Diversity in Board of Directors of Dow Jones Sustainability World Index Enterprises

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Some scholars suggest that the ability of incorporating sustainability into corporate mission and strategies will define success in the 21st century. In fact, in 1999 the Dow Jones Sustainability World Index (DJSWI) was established to track the performance of corporate sustainability of the world's largest companies. Ultimately, whether a firm is sustainable or not depend on the actions and decisions of the board of directors, the ultimate decision-maker in any firm. The purpose of this research is to determine whether there are significant differences in the diversity of board directors among the firms that constitute the DJSWI. A sample of 117 firms was drawn from those listed on The Sustainability Yearbook 2013. The sample represents 25% of the total universe of the Index. For each selected company the annual report was the main source to obtain the variables of board of directors' diversity: gender, age, ethnicity, and tenure. Logit regression and multiple discriminant analysis were the statistical methods employed to answer the research questions. The results show that only ethnicity diversity is positively related with a higher category of sustainability as defined by the DJSWI. Specifically, ethnic diversity is an excellent variable for classifying gold and non-medalist firms.

Keywords: *sustainability, board of directors, diversity, Dow Jones Sustainability World Index*

Diversidad en la junta de directores de las empresas del Índice Mundial de Sostenibilidad de Dow Jones

Algunos investigadores sugieren que el poder incorporar la sostenibilidad en la misión y las estrategias de una empresa definirán el éxito de ésta en el Siglo 21. En el 1999, se estableció el Índice Mundial de Sostenibilidad de Dow Jones (DJSWI, por sus siglas en inglés) para monitorear el desempeño corporativo sostenible de las empresas más grandes del mundo. De hecho, el que una empresa sea sostenible o no depende de las acciones y decisiones de la junta de directores, quienes toman las decisiones en cualquier corporación. El propósito de esta investigación es determinar si existen diferencias significativas en la diversidad de las juntas de directores de las firmas que constituyen el DJSWI. Se utilizó una muestra de 117 empresas de las que aparecen listadas en "The Sustainability Yearbook 2013". Esta muestra representa un 25% del universo de empresas en el DJSWI. Para cada una de las compañías seleccionadas el reporte anual se utilizó para obtener las variables de diversidad de la junta de directores: género, edad, origen étnico y años en la junta. Regresión logística y "Multiple discriminant analysis" fueron los métodos estadísticos utilizados para contestar las preguntas de investigación. Los resultados muestran que la diversidad étnica se relaciona positivamente con una categoría mayor de sostenibilidad como se define en el DJSWI. En particular, la diversidad étnica es una excelente variable para clasificar las firmas de oro y sin medallas.

Palabras claves: *sostenibilidad, junta de directores, diversidad, Índice Mundial de Sostenibilidad de Dow Jones*

Introduction

The Chernobyl nuclear power plant explosion in Russia, the Exxon Valdez oil spill in the Gulf of Mexico, and the Kuwait oil-well fires during the Gulf War are examples of environmental disasters of the 1980s and 1990s. On the other hand, Enron, Tyco, and the sub-prime mortgage crisis in the United States are cases of firms' social irresponsibility. All of these scandals have fueled the global interest among industry, governments, and non-governments organizations for corporate sustainability (Christofi, Christofi, & Sisaye, 2012).

Along the efforts to share responsibility and respect for the laws that preserve the environment and its natural resources, companies have also emerged into sustainability reporting. Several frameworks for sustainability accounting measurement and reporting have been developed such as the integrated reporting[1] and the triple bottom line. However, full standardization and enforcement is still to come.

Despite the lack of a formal measurement or reporting of sustainability, companies have voluntarily adopted sustainability principles.[2] Theoretically, being environmental and socially responsible lead to shareholder wealth maximization (Wilson, 2003). In fact, in 1999 the Dow Jones Sustainability World Index (DJSWI) was established to track the performance of corporate sustainability of the world's largest companies. It is the first family of global indices to track financial performance of this type of enterprises (Malone, 2013).

[1] Prince's Accounting for Sustainability Project.

[2] Some examples of institutional sustainability principles are United Nations' Global Compact and the World's Bank Social Assessment Structure. At the firm level, the standards from the Global Reporting Initiative (GRI) is the most employed worldwide.

