impact of asset allocation on investment returns. The empirical results do not show positive marginal impacts of alternatives on investment returns for university endowment funds during the sample period of 2002 to 2017.

SPENDING RATES AND INVESTMENT RETURNS

To conduct our empirical research, we use data from the publications by NA-CUBO in the following discussions and analyses. The annual data are from 2002 to 2017. Data include spending rate, investment returns, and asset allocation in equities, fixed income, and alternatives. Data are based on academic year, not calendar year. University endowment funds are grouped to (1) over \$1 billion, (2) \$501 million to \$1 billion, (3) \$101 million to \$500 million, (4) \$51 million to \$100 million, (5) \$25 million to \$50 million, and (6) under \$25 million. Data also include bond market index and stock market index. The bond market index is Barclays Aggregate Bond Index (formerly Lehman Brothers Aggregate Bond Index). The index includes U.S. government, corporate, and mortgage-backed securities with maturities of at least one year. The stock market index is the S&P 500 Index.

University endowments have become an important source to provide funds to meet operating, strategic, and financial requirements. Many universities rely on endowments as a perpetual support of the institution and its mission of teaching, research, and public service. Universities thus make efforts in capital campaigns to raise money and in investment strategies to increase their investment performance. In the pursuit of higher returns, they shifted endowment investments from fixed income to equities in the 1970s and 1980s and then toward alternative assets such as private equity, venture capital, and hedge funds.

Universities have spending policy that governs how they spend money from the endowment. At many institutions, most of the endowments are restricted to specific programs, departments, or purposes. Funds must be spent to support the donor's designated purposes. Unrestricted funds are more flexible, and the university has more discretion on how to spend the money. Overall, the spending policy aims at balancing the need to fund a budget and the obligation to maintain the value of the endowment after accounting for inflation. Table 1

lists the average annual spending rates (for academic year) from 2002 to 2017 for different-sized endowments. During this sample period, the spending rates declined slightly for all endowments. The average spending rate increased with the size of the endowment. For example, the average spending rate for the largest endowments (over \$1 billion) was 4.76 percent, higher than those with smaller endowments. The spending rates in other groups of endowments were 4.73 percent, 4.60 percent, 4.66 percent, 4.38 percent, and 4.28 percent, respectively. The observations in Table 1 also indicate that there is no particular pattern in the variation (standard deviation) in spending rates over the sample period.

Investment performance fluctuated, as evidenced by the rates of returns listed in Table 2. University endowment funds lost money in three of the sample years. University endowments posted a return of –6.2 percent in 2002 (the internet bubble), –18.7 percent in 2009 (global financial crisis), and –1.9 percent in 2016. The average rate of investment returns was 6.16 percent. The average spending rate for the sample period was 4.55 percent. During the time period, the spending rates decreased from 5.1 percent in 2002 to 4.4 percent in 2017.

INVESTMENT STRATEGIES AND ASSET ALLOCATION

As mentioned previously, large university endowments have performed strongly since some started increasing asset allocation from public investments to illiquid alternative assets. In theory, there are at least two benefits to adding alternatives.

TABLE 1. Annual Spending Rates

	Over \$1 Billion	\$501 Million to \$1 Billion	\$101 Million to \$500 Million	\$51 Million to \$100 Million	\$25 Million to \$50 Million	Under \$25 Million
2002	4.8	5.0	5.1	5.3	4.9	5.2
2003	5.3	5.2	5.2	5.3	4.9	4.8
2004	5.2	5.0	5.0	4.9	4.7	4.5
2005	4.8	4.7	4.7	4.8	4.7	4.7
2006	4.5	4.5	4.6	4.7	4.7	4.7
2007	4.4	4.4	4.6	4.8	4.8	4.6
2008	4.2	4.5	4.2	4.6	4.3	4.1
2009	4.6	4.9	4.4	4.7	4.3	3.9
2010	5.6	5.7	4.9	4.6	4.1	3.5
2011	5.2	5.2	5.0	4.5	4.0	3.7
2012	4.7	4.7	4.3	4.3	3.8	3.7
2013	4.8	4.6	4.4	4.4	4.3	4.1
2014	4.6	4.3	4.3	4.4	4.2	4.6
2015	4.3	4.1	4.1	4.4	4.0	4.5
2016	4.4	4.3	4.3	4.4	4.1	3.8
2017	4.8	4.6	4.5	4.5	4.2	4.0
Average	4.76	4.73	4.60	4.66	4.38	4.28
Standard deviation	0.39	0.41	0.35	0.30	0.35	0.49

Data source: National Association of College and University Business Officers (NACUBO).