According to the creators of DJSWI corporate sustainability is "a business approach that creates long-term shareholder value by embracing opportunities and managing risks deriving from economic, environmental and social developments" (RobecoSAM, 2013a). Ultimately, whether a firm is sustainable or not depend on the actions and decisions of the board of directors, the ultimate decision-maker in any firm.

Only recently, governance researchers have studied board of directors' diversity and its relationship with corporate sustainability (Hafsi & Turgut, 2013). Therefore, the purpose of this research is to determine whether there are significant differences in boardroom diversity among the different categories of groups that constitute the DJSWI. Specifically, this paper looks to answer the following research questions:

- Does diversity in boards lead to corporate sustainability?
- Is there a difference between diversity in boards of directors among the different categories of companies of the DJSWI?

A sample of 117 firms were randomly selected from those that appeared on The Sustainability Yearbook 2013. Regressions and multiple discriminant analysis were performed. The results show that only ethnicity diversity is positively related with a higher category of sustainability as defined by the DJSWI. Specifically ethnic diversity is an excellent variable for classifying gold and non-medalist firms.

The paper discuss in the following section the literature on corporate sustainability and board of directors' diversity. Then, the hypotheses, the methodology, and discussion follows. Lastly, the paper ends with some concluding remarks and ideas for future research.

Literature Review

Dow Jones Sustainability Indexes

The DJSWI tracks the performance of the top sustainable companies of the 2,500 largest in the Dow Jones Global Total Stock Market Index. In addition, for 2013, there are 14 subset indices, derived from the World Index.

The indexes are product of the collaborative work of a Swiss investment specialist (RobecoSAM) and S&P Dow Jones Indices. To be included in the index the companies are scored on an annual Corporate Sustainability Assessment (CSA). Eligible companies can voluntarily fill an assessment or RobecoSAM reserves the right to apply the same methodology to non-participating companies from the eligible universe based on publicly available information.

The assessment is made using the responses that companies provide to a survey. This survey includes questions that capture general and industry-specific criteria covering three dimensions: economic, environmental, and social (RobecoSAM, 2013b). These dimensions are the three interlocking principles of the World Commission on Economic Development to conceptualize sustainability (Galbreath, 2011).

The companies included in the World Index have the highest sustainability score on the CSA. The score ranges from 0 to 100 and are ranked against other companies in their industry (58 sectors for 2013). Only the top 10% of the companies of each sector based on the score are included in the DJSWI.

Every year RobecoSAM publishes The Sustainability Yearbook. The list includes companies representing the highest 15 percent scores of the CSA for the previous year. The companies are presented by sectors. In addition, within each sector three categories are awarded: gold class,

silver class, and bronze class. The gold class category is given to companies whose scores are within 1% of the sector's leader. The silver class category is for companies with a score within a range of 1% and 5% from the sector's leader. The companies who score is within a range of 5% to 10% from the score of sector's leader receive the bronze class category. Along these three categories, a sector leader and a sector mover is also highlighted. The sector mover is the company that achieved the largest proportional improvement in its sustainability performance compared to the previous year. Finally, sectors identify runners up enterprises, which are not leaders, nor winners of any class.

Empirical research on Dow Jones Sustainability World Index

A couple of papers have employed the firms on the DJSWI as subjects of inquiries. For example, Ricart, Rodríguez, and Sánchez (2005) analyze how and to what extent DJSWI leaders were integrating sustainability into their corporate governance systems. Then, they develop a model for sustainable corporate governance based on their results. According to their model, the sustainable governance system should four key questions: who the board's members should be, what their most important roles should be, how the board should function to play those roles in an efficient and effective way, and why the board should do it.

Another example is López, García, and Rodríguez (2007) that examine whether business performance is affected by the adoption of practices of corporate social responsibility. They analyzed two groups of 55 firms; one group belonged to the DJSWI and the other does not. Their analysis of accounting indicators reveals a difference in performance between both groups.

Board of directors' diversity and corporate sustainability

There are a couple of papers that works with the relationship between diversity of board of directors and some type of measurement of corporate sustainability. For example, Hafsi and Turgut (2013) look into the relationship between the boardroom diversity and corporate social performance using a sample of S&P 500 firms. Their results suggest that females and older directors are positively related to corporate social performance. Their result about female directors is also supported by others such as Galbreath (2011) and Zhang (2012).

Hypotheses

Diversity on the attributes of directors serving on boards is expected to improve linkages with stakeholders and increase sensitivity to differences and society's concerns. Research has shown that women, minority or foreign-based directors tend to be more sensitive to social performance of an enterprise (Hafsi & Turgut, 2013). Therefore, as diversity in boards of directors increases corporate sustainability should increases as well:

H1. The higher the diversity in boards of directors, higher the level of corporate sustainability.

Although diversity in board of directors has been measured in various forms ((Hafsi & Turgut, 2013), for this study I am planning to measure it with diversity in gender, age, ethnicity, and tenure. Evidence suggests that a mixture of those variables tend to create a more sensitive environment for corporate sustainability. Research documents that women think more favorably of ethical matters than men (Luthar, DiBattissta, & Gautschi, 1997), and tend to be more sensitive to corporate social performance (Burgess & Tharenou, 2002). In addition, both mature and younger directors tend to be more socially responsible and environmentally friendly (Hafsi & Turgut, 2013). Moreover, ethnically diverse boards may facilitate interactions with different stakeholders groups and enhance firm's response to environment (Zhang, 2012). Finally, diversity

in directors' tenure is expected to generate a mix of sensitivities that may favor corporate sustainability (Hafsi & Turgut, 2013). Therefore, the following sub set of hypotheses are proposed:

H1a. The higher the diversity in gender on boards, higher the level of corporate sustainability.

H1b. The higher the age diversity of directors, higher the level of corporate sustainability.

H1c. The higher the ethnic diversity on boards, higher the level of corporate sustainability.

H1d. The higher the directors' tenure, higher the level of corporate sustainability.

// FIGURE 1 ABOUT HERE//

Methodology

Sample and Data Sources

The sample selection process initially identifies all the 461 companies of the Sustainability Yearbook 2013.[3] From those the final sample includes 117 firms, which represent a 25%[4] of the population of interest of each category defined by the DJSWI methodology. The companies were selected randomly by an undergraduate research assistant. Although the selection of each firm was random, the student was instructed to select firms up to the 25% of each category.

As depicted in Table 1, the final sample include 20 companies from the Gold class[5], 13 from the Silver class, 27 from the Bronze class, and 57 non-medal winners[6]. In addition, the final sample includes the following variety of companies from the different regions: 46% from Europe,

[3] These companies represent the highest 15 percent scores of the Corporate Sustainability Assessment for 2012.
[4] Limiting the number of companies to a 25% of each category was necessary to complete the proposed research in a timely manner.
[5] In this category 17 of the 20 firms are also leaders in their industry.
[6] This category includes 44 firms that are runner-ups and 13 movers.

38% from the US, 6% from Asia, 4% from Latin America, 2% from Australia, and 3% from Africa. This regional composition does not differ from actual pool of companies that RobecoSAM invites to participate in the sustainability assessment, where the majority comes from Europe[7]. Furthermore, the highest frequency of leaders firms come from Europe. This result is not much different from reality since Europe has the leadership in terms of sustainability enforcement.

// TABLE 1 ABOUT HERE//

Among the 1,385 directors of the final sample, 244 were females (17.6%), the average age was 60 years (being 30 and 89, the lowest and highest age, respectively), and the average tenure was seven years.

For each selected company the annual report was the main source of information for all the variables. The annual reports were obtained through the different web pages of the companies. If some additional data was necessary Bloomberg database and the Internet were employed.

Variables

Three different types of information from the annual reports were collected to create the necessary variables. The first is company-related category within DJSWI including whether the firm is a: leader, gold class, silver class, bronze class, runner up, or mover. This information provides the independent variables for the different statistical tests. The second set covers

[7] "Ten years ago, there was a clear divide in terms sustainability performance between European companies and those from other regions, which was also reflected in the regional response rate to our questionnaires. Since then, interest in our assessment has grown considerably in every region", expressed Gabriela Grab, Deputy Head of Research of RobecoSAM (RobecoSAM, 2013a).

director-related data, including age, gender, ethnicity, and director tenure. This information provides the diversity in board of directors' variables and the dependent variables for the analyses. Finally, to increase the accuracy of the predictions, the following control variables were constructed as dummies: board size, type of industry, CEO duality, and region.