TABLE 2. Average Annual Spending Rates and Investment Returns (Percentage)

Year	Spending Rate	Investment Returns
2002	5.1	-6.2
2003	5.1	3.2
2004	4.9	15.3
2005	4.7	9.3
2006	4.7	10.8
2007	4.6	17.2
2008	4.3	-3.0
2009	4.4	-18.7
2010	4.5	11.9
2011	4.6	19.2
2012	4.2	-0.3
2013	4.4	11.7
2014	4.4	15.5
2015	4.2	2.4
2016	4.3	-1.9
2017	4.4	12.2
Average	4.55	6.16
Standard deviation	0.29	10.26

Data source: NACUBO.

First, adding another asset leads to diversification. In addition, those alternative assets provide higher rates of returns because of illiquidity. Smaller endowments followed with increased exposure to alternatives. As a result, nearly all university endowment funds have significantly increased exposure in alternatives. However, the results of investment returns were mixed. As Table 3 shows, the average rate of returns for large endowments (over \$1 billion) was 7.781 percent, higher than any of the groups with smaller endowments during 2002 to 2017. Such performance was also better than the traditional 60 percent equity/40 percent fixed-income passive benchmark of 6.69 percent.

The performances varied for the sub-sample periods (2002 to 2008 and 2009 to 2017). During the 2002 to 2008 period, the investment performances were similar to the whole sample period. After the global financial crisis (2009 to 2017), the results showed that it is worthwhile to reexamine the investment strategy of increasing exposure to alternative assets. For the period, the largest endowments had an average of 6.233 percent gains in their investments, still better than other endowments of smaller sizes (all between 5.50 percent and 5.90 percent). However, the active investment strategies of increasing exposure to alternatives did not result in better investment gains. The simple 60 percent equity/40 percent fixed-income outperformed all groups of endowments. The passive benchmark generated 8.58 percent returns.

The investment returns after the financial crisis indicated that alternative assets are not the guarantee for better performance. But all endowments continued to up their allocations to alternatives. Table 4 provides more details in

TABLE 3. Annual Returns for Different-Sized University Endowment Funds (Percentage)

Size	2002 to 2017	2002 to 2008	2009 to 2017
Over \$1 billion	7.781	9.771	6.233
\$501 million to \$1 billion	6.838	8.143	5.822
\$101 million to \$500 million	6.244	7.029	5.633
\$51 million to \$100 million	5.856	6.200	5.589
\$25 million to \$50 million	5.756	5.871	5.667
Under \$25 million	5.425	4.857	5.867
60 percent equity/40 percent fixed-income	6.69	4.24	8.58

Data source: NACUBO.

asset allocation to alternative assets for university endowment funds of different sizes. Overall, larger endowments allocated a higher percentage of endowments in alternatives. For the sample period (2002 to 2017), the largest endowments (over \$1 billion) invested almost half of assets in alternatives (49.85 percent). The smallest endowments (under \$25 million) allocated 8.43 percent in alternatives. The pattern is that the allocation to alternatives increases with the size of endowments.

To understand investment strategies of university endowments better, we also examine their allocations in the sub-sample periods. During the first sub-sample period of 2002 to 2008, larger endowments allocated a higher percentage to alternatives than smaller endowments. During the second sub-sample period of 2009 to 2017, their allocations to alternatives showed a similar pattern. Comparing allocations in the two sub-sample periods, university endowments increased exposure to alternatives in the second period significantly. The largest endowments (over \$1 billion) increased by more than 20 percent, from 38.23 percent to 58.89 percent. As Table 4 shows, endowments with less than \$1 billion also raised allocations to alternatives. The smallest (under \$25 million) more than doubled their exposure from 5.12 percent to 11.00 percent.

As discussed previously, the average investment performances declined from the first sub-sample period to the second. Increased exposure to alternative assets during the second sample period did not lead to better investment perfor-

TABLE 4. Asset Allocation in Alternatives for Different-Sized University Endowment Funds (Percentage)

Size	2002 to 2017	2002 to 2008	2009 to 2017
Over \$1 billion	49.85	38.23	58.89
\$501 million to \$1 billion	37.89	29.19	44.67
\$101 million to \$500 million	27.96	20.04	34.11
\$51 million to \$100 million	18.53	12.20	23.44
\$25 million to \$50 million	14.51	10.31	17.78
Under \$25 million	8.43	5.12	11.00

Data source: NACUBO.

mance. It is thus helpful to reevaluate the market environment and revise investment strategies. Following the endowment model may not lead to investment success. The empirical observations suggest that, even for the largest endowments, active strategies (and increasing exposure to alternatives) are not always better than the simple 60 percent equity/40 percent fixed-income passive, cost effective strategy.