Dependent variable

For this study the concept of corporate sustainability is based on the assessment made by RobecoSAM to compile the DJSWI. Once the assessment is made, this company publishes an annual report identifying several classes of companies depending on the final score each company had. The highest class a company can obtain is becoming a leader within its sector, which means the highest score of that particular sector. Therefore, for this study, leaders have better sustainability practices than others firms. In addition, the other classes can be ordered, in decreasing assessment scores, as Gold, Silver, and Bronze. Furthermore, a firm without a medal class (a runner up or mover) had a lower assessment than a medal class company.

Based on that rankings several measures were constructed. First, MEAS1, was constructed as a dichotomous variable, where 1 was assigned to any company that was a leader or a medalist, and 0 to non-medalist firms (runner ups and movers). Second, MEAS2, was a categorical variable depending on the class of the firm. MEAS2 was coded as follows: 1 for the leaders; 2 for the gold firms; 3 for the silver firms; 4 for the bronze firms; and 0 for non-medalist firms (runner ups and movers). Third, MEAS3, was also a dichotomous variable where 1 was assigned to any company that was a leader or a gold medalist, and 0 to other firms (silvers, bronzes, runner ups and movers).

Independent variables

The independent variables were the diversity characteristics of boards. For this study, diversity in boards was measure for gender, age, ethnic background, and tenure. To measure diversity in gender, GEN, the number of females sitting on a board was computed. The age diversity, AGE, was the difference between the age of oldest and the youngest director serving on a board. Given that both mature and younger directors tend to be more socially responsible and environmentally friendly, as stated by Hafsi & Turgut (2013), the higher the range of ages in a board might lead to better sustainability practices. Ethnic diversity, ETHN, was calculated as the sum of directors born outside the country where the firm operates. Finally, director tenure, TEN, is the average numbers of years directors have been in their chairs.

Control variables

Previous research on sustainability and diversity has shown differences between industries, board size, industries and regions. Therefore, the following control variables were constructed: board size (SZ), region (REG), type of industry (IND), and board leadership duality (DUAL). Region dummies were created based on six categories: Europe, US and Canada, Latin America, Asia, Australia, and Africa. Industry dummies were created based on the Standard Industrial Classification (SIC) of 2012 of each company and includes: mining, construction, manufacturing, transportation and public utilities, trade, financial and other services. Finally, the board leadership duality is a dichotomous variable, where 1 is assigned if the chairman is also the CEO of a company.

Table 2 thru 4 present the descriptive statistics and the correlation matrix for the variables. As shown on Table 2, board diversity is not a common characteristic of the boards of the firms in the sample. On average, there are two females directors serving on boards. This

number seems small given that the average size of boards in the sample is 12. Ethnic diversity is also low as boards have only one member, on average that has a different ethnic background. The average tenure is seven years. These results support previous reports on limitations of gender and ethnic diversity in boards. For example, Zhang (2012) reports that women and minority men sits in less than one-third of Fortune 100, and the percentage of representation of these groups have remained fixed (from 2004 to 2008).

Table 3 presents the descriptive characteristics of the categorical variables for corporate sustainability (MEAS 1, MEAS2, MEAS 3), and the control variables for industries and CEO duality. On Table 4 correlation between MEAS2 and all the independent variables is presented. MEAS2 provides all the categories available in the sample (leaders, gold, silver, bronze, and non-medalist).

Methods

In order to answer the research questions two statistical methods were employed: regression analysis and multiple discriminant analysis (MDA). Both tests looks to identify the independent variables that impact group membership. Specifically, the methods look to measure whether there was a difference in the degree of board of directors' diversity among the different categories of enterprise that comprise DJSWI.