EMPIRICAL ANALYSES

A panel data regression is performed to analyze the impact of asset allocation on investment returns. The panel data analysis controls for covariates such as year and size of the endowments. The panel data regression model is:

$$R_{it} = a_i + bE_{it} + cF_{it} + dA_{it} + u_{it}$$

Where

R is the annual rate of return of university endowments

a is a constant term

b is a coefficient measuring the impact of the asset allocation in equities on investment returns

c is a coefficient measuring the impact of the asset allocation in fixed-income on investment returns

d is a coefficient measuring the impact of the asset allocation in alternative assets on investment returns

E is the percentage of university endowment portfolio allocated to equities

F is the percentage of university endowment portfolio allocated to fixed income

A is the percentage of university endowment portfolio allocated to alternative assets

u is the error term

i is the group index

t is the time index

The university endowments are grouped to (1) over \$1 billion, (2) \$501 million to \$1 billion, (3) \$101 million to \$500 million, (4) \$51 million to \$100 million, (5) \$25 million to \$50 million, and (6) under \$25 million.

Table 5 shows the summary statistics of returns and asset allocations. The mean return was 6.16 percent, with a standard deviation of 10.11 percent. The maximum return was 21.30 percent while the minimum was -20.50 percent. In asset allocation, the mean in equities was 49.93 percent, in fixed-income was 18.57 percent, and in alternatives was 26.19 percent. Note that the highest allocation in alternatives was 61.00 percent.

The estimates from panel data regression are reported in Table 6. The estimated coefficient for equities is 0.059, for fixed-income is -0.192, and for alternatives is -0.207. The t -value for each of the estimates is low. Thus, the estimated coefficients are not significant at 10 percent significance level. The

TABLE 5. Summary Statistics

	Mean	Standard Deviation	Minimum	Maximum
Annual returns	6.16	10.11	-20.50	21.30
Asset allocation in equities	49.93	9.63	26.00	63.20
Asset allocation in fixed-income	18.57	6.33	7.00	31.00
Asset allocation in alternatives	26.19	16.04	3.30	61.00

Data source: NACUBO.

TABLE 6. Panel Regression Estimates

	Coefficients	Standard Error	t-value
Equities	0.059	0.118	0.503
Fixed-income	-0.192	0.182	-1.057
Alternatives	-0.207	0.131	-1.581
R-squared	0.322		
Adjusted R-squared	0.105		

Data source: NACUBO.

R-squared is 0.322 and the adjusted R-squared is 0.105. In summary, the results of panel data regression do not show significant positive impact of increasing exposure in alternative assets on investment returns.

CONCLUSION

The endowment model generated strong returns for large university endowment funds in recent years. Such success has attracted endowments of all sizes to increase exposure in alternative assets. During 2002 to 2008, alternative investments comprised 38.23 percent of portfolios for endowments with over \$1 billion. During 2009 to 2017, they averaged 58.89 percent. For endowments with less than \$1 billion, the allocations also increased significantly. However, the investment performance declined as the allocations to alternative assets increased. The results from the panel data regression did not show positive impacts of alternatives on investment returns.

The reported successes of high-profile university endowment funds from the endowment model could not be duplicated by endowments of all sizes. Yes, there are winners. But, many small and midsize endowments fell short. They failed to generate the anticipated higher returns and they at times underperformed the simple index benchmark. Successful investing in alternatives is more complex than allocation of money. They also need to identify and access top-performing managers at the right time.

The research can be extended to use more detailed, refined independent variables. The independent variables used in the regression are the broad classification of equities, fixed income, and alternatives. Within each category, there are different types. For example, equities include various types of equity securities and indexes, domestic, international, and emerging markets. Fixed income covers governments, corporates, domestic, foreign, and others. There are also several asset types in alternatives such as hedge funds, private equity, and ven-

ture capital. A more complete empirical study can be performed with those refined asset types when those data are available in the future. Another possible extension is to compare the investment strategies and performances of university endowment funds and pension funds. They all have long-term investment horizons and they invest in similar asset classes. However, there are regulatory and payout/spending differences.

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