First, given that two of the measurements for the dependent variable (MSE1 and MSE3) are dichotomous a logistic regression was performed[8]. The main regression function was:

[8] Logistic regression is preferred when a dependent variable has only two groups because it does not face the strict assumptions of multivariate normality and equal variance-covariance matrices across groups. Furthermore, logistic regression provides straightforward statistical tests (Hair, et al., 2010).

$$MEAS_i = \alpha_i + \beta_1 GEN_i + \beta_2 AGE_i + \beta_3 ETHN_i + \beta_4 TEN_i + \beta_5 SZ_i + \beta_6 IND_i + \beta_7 DUAL_i + \varepsilon_i$$

where, *i* = 1, …..117.

Second, for the third measurement of corporate sustainability, MSE2, which has five categories, multiple discriminant analysis (MDA) was used. The objective was to determine if there are statistical differences in the diversity between firms in the following categories: leaders, gold, silver, bronze and non-medalist firms. The main discriminant function was:

$$Z_{jk} = a + W_1 GEN_{1k} + W_2 AGE_{2k} + W_3 ETHN_{3k} + W_4 TEN_{4k} + W_5 SZ_{5k} + W_6 IND_{6k} + W_7 DUAL_{7k}$$

where Z_{jk} = discriminant *Z* score of discriminant function *j* for firms *k* = 1, …..117 firms.

Results and Discussion

Based on the models and statistical results the main hypothesis (H1) is partially supported. Specifically, Hypothesis 1b, about ethnic diversity is the only variable statistically supported across all the models. Tables 5 thru 8 report the results for the regression and multiple discriminant analysis.

Table 5 presents the results for the Logit regression for two of the corporate sustainability measurements (MSE1 and MSE3). On the first Model, with MSE1, the objective was to determine if firms with medals (gold, silver, and bronze) differ from non-medalist firms in terms of any diversity in boards' variables. Ethnic diversity is positive related with obtaining a medal from DJSWI, and thus, a higher corporate sustainability assessment. Controlling for size, CEO duality, and industry is also significant on the probability of obtaining a medal or not. Therefore, boards with more diverse ethnic directors increase the probability of being more sustainable, especially for the mining and construction sector. However, this probability decreases as the size of the board increases and as the CEO also is the Chairman of the board. This first model accounts for

approximately one third of the variance of being classified as medalist or non-medalist (as Cox & Snell R^2 = .335 and Nagelkerke R^2 = .446). Moreover, as we look to the exponentiated coefficient of ETHN we can say as ethnic diversity increases the odd of achieving a medal by 34%.

Also on Table 5 results of Model 2, using MSE3, indicates that ethnic diversity is an important variable for categorizing between obtaining a gold medal and not. This model has a lower power of discriminating between groups as the Cox & Snell R^2 and the Nagelkerke R^2 decreases.

Table 6 provides the classification table for Model 1 and 2. These results provide practical significance or predictive accuracy. Model 1 provides 77.8% of accuracy, while Model 2, 81.2%, Specifically both models predict better for leader firms in comparison with other categories.

Table 7 provides the results of the tests F equality of group means that was done before the MDA. The Wilks'Lambda was used to choose which variable to entry into the equation of the MDA. The results shows, once more, that ETHN is the independent variable most important to for discriminating among categories of firms. In addition, these results show that none of the variables present problems with multicollinearity.

The final discriminant function only includes ETHN: -.604 + .445ETHN. This function accounts for 100% of the variance of the dependent variable (Eigenvalues = .220, with canonical correlation = .425).

Table 8 provides the classification table for the original count and the cross validation of the final discriminant function. The accuracy of prediction among groups range from 77.2% to 3.7%. In other words, the current models excel at identifying non medalist firms and gold.

However, it does not accomplish a good accuracy for bronze, silver and leader. Another variable might be better predictor for these groups.

These results support previous research linking board demographic diversity and corporate sustainability performance. Specifically, previous studies have shown that minority directors increase independence of boards and thus sustainability practices. The increased independence can be linked to the fact that these ethnic diverse directors does not come from traditional academic and occupational backgrounds (Zhang, 2012). This diversity lead to better links with different groups of stakeholders.

Conclusions

In order to determine whether there are significant differences in boardroom diversity among the categories of the DJSWI, this research sample 117 firms from The Sustainability Yearbook 2013. For this research, corporate sustainability performance is operationalized by the categories given by RobecoSAM. Diversity in the board was measured using gender, age, ethnic background, and directors' tenure. The analysis included control variables for industry, board size, region, and CEO duality.

Previous research has shown that diversity on the characteristics of directors serving on a board might improve the linkages with stakeholders and increase sensitivity to differences and society's concerns. Therefore, the main hypothesis of the research was a positive relationship between diversity in boards of directors and level of corporate sustainability. Using logit regression and MDA, the results show that only partial support for the hypothesis. Ethnic diversity is the only variable statistically supported across all models. Indeed, ethnic diversity

increases the odd of achieving a higher corporate sustainability assessment by 34%. The models also accurate predict the membership to non-medalist firms and gold class.

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Figure 1. Conceptual Model: Diversity in boards and corporate sustainability

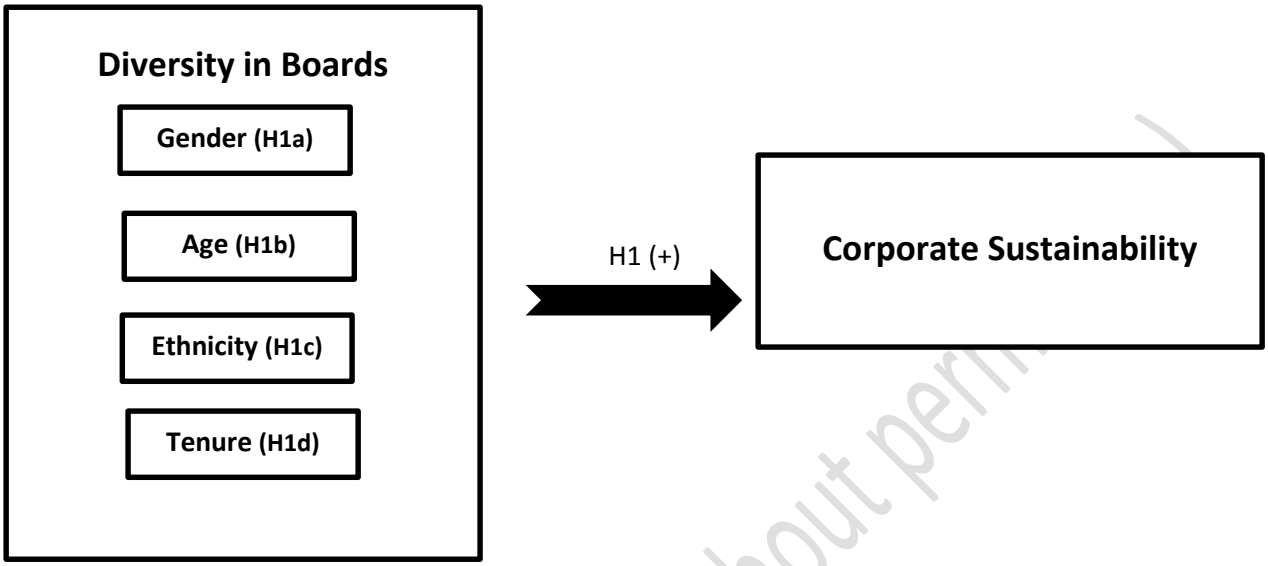
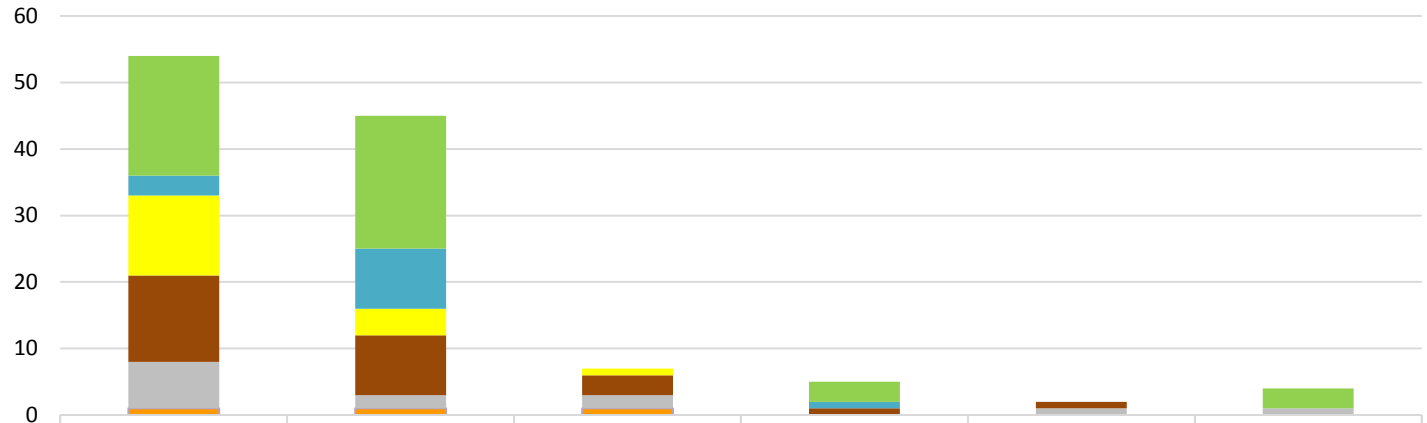


Table 1. Sample by Region and Class



	Europe	US & Canada	Asia	Latin America	Australia	Africa
Runner-up	18	20		3		3
Mover	3	9		1		
Leader & Gold	12	4	1			
Bronze	13	9	3	1	1	
Silver	7	2	2		1	1
Gold	1	1	1			

Table 2. Descriptive Statistics				
	Min.	Max.	Mean	SD
MEAS1	0	1		
MEAS2	0	4		
MEAS3	0	1		
GEN	0	8	2	1.38
AGE	7	51	24	7.34
ETHN	0	12	1	2.44
TEN	0	49	7	6.51
SZ	4	24	12	3.70
IND	0	4		
REG	0	5		
DUAL	0	1		

Table 3. Descriptive Statistics of Categorical Variables		
Variable	Category	Percentage (%)
MEAS1	Leader or medalist	48.7
	Non medalist	51.3
MEAS2	Leader	14.5
	Gold	2.6
	Silver	11.1
	Bronze	23.1
	Non medalist	13.7
MEAS3	Leader or gold	17.1
	Non gold	82.9
IND	Mining	9.4
	Construction	1.7
	Manufacturing	54.7
	Transportation and utilities	10.3
	Trade	10.3
	Financial and other services	13.7
DUAL	Yes	41
	No	59

Table 4. Correlation matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	MEAS2	1																	
2	GEN	.017	1																
3	AGE	.076	.133	1															
4	ETHN	.362**	-.035	.127	1														
5	TEN	-.074	.089	.199*	-.036	1													
6	SZ	.003	.317**	.400**	.164*	.186*	1												
7	MANUF	.144	-.006	-.173*	.163*	.117	.047	1											
8	MIN_C	-.163*	-.180*	-.005	.037	-.071	-.003	-.389**	1										
9	TRANSP	.093	.020	.071	-.073	-.064	-.010	-.371**	-.120	1									
10	TRADE	-.027	.266**	.217**	-.154*	.092	-.104	-.371**	-.120	-.114	1								
11	FIN_SER	-.119	-.079	.000	-.069	-.129	.035	-.437**	-.141	-.135	-.135	1							
12	EUROPE	.218**	.242**	.142	.160*	-.266**	.221**	-.122	-.055	.196*	-.143	.180*	1						
13	US & CANADA	-.224**	-.011	-.132	-.283**	.438**	-.096	.084	.000	-.094	.138	-.161*	-.732**	1					
14	ASIA	.159*	-.278**	-.059	.348**	-.070	-.094	.085	-.089	-.085	.034	.004	-.234**	-.199*	1				
15	LATIN AMERICA	-.136	-.290**	.009	-.083	-.187*	-.126	.192*	-.075	-.071	-.071	-.084	-.196*	-.167*	-.053	1			
16	AUSTRALIA	.036	-.056	-.043	.089	-.045	-.064	-.012	-.047	-.045	-.045	.139	-.122	-.104	-.033	-.028	1		
17	AFRICA	-.081	.091	.061	-.105	-.111	-.041	-.207*	.382**	-.064	.091	-.075	-.174*	-.149	-.047	-.040	-.025	1	
18	DUAL	-.045	.090	.038	-.106	.341**	.000	-.061	-.037	.053	.110	-.022	-.064	.195*	-.009	-.253**	-.024	-.034	1
	N=117																		

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

Table 5. Regression results

	Model 1 MSE1		Model 2 MSE3	
	β	Exp(β)	β	Exp(β)
Intercept	-.927	.396	-21.583	.000
	(1.869)		(18872.19)	
GEN	-.179	.836	-.033	.968
	(.224)		(.247)	
AGE	.047	1.048	.020	1.020
	(.041)		(.043)	
ETHN	.296*	1.344	.224**	1.251
	(.159)		(.114)	
TEN	-.136	1.146	-.052	.950
	(.094)		(.102)	
SZ	-.011**	.989	-.076	.927
	(.020)		(.087)	
DUAL	-1.031*	.357	-.306	.736
	(.537)		(.570)	
REG				
US & Canada	-.429*	.651	19.756	379945073.261
	(1.450)		(18872.719)	
Asia	-1.510	.221	19.068	379945073.261
	(1.462)		(18872.719)	
Latin America	20.569	857010165.739	18.952	170167760.571
	(12527.401)		(18872.719)	
Australia	-3.377	.034	-.618	.539
	(1.938)		(26030.288)	
Africa	20.053	857010165.739	-.334	.716
	(25962.345)		(33358.921)	
IND	**			
Mining & Construction	1.237*	3.445	1.342	3.826
	(.742)		(1.158)	
Trade	-1.119	.327	.318	1.374
	(1.038)		(1.564)	
Transp. & Util.	1.366	3.921	1.537	4.649
	(.914)		(1.272)	
Fin. & Serv.	-.871	.419	2.235	9.347
	(1.252)		(1.385)	
Cox & Snell R Square	.335		.141	
Nagelkerke R Square	.446		.235	
Hosmer and Lemeshow χ^2	4.506		14.101*	

N = 117

Standard errors are presented in parentheses.

* and ** denotes significance at 10% and 5%, respectively.

Table 6. Classification Table

OBSERVED		PREDICTED		
		MSE1		
		Leader/Medalist	Non medalist	% correct
MSE1	Leader/Medalist	46	11	80.7
	Non medalist	15	45	75.0
	Overall %			77.8
		MSE3		
		Leader/Gold	Non gold	% correct
MSE3	Leader/Gold	94	3	96.9
	Non gold	19	1	5.0
	Overall %			81.2

Table 7. Tests of Equality of Group Means

Variable	Wilks'Lambda
GEN	.985
	(.439)
AGE	.982
	(.511)
ETHN	.819***
	(6.171)
TEN	.944
	(1.677)
SZ	.977
	(.646)
DUAL	.943
	(1.705)
MINING & CONSTRUCTION	.934
	(1.964)
TRANSPORTATION & UTILITIES	.976
	(.692)
TRADE	.933*
	(2.005)
FINANCE AND SERVICE	.966
	(.979)
US & CANADA	.927*
	(2.214)
ASIA	.907**
	(2.883)
LATIN AMERICA	.978
	(.622)
AUSTRALIA	.959
	(1.184)
AFRICA	.975
	(.729)

F values are presented in parentheses; df1 = 4; df2 = 112.
*, **, and *** denotes significance at 10%, 5%, and 1% respectively.

Table 8. Classification table

		Predicted Group Membership					
		Non medalist	Bronze	Silver	Gold	Leader/Gold	Total
Count	Non medalist	44	5	2	3	3	57
	Bronze	19	1	1	3	3	27
	Silver	5	0	2	5	1	13
	Gold	1	0	0	2	0	3
	Leader/Gold	7	0	2	5	3	17
%	Non medalist	77.2	8.8	3.5	5.3	5.3	
	Bronze	70.4	3.7	3.7	11.1	11.1	
	Silver	38.5	0	15.4	38.5	7.7	
	Gold	33.3	0	0	66.7	0	
	Leader/Gold	41.2	0	11.8	29.4	17.6	

N = 117

44.4% of original grouped cases correctly classified.

Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.

42.7% of cross-validated grouped cases correctly classified